

Literature review of heavy vehicle driver seatbelt use

Final report

Prepared for:
Centre for Road Safety
Transport for New South Wales

By:
Lori Mooren and Ann Williamson

November 2013



TRANSPORT AND ROAD SAFETY
(TARS) RESEARCH

Table of Contents

Introduction	3
Background	3
Project scope.....	4
Method	4
Results	5
The problem of non-restraint use by heavy truck drivers	5
Attitudes towards restraint use	5
Strategies for improving seatbelt use by truck drivers	7
Relevant workplace policies, practices and strategies on restraint use.....	7
Prevalence and effectiveness of any relevant in-vehicle technology, such as seatbelt reminders	9
Effective campaign approaches to improve wearing rates	12
Discussion	15
Conclusions and recommendations.....	16
References	19

Introduction

Transport and Road Safety (TARS) conducted a literature review into heavy vehicle seatbelt use in order to provide Transport for NSW (TfNSW) with a comprehensive understanding of current attitudes and practices about seatbelt use by these drivers. The aim of this project was to conduct a literature review to attempt to develop a comprehensive understanding of attitudes towards seatbelt use among heavy vehicle drivers, including motivators and barriers to seatbelt wearing. This information can be used to guide the development of a new communication campaign aimed at heavy vehicle drivers, as well as inform a countermeasure strategy to help increase seatbelt use among the target group.

The review included research relating to the attitudes and practices of both operators and drivers, including any workplace policies, as well as research on observed or self-reported use of restraints.

Background

Seatbelts are a secondary safety device that operate to reduce the risk of serious or fatal injury should a crash occur. Seatbelts have been required to be fitted to the driver's seating position to new goods-carrying vehicles over 4.5 tonnes since 1977 and for buses over 3.5 tonnes since 1987. Since seatbelt use by heavy vehicle occupants in NSW became mandatory in 2000, there has been a notable increase in seatbelt usage from an initial low rate of around one-third of truck occupants. Observational studies by the Centre for Road Safety showed that, in New South Wales in 2011, around one-quarter of heavy truck drivers still failed to wear seatbelts at all times [1]. However, the wearing rates have been improving in recent years. Among truck driver deaths, NSW crash data for the five-year period 2010-12 (2012 preliminary data) shows that only 24% of these drivers were not wearing a seatbelt at the time of the crash. This compares favourably to 50% of truck driver fatalities in 2008-10 and 38% in 2009-11 [2].

Some attempts have been made to understand the reasons for non-use of seatbelts by this driver group. This research identified factors like: restriction in the use of side mirrors, discomfort during normal driving, inconvenience when performing deliveries and perceptions of impeding the driver's ability to move or escape from the cabin to avoid injury during or after a crash [3].

In the past, public education campaigns have been used in NSW to promote seatbelt use among heavy vehicle drivers. (e.g., 'Do or die: seatbelts save truckies too'). Evaluation of the campaign suggested that it was effective in increasing heavy vehicle driver awareness of the effectiveness of seatbelts in reducing death and injury. However, it was felt that further communication was necessary to ensure that drivers are aware of their legal requirements to wear seatbelts and that operators are aware of their obligations under Workplace Health & Safety law to provide a safe working environment for their drivers.

With the development of improved in-vehicle technology such as seatbelt warning systems, there are currently more options for ensuring seatbelt usage by heavy vehicle drivers and greater awareness of the need to encourage wearing. Research from the US suggests that some fleet managers discuss seatbelt use during safety meetings or have company policies requiring seatbelt use [4]. This approach is encouraged by Roads and Maritime Services' practices and by NSW WorkCover. Although these other strategies exist, state-wide education campaigns are still a key approach adopted by TfNSW to encourage seatbelt wearing among heavy vehicle drivers.

The NSW Road Safety Strategy 2012-2020 highlights the need to increase heavy vehicle compliance, and therefore a new campaign is proposed to encourage restraint use among heavy vehicle drivers. Research is required into the attitudes and practices of heavy vehicle drivers, in order to guide and inform, and ensure effective targeting of, the campaign. The research will also help to guide a more holistic countermeasure strategy to help increase seatbelt use among heavy vehicle drivers.

Project scope

The project scope was restraint use among heavy vehicle drivers, and their attitudes towards use, as well as any workplace policies or practices, strategies, public education or other countermeasures such as in-vehicle reminders related to seatbelt usage.

In particular, the review explored the following areas in relation to heavy vehicles:

- Attitudes towards restraint use
- Observed/self-reported restraint use
- Any relevant workplace policies, practices and strategies on restraint use
- The prevalence and effectiveness of any relevant in-vehicle technology such as seatbelt reminders
- Campaign approaches towards the issue, and their effectiveness.

Although observed/self-reported restraint use was explored, this was not the focus of the review.

The review included published and unpublished literature from Australia, Europe and the U.S. as far as it was available from on-line and electronic sources. This review does not include direct contact with other road safety authorities in these countries.

Method

The project involved the following stages:

1. Discussions were held with key personnel from the Centre for Road Safety and the final scope and research methodology was agreed on .
2. The review involved a literature review using conventional on-line search tools including Google Scholar and the University of New South Wales Library online tool, Sirius. The following key words were used: “heavy vehicles and seatbelts, trucks and seatbelts, motor carrier driver seatbelt use, safety belts, truck occupant restraint use, heavy vehicle driver restraint use, driver attitudes, seatbelt policies, restraint reminder, seatbelt technology, seatbelt campaigns”. Sirius enables a simultaneous search of databases including: Scopus, ScienceDirect, Proquest Research Library, APAFT, Business Source Premier, Social Sciences Citation Index, Web of Science, JSTOR and Primo Central Index. In addition, the grey literature was explored through Google search facilities.

3. The websites of key organisations concerned with heavy vehicle safety were searched for relevant material. These included Austroads, the Australian Trucking Association (ATA), NatRoads, Australian Logistics Council, Australian Road Transport Industry Organisation (ARTIO), National Transport Commission (NTC), Roads and Maritime Services (RMS, formerly the Roads and Traffic Authority), NSW WorkCover, and Transport Workers Union (TWU) in Australia. Also, the websites of the US Federal Motor Carrier Safety Administration, Commercial Vehicle