**Department of Forensic Medicine**
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# Work Related Fatality project
# Department of Forensic Medicine, Monash University

# Unintentional Work Related Fatalities Research Programme
# Out of Vehicle Truck Driver Fatalities

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## EXECUTIVE SUMMARY


- Truck drivers being killed while out of their vehicle undertaking related tasks represents an under recognised source of potentially preventable fatalities in Victoria (and Australia).
- Non crash fatalities represent approximately 25% of the burden of death for work related deaths in the road freight transport industry, however Out-of-Vehicle fatalities are drawn from a broader occupational mix than the road freight transport industry alone.
- We identified 47 Out-of-Vehicle fatal injury cases in Australia between 2000-2009, using a broad definition of truck driver. This is likely to be an underestimate of the actual number.
- The causes of the fatalities were heterogeneous, but a common mechanism (brakes working inappropriately for the environment leading to the truck/trailer rolling and then crushing the driver) was present in approximately half of the cases.
- A major factor in approximately half of the cases was that the truck was stopped or parked on an incline.
- No proven prevention interventions could be identified from the literature.
- A model for prevention interventions is presented.
- Potential interventions include:
    - Alarms when parking on an incline, or when the parking brakes are not applied.

- Awareness for drivers of the issue, and training on procedure relating to parking, loading/unloading and coupling/uncoupling.
- Redesigning procedures and the physical environment (eg loading facilities) to keep drivers out of harm's way.

**Introduction**

This report addresses an under-recognised cause of work related fatalities in Australia: Out-of-Vehicle truck driver fatalities. It is divided into three sections:

- Section A: Review of the scope of Out-of-Vehicle truck driver fatalities and injuries.
- Section B: Review and analysis of Out-of-Vehicle truck driver fatalities in Australia between 2000 – 2009.
- Section C: Prevention opportunities analysis.

## SECTION A: REVIEW OF THE SCOPE OF WORK RELATED OUT OF VEHICLE TRUCK DRIVER FATALITIES AND INJURIES

The road freight transport industry in Australia has a high fatality rate (37.6 per 100 000 workers) when compared to the fatality rate in other industries and in 2006 the 'Transport and storage industry' had the highest fatality count of all industries (74 of 295, of which 56 were from the Road freight industry) (Safe Work Australia, 2009). The majority, 41 (73%) of fatalities that year were due to road crashes while the remaining 15 (27%) were non road crash fatalities.

While considerable effort has been made researching in the causes, prevention methods and costs for all types of vehicle crash fatalities over the previous 40 years e.g. (Elvik, 2010) there does not appear to have been any published research to date into work related deaths occurring in non-crash scenarios.

As none presently exists, a framework by which work related Out-of-Vehicle truck driver fatalities can be considered is to take the public health approach of Out-of-Vehicle truck driver injury research. One published report to date acknowledges that many drivers have more actions to perform than just driving, and therefore take a job-task perspective to identify non driving injuries. They note that,
*"Although the job title 'driver' is strongly associated with driving trucks on roads, it should be noted that driving is not the only task that drivers will engage in. Truck drivers' work involves, for example, ascending to, descending from, and operations at heights... Furthermore, truck drivers' work involves, in many cases handling of goods"* (Shibuya et al, 2010, p.19).

The common thread to all of the scenarios identified is that these activities place the driver in the position in which he or she is exposed to risks located outside of the vehicle cabin. Shibuya et al. (2010) found that the major trigger factors for accidents around the truck other than falls were slips/ trips and equipment defect/malfunction. In an earlier study, (Shibuya et al, 2008) used this job-task perspective to categorise occupational truck driver injuries in Denmark into loading and unloading injuries, falls from heights, overexertion, being caught between/underneath objects, slips/trips and being struck by falling objects.

Specific research attention has been directed to these injury sub types. Slips, trips and falls can encompass a range of scenarios in the context of heavy vehicles. For example, (Jones and Switzer-McIntyre, 2003) describe typical falls from non moving trucks as those that occur from the cabin, the trailer or the cargo. In their study of injuries reported to the Workplace Safety and Insurance Board of Ontario, Jones and Switzer-McIntyre (2003) note that the majority of falls occur from the back of the truck/trailer, the cargo and the truck step, and although not providing a figure, the table describing falls indicates that the most common distance of a fall is between 2 – 3 metres. In addition, (McClay, 2008) notes that the physical characteristics of drivers, in particular older age related balance, coupled with the usually sedentary nature of the job can have implications for response time and general coordination that may lead to a greater rate of falls. Age can also have implications that make people more vulnerable to injury and can suffer more severe injuries from a similar event.

Coupling and uncoupling necessarily involves parking and connecting two or more heavy pieces of machinery, the prime mover and one (or more) trailer units. The Health and Safety Executive (HSE) in the United Kingdom notes that in relation to parking a number of risks exist, stemming from the fact that only a slight gradient is needed for a vehicle to move, and state that they have investigated 24 fatal and serious accidents resulting from bad practice during the coupling of heavy vehicle combinations between 1986 and 1996 (HSE, 2002). The HSE advises that emergency brakes cannot always be relied upon, and even if air brakes are applied, the air can escape rendering them ineffective. The Society of Operations Engineers (SOE) has updated the HSE (2002) advice and further observes that bad practice such as leaving truck parking brakes unapplied can often occur and that, '*Typically, fatal and serious accidents can occur when drivers or others are run over or crushed between the moving vehicle and another object as they attempt to get into the vehicle cab and gain control*' (SOE, 2007, p.6).

'Struck by' incidents typically involve workers struck by equipment, other vehicles, falling equipment or cargo, or being hit by machinery or moving parts (e.g., (Hinze et al, 1998; Binch et al, 2008; Rauser et al, 2008). As such, there can be multiple causes and determining prevention methods for universal application is difficult.

(Hinze et al, 2005) propose that effective interventions can best be developed by understanding the root causes of 'struck by' injuries.

Thus, the truck driver injury literature has identified that tasks such as coupling/uncoupling and goods handling lead to circumstances such as working at heights, working with heavy materials (including cargo, or the vehicle itself) which in turn lead to common injuries (slip/trip fall injuries, 'struck by' injuries and 'caught in/between' injuries. Use of job task descriptions can assist in describing the whole of the circumstance surrounding of Out-of-Vehicle fatalities by enabling a link to be drawn between the task, the circumstances in which a fatality occurred and the type of injury sustained. This approach will be adopted in the following Sections of this report.

## SECTION B: THE PREVALENCE OF WORK RELATED OUT OF VEHICLE FATALITITES IN AUSTRALIA, 2000-2009.

### Aims

To investigate non crash work related Out-of-Vehicle truck driver fatalities in Australia between 2000 - 2009.

### Method

The National Coroners Information System (NCIS) is an Australia- and, as of July 2010, New Zealand-, wide data storage and retrieval system of all coroner-reported deaths that commenced July 2000[1]. When a fatality is reported to a coroner, staff at the coronial office send the details of the case to the central NCIS database, coded according to an agreed minimum dataset (NCIS, 2007). They also attach other relevant material such as police reports, toxicology and autopsy results and coronial findings where available. This database is then searchable by registered users by

[1] Queensland data is from January 2001

code and free text keyword search. As all work related deaths are likely to fall into the definition of a ‘reportable death’ (e.g. s4 *Coroner’s Act, 2008 (Vic)*), there is a high probability that this database will contain almost all fatalities of interest.
The Victorian Work Related Fatality Database (VWRFD) is a database collated from surveillance of fatalities reported to the Victorian Institute of Forensic Medicine (VIFM). This database is therefore limited to one jurisdiction (Victoria), however it specifically identifies work-related cases, and codes extra information for work relatedness and occupation. In combination, the NCIS and VWRF databases provide a comprehensive source of information that enables the identification of population based case series, and the subsequent identification of risk factors that can be analysed to point to potential prevention actions.

To create a case series of work related Out-of-Vehicle truck driver fatalities from these two databases, the following inclusion and exclusion criteria were used:

Inclusion criteria:

1. the decedent was described as the driver of a truck in the police narrative or other documents available in the database, and
2. the incident was coded as work related and unintentional.

Exclusion criteria:

1. the incident occurred when the vehicle was being driven (moving or stationary); or
2. the vehicle had a GVM of less than 4.5t

The VWRFD and the NCIS databases for the period July 2000 - December 2009[2] were interrogated according to the criteria above. Police narratives accompanying the cases identified were examined by a researcher to confirm case inclusion.

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[2] Excluding Western Australia

After the case series had been constructed, the available material for each case (including coronial finding if available) was then analysed to extract information about:

- the age of the person at death, and their gender,
- the jurisdiction in which the fatality occurred,
- the year in which the fatality occurred,
- the location (with reference to the truck) of the incident causing death,
- the mechanism of injury that lead to the death (e.g. fall, electrocution, crush),
- the principle underlying or triggering cause of the incident,
- an assessment of the reason why the driver was out of the vehicle,
- whether the driver was working alone, with someone else at the same location but not on the same direct task, or was directly observed/supervised, and
- post mortem toxicology status, if available (coded into 4 categories: “illegal drug or alcohol present”, “therapeutic drug present”, “not illegal and not therapeutic drug present” and “no drug or alcohol present”)

**Injury Data**

For the topic currently under investigation, it could be reasonably expected that for every fatality, there would be a larger number of similarly caused non-fatal injuries. In 2003-2004 the ‘Intermediate production and transport workers’ occupational group (which includes truck drivers) had the highest injury rate (108 per 1000 employed) of all occupational groups in Australia (ABS, 2007).Therefore, examination of available injury surveillance databases for reports for similar but non fatal, injuries was undertaken.

The Victorian Injury Surveillance Unit (VISU) maintains the Victorian Emergency Minimum Dataset (VEMD) which is an ongoing surveillance database of injury presentations to 38 Victorian public hospital emergency departments. The VEMD collects variables including: age, sex, injury cause, location, activity, nature of main injury, body region, human intent, birth place, preferred language, address postcode, departure status, referral on departure and a 250 character text description of the injury event.

The VEMD was searched for records between 2000-2007 for presentations in Victorian public hospitals using a keyword search for text containing the word “truck” and then excluding any results that had the word “crash” or “accident”. The search was also limited to persons above the age of 15 years, and where the person was working for income. The text descriptions resulting from this search were then manually scanned by a researcher to exclude any cases in which the person presenting at the hospital was not a driver at the time, or the vehicle involved was not a truck.

**Results**

There were 47 fatal cases Australia wide that meet the selection criteria. Of these cases, only one fatality was female, however caution is advised when drawing any conclusions from this fact, as the population of truck drivers in Australia is overwhelmingly male (ABS, 2007).

The age range at death was 21 – 68 years (Mean = 46.5 years) and the peak of fatalities occurs for the 50-54 year old range. This is older than the average Australian worker (male & female) (38.6 years), however similar to the average (Mean = 41.3 years) for truck drivers (ABS, 2010) (See Table 1).

**Table 1. Age of drivers in case series, Australia 2000 – 2009 (Excluding WA).**


Fatalities occurred in all jurisdictions examined, other than the Australian Capital Territory (See Table 2). The distribution of fatalities would suggest that out-of-vehicle fatalities are far more prevalent in Victoria than other jurisdictions, however caution is urged in relation to this interpretation, as it is more likely that relative jurisdictional frequencies are an artefact of the way that the data has been recorded and provided to the database compilers. That is to say, in some jurisdictions the textual description of the event is more detailed than in others, resulting in fewer cases being excluded that met the inclusion criteria. There is reasonable confidence in the completeness of the Victorian data. It follows from this that that the likely incidence of this fatality type is in fact higher than would be expected from the sample described here.

**Table 2. Jurisdiction of fatalities, Australia 2000 – 2009 (Excluding WA).**

| Jurisdiction | No. Of Fatalities |
|---|---|
| **Victoria** | 21 |
| **Queensland** | 13 |
| **New South Wales** | 9 |
| **Tasmania** | ≤3 |
| **South Australia** | ≤3 |
| **Northern Territory** | ≤3 |
| **Total** | 47 |

Between one and eight fatalities were recorded for each of the years in the study, however as the figure for 2000 does not include cases from Queensland. In addition, the figures for 2008 and 2009 are likely to be lower due to the number of cases open for investigation by the coroner that were unavailable for investigation. Although the relatively small sample size calls for caution in drawing conclusions, if 2000 and 2008-9 are excluded, it appears that apart from a spike in 2001, there is an increase in fatalities with time. While further study would be required to confirm this as a trend, the frequency of Out-Of-Vehicle truck driver fatalities appears to be rising.

**Table 3. Number of fatalities per year, Australia 2000 – 2009 (Excluding WA).**

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 |
|---|---|---|---|---|---|---|---|---|---|---|
| Number of fatalities | ≤3 | 10 | 5 | ≤3 | 5 | 4 | 7 | 8 | 3 | ≤3 |

In the majority of cases (37 of 47) the location of the incident that caused the injury leading to death was by the side of, or between the truck/trailer and another object. Smaller numbers died in or on the cabin, in or on the trailer, or under the truck.

**Table 4. Position of driver following fatal incident, Australia 2000 – 2009 (Excluding WA).**

| **Location of incident** | **By the side of the truck** | **Between the truck or trailer and another object** | **In or on the cabin** | **In or on the trailer** | **Under the truck** |
|---|---|---|---|---|---|
| Count | 15 | 22 | ≤3 | 3 | 6 |
| % of total | 31.9 | 46.8 | ≤6 | 6.4 | 12.8 |

The most frequent mechanism of death was by crushing (33,70%), typically between a truck/trailer and an external body (see Table 4), although there were also incidents of people being crushed within the truck mechanisms (e.g. tray and truck body), followed by falls (6, 13%), hit by falling object (4, ≤10%), electrocution (≤3, ≤10%) and poisoning (≤3, ≤10%).

**Table 5. Mechanism of Death, Australia 2000 – 2009 (Excluding WA).**

| **Mechanism of death** | **Crush** | **Fall** | **Hit by falling object** | **Electrocution** | **Poisoning** |
|---|---|---|---|---|---|
| Count | 33 | 6 | 4 | ≤3 | ≤3 |
| **% of total** | **70.2** | **12.8** | **≤10** | **≤10** | **≤10** |

The most frequent underlying cause or trigger of an incident that lead to death was associated with a failure of the braking system to operate as appropriate for the circumstances (25, 53%), either due to malfunction, deliberate disablement or not being applied. In combination, these two factors lead to a pathway of events that was common to a third of fatalities, namely where a brake failure lead to a crushing death. When this scenario is considered, it becomes apparent that a necessary pre-condition for this chain of events is that the vehicle was parked on an incline. Subsequent analysis of the documentation associated with the cases found mention of an incline in 21 of the 47 cases.

The next most frequent underlying cause was due to the operation of external machinery (such as loading cranes) (8, 17%), followed by a fall (7, 15%), hit by another vehicle (4, ≤10%), vehicle jumping forward (≤4, ≤10%), ingestion of a noxious substance (≤4, ≤10%), rapid change of environmental conditions (≤4, ≤10%) and cargo restraint failure (≤4, ≤10%). Change of environmental conditions refers to the rapid change of something in the environment, making a situation dangerous (e.g. collapse of earthworks).

**Table 6. Principle underlying cause of the incident.**

| Underlying cause | Count | % of total |
|---|---|---|
| Brake (all causes)<br>• Not applied<br>• Air pressure issue | 25<br>*5*<br>*6* | 53.1<br>*10.6*<br>*12.7* |
| Operation of external machinery | 8 | 17 |
| Fall | 7 | 14.9 |
| Hit by another vehicle | 4 | ≤10 |
| Vehicle jump forward (vehicle in gear) | ≤4 | ≤10 |
| Noxious substance | ≤4 | ≤10 |
| Change in environmental conditions | ≤4 | ≤10 |
| Restraint failure | ≤4 | ≤10 |

When the cases were examined to determine why the driver was out of the vehicle at the time, the most common reason was that the driver was in some way attending to the load (22), either loading or unloading, observing someone else doing that, or securing the load. Other frequent causes were that the driver was performing some sort of repair or maintenance (12) or coupling / uncoupling a trailer (4).

In terms of the work environment, 17 drivers were working alone with no other in the immediate vicinity, 14 were working alone with no other around, 12 were working with another on a task and there was insufficient information to determine the work environment for 4 cases. The majority of cases involved the driver performing their actions either alone, or not being directly assisted if someone else was present. Therefore in 31 cases, there was no one to sound the alarm to the driver should a dangerous circumstance emerge.

In 11of 27 cases where a toxicology report was available, it recorded positive results for drugs or alcohol. In 6 cases (12.8% of all cases) alcohol or illegal drugs (cannabis metabolites or amphetamines) were detected (one case had alcohol and therapeutic drugs detected together), in 4 cases therapeutic drugs were detected, presumably administered by either the ambulance crew or at a hospital, and in one case non-therapeutic, non-illegal drugs were detected (caffeine).

In one case, alcohol was reported in the police report, but there was no toxicology report available (not included in the total), and in one case methadone was detected (in combination with cannabis metabolites). Not all jurisdictions were able to provide toxicology reports to NCIS for the whole period investigated (2000-2009) (NCIS, 2009), and therefore it is possible that these figures are an underestimate of the actual presence of drugs/alcohol for those jurisdictions.

**Injury Data**

During the 2000-2007 period, there were 2205 presentations and 326 admissions to VEMD hospitals meeting the study criteria, detailed in the injury data methods section (p.10). No further relevant information was available. This non-fatal injury data suggests that Out-of-Vehicle fatalities probably only represent a fraction of the overall injury burden associated with this issue, with a far larger number of non-fatal incidents resulting in hospital admission and/or presentation.

Nevertheless, a direct comparison could not be made between the numbers of fatalities from the NCIS and VWRF databases and the number of presentations and admissions from the VEMD as the two sources of data could not be queried in the same way, and were therefore not subject to the same exclusion and inclusion criteria. In particular, the number of cases from the VEMD dataset is likely to over include cases in some respects, as it was not possible to determine who of the injured parties had been a driver of the truck and to under include cases when the person entering data in a busy hospital does not happen to use the keywords that were chosen for this study. The VISU reports that the VEMD probably records only two-thirds of injury ED presentations in Victoria. It also reports that only around 30% of VEMD cases have a good quality narrative such as would likely identify relevant cases. The numbers reported here are therefore likely to be a substantial underestimation of the true number of cases.

**Study Limitations**

A limitation of this study is that the coding accuracy and amount of information available from these databases relies on a wide range of actors including police, coronial staff and scientific laboratories (for autopsy and toxicology data) across the jurisdictions, which can result in inconsistency in the database. This will inevitably be amplified when non-standard, or under-recognised issues are being investigated for which the databases are not specifically designed, and for which specific codes do not exist.

Therefore there is a risk that any case series extracted from these databases may misrepresent the size of the problem to an extent that cannot be estimated. Thus, the current research is not intended to provide a quantification of the relative burden of non driving truck driver fatalities in Australia; it is to provide a description of Out-of-Vehicle driver fatality characteristics.

### Conclusion

This study identified 47 fatalities in Australia between 2000 -2009 in which a truck driver was killed outside their vehicle, and suggests that this is an area in which further research and prevention efforts can be applied. Issues with braking mechanisms leading to trucks rolling was the most frequent pathway leading to driver death, and prevention efforts in this area may have a greater effect than if applied elsewhere.

## SECTION C: PREVENTION STRATEGIES

Searches of the literature did not reveal any prevention strategies for Out-of-Vehicle truck driver fatalities that have been implemented and their effectiveness assessed. Therefore, in this circumstance prevention strategies will be generated by the application of intervention design principles that have been used in other areas of injury prevention. Additionally, sources of strategies to consider are any relevant interventions that have been proposed for preventing in-vehicle fatalities (e.g Radun and Summala, 2004), or Out-of-Vehicle injuries (e.g. Fathallah et al, 2000)).

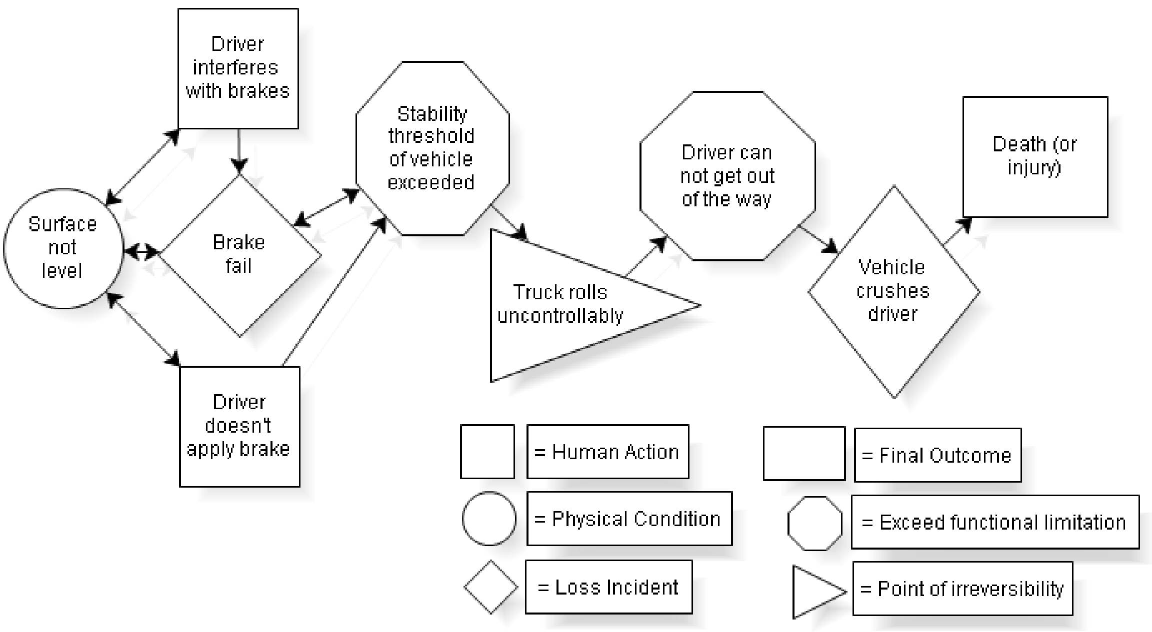
Most of the interventions relating to in-vehicle fatalities are not relevant, as they address prevention of crashes. Nevertheless, those interventions that address driver factors (e.g. drugs, alcohol and fatigue) will be relevant to Out-of-Vehicle fatality prevention, in as much as fit, unimpaired and rested workers will be able to react optimally to any circumstance with which they are presented. In particular, the need to continue interventions in relation to drugs and alcohol appear necessary, as the rate of positive drug/alcohol toxicology findings are of a similar prevalence as reported in recent Australian research, where positive results were found in 79/355 (22%) cases work related fatalities in Victoria between 2001-2006 (McNeilly et al, 2010).

Interventions proposed in the Out-of-Vehicle injury literature will be considered alongside those generated by the application of the intervention design process. When considering prevention strategies, the trajectory of the error that becomes the injury or fatality can be represented in a diagram so that the incident can be broken down into different dimensions, such as time, personal factors, physical factors and social factors, each of which may be a site for an intervention.

In the context of Out-of-Vehicle fatalities, a trajectory model can be created based on the Universal Model technique proposed by (McClay, 1989 a, b). This technique requires identifying the proximal causal factors (those factors which occur in the same time and space as the incident), distal causal factors (those factors which do not occur in the same time and space as the incident), the point of irreversibility (the point at which loss cannot be stopped) and factors that are unrelated (or that there is no evidence that they are related) to the incident.

A number of these models could be drawn from the case series described in Section B. The model presented as Figure 1 shows a pathway between the most common underlying proximal cause (inappropriate functioning of brakes) and the most common mechanism of death (crushing) via a point of irreversibility (the vehicle rolling uncontrollably). The distal factors have not been included in this Figure for simplicity, however, in the case series reported in Section B, the distal factors identified are associated with the reason that the driver is out of the truck (the task being performed).

**Figure 1. Universal Model of causation for "Truck rolling" Out-of-Vehicle truck driver fatalities, Australia 2000 – 2009 (Excluding WA).**



In order to generate prevention possibilities, the Haddon's Matrix technique[3] (e.g. Haddon, 1980) was applied to the error pathway described in Figure 1. In addition, for those cases with coronial prevention recommendations, the coroner's report was taken into account when the prevention recommendations were being developed for any injury or fatality type. A summary of the results of this process is described in Table 7.

**Table 7. Opportunities for Prevention Interventions for "Truck rolling" Out-of-Vehicle fatalities.**

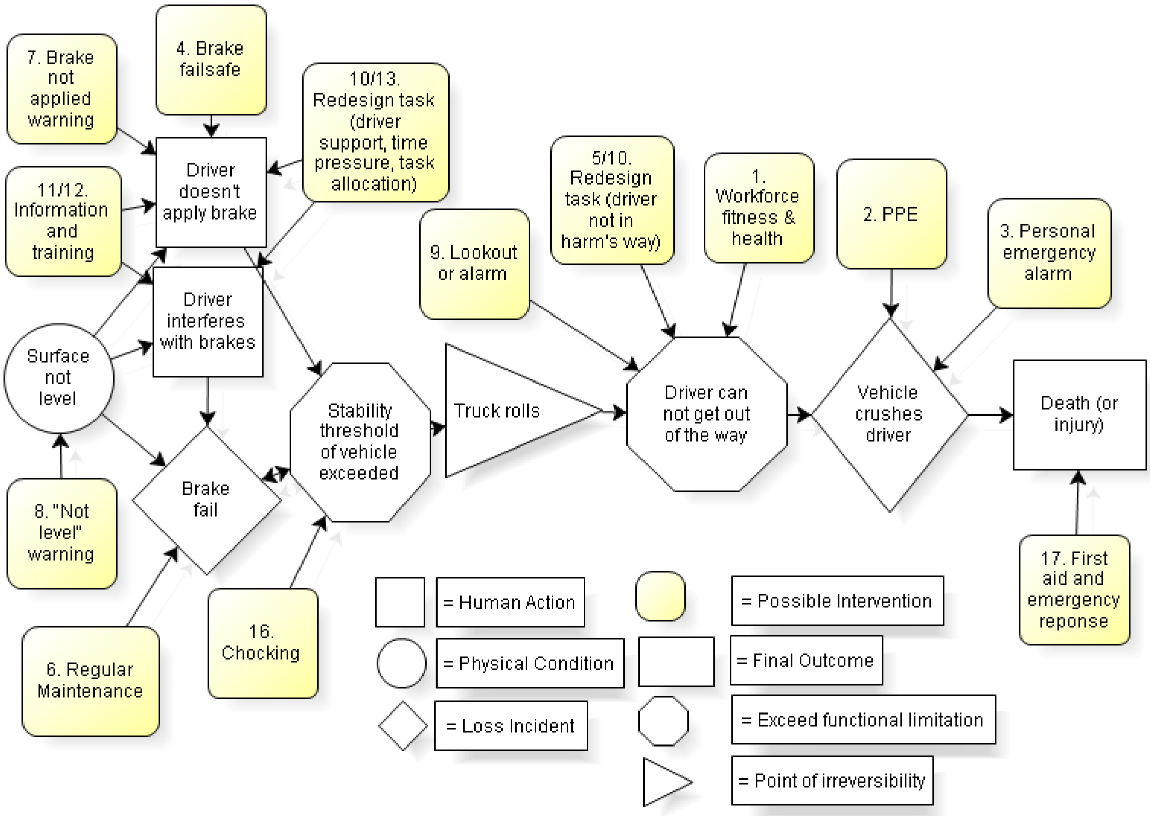
| | **Before Incident** | **During Incident** | **After Incident**<br><br>For the fatal cases, generally, little practical can be done at this stage, given the typically severe injury |
|---|---|---|---|
| **Person** | 1. Agility<br>- Recruit a younger workforce<br>- Worker fitness | 2.Use Personal Protective Equipment (PPE) [May not be effective in the presence of the forces involved] | 3. Personal alarm / mayday signal |

[3] The Haddon's Matrix technique involves assessing what changes could be made to human factors (e.g. age), the social environment (e.g. training), the physical environment (e.g. terrain) and the agent or carrier (the truck or trailer) at three conceptual phases: pre-event, during the event and post-event.

| | | | |
|---|---|---|---|
| **Agent (truck/trailer)** | 4. Failsafe / automatic brakes<br>5. Design of coupling systems<br>6. Brake maintenance | 7. Brake application warnings<br>8. Incline warning<br>9. Truck rolling alarm | |
| **Social environment** | 10. Task allocation (e.g. ‘driver’ / ‘loader’)<br>11. Training to remove normalisation of maladaptive behaviours. E.g. “Fix-it-yourself”<br>12. Awareness of issue | 13. Manage distraction / multitasking & time pressure (Task design)<br>14. Provision of support worker (lookout) | 17. First aid and emergency response |
| **Physical environment** | 15. Treatments for loading bays. | 16. Chocking practice (Training) | |

These numbered interventions can be placed in the Universal Model to indicate the point at the trajectory that they would be expected to be effective (See Figure 2).

**Figure 2. Universal Model of causation for “Truck rolling” Out-of-Vehicle truck driver fatalities with opportunities for prevention interventions.**




As indicated, there are a number of interventions that could be made in an attempt to halt progress through this chart, however some of them are likely to be more practical or useful than others. For example, PPE (Intervention 2) may reduce the severity of an incident, although in the context of crushing injuries, it may not be of sufficient strength to make a meaningful difference to the outcome. Likewise, an attempt to substitute into the workforce younger and more agile individuals (Intervention 1) who could escape to safety when a truck rolls towards them would be difficult realistically, and may indeed introduce new risk factors such as inexperience.

Analysis of the available material indicated that there were two main reasons why the driver was out of the vehicle. The drivers were either attending to their load in some fashion (e.g. loading/unloading or inspecting it) or they were attending to repairs or maintenance of the truck or trailers. Reducing or removing the need for the driver to be out of their vehicle would reduce or remove the risk of being injured or killed (E.g. Interventions 5, 10 & 13). Examples of how this could be accomplished include having an automated or dedicated loading / unloading machinery or a workforce that would reduce the need for the driver to attend to the loading or unloading, and ensuring vehicles are properly maintained would reduce the need for repairs (Intervention 6). In addition, in a number of the situations where repairs were being carried out, they were using incorrect tools. In these situations, provision of correct tools or training, or the provision of specialist repair crews may have reduced the risk for the driver (E.g. Intervention 10 – redesign task).

Technical design solutions, such as coupling systems that enable a driver to perform their task physically removed some distance from the trailer & prime mover have been investigated in the United Kingdom (Society of Operations Engineers, 2007) although at the time of the publication, difficulties in universal application of solutions to all combinations of prime movers and trucks were reported. As vehicles used in Australia are imported from all major manufacturers, this may also be a significant difficulty locally.

Many of the tasks that a truck driver will be called upon to perform will be solitary, however the high number deaths that occurred where a driver was working alone or unassisted suggests that some form of lookout or alarm could warn workers if something unexpected is occurring, such as the vehicle commencing to roll (Interventions 7, 8 & 9).

Behavioural interventions, such as awareness, training (Interventions 11 & 12) and applying a regular maintenance schedule (Intervention 16) can also be targeted at people other than the driver for maximum impact, so for example that loading and unloading staff and drivers have clearly delineated roles and functions (Interventions 10 & 13).

Some of the interventions mentioned, such as preventative maintenance and use of PPE are of general application, however it may be that they require some modifications if they are to address out-of-vehicle fatalities. For example, when being serviced, braking mechanisms could also be tested for efficacy on inclines.

Finally, personal emergency alarms (Intervention 3) will not be of any preventative use, but may decrease the time taken for rescue and medical services to arrive which in turn may improve survival chances. Likewise, an increased understanding of first aid (Intervention 17) in the working and broader population may increase survival chances for those situations where the individual is not killed instantly, and the availability of suitable rescue equipment may also allow medical care to be applied in a more timely fashion.

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## APPENDIX 1. NOTES TO VEMD DATA

The Victorian Injury Surveillance Unit at the Monash University Accident Research Centre provided all of the injury data presented in this report. They provide the following advice about this data.

**Source:**

Victorian Emergency Minimum Dataset (VEMD): emergency department presentations (including subsequent admissions), January 2000 – December 2007

The VEMD is an ongoing surveillance database of injury presentations to 38 Victorian public hospital emergency departments. As of January 2004 all public hospitals with a 24 hour service have participated in the data collection. The VEMD collects data in accordance with National Minimum Data Standards for injury surveillance. While data is *not* coded using the ICD-10-AM system, the code set is similar and comparable.

**Search criteria:**

Cases recorded in the VEMD were extracted using the following criteria:

- Age of injured person: 15 years old or greater.
- Person was ‘working for income’
- Text description of the injury event contained the word “truck”. Cases were then checked for relevance to exclude crash related incidents.

**Notes:**

- Case identification is reliant on good data being provided. Data is collected in the busy emergency department, so detailed data collection is not always achieved. Hence these data may be an underestimate of the true number of cases.

**Victorian Emergency Minimum Dataset (VEMD):**

VISU records details of injuries treated at the Emergency Departments of the 39 hospitals collecting data in accordance with the Victorian Emergency Minimum Dataset (VEMD). The total number of cases on the database to date is in excess of 3.2 million cases.

Variables collected include: age, sex, injury cause, location, activity, nature of main injury, body region, human intent, birth place, preferred language, address postcode, departure status, referral on departure and a 250 character text description of the injury event.

VEMD caveats:

1. Hospital specific data cannot be provided without specific, written permission, from the hospital in question.
2. The VEMD collects data from Victorian public hospitals with 24-hour emergency departments. 100% state wide coverage of these hospitals applies from April 2005.
3. Only injury deaths that actually occurred within the Emergency Department or patients who were dead on arrival are reported on the VEMD database. Deaths that occur after the patient left the Emergency Department may not be identified and may be coded as an admission or transfer. In the year 2005, 40 child and 1925 adult injury deaths were registered with the Australian Bureau of Statistics in Victoria.

Thirty-nine hospitals are currently contributing data to the collection and these, along with starting dates, are listed below:

***From October 1995***

| | | |
|---|---|---|
| Austin Health | Ballarat Base Hospital | The Bendigo Hospital |

| | | |
|---|---|---|
| Box Hill Hospital | Echuca Base Hospital | The Geelong Hospital |
| Goulburn Valley Base Hospital | Maroondah Hospital | Mildura Base Hospital |
| Northern Hospital | Royal Children's Hospital | St Vincent’s Public Hospital |
| Northeast Health Wangaratta | Warrnambool Hospital | Western Hospital (Footscray) |
| Sunshine Hospital | Williamstown Hospital | Wimmera Base Hospital |
| ***From November 1995*** | ***From December 1995*** | |
| Dandenong Hospital | Royal Victorian Eye and Ear Hospital | |
| | Frankston Hospital | |
| ***From January 1996*** | ***From July 1996*** | ***From September 1996*** |
| Latrobe Regional Hospital | Alfred Hospital | The Angliss Hospital |
| | Monash Medical Centre | |
| ***From January 1997*** | ***From January 1999*** | ***From December 2000*** |
| Royal Melbourne Hospital | Werribee Mercy Hospital | Rosebud Hospital |
| | ***From January 2004*** | |
| Sale Hospital | Warragul Hospital | Bairnsdale Hospital |
| Swan Hill Hospital | Wodonga Hospital | Hamilton Hospital |
| Sandringham Hospital | Royal Women’s Hospital | Mercy Women’s Hospital |

***From April 2005***

Casey Hospital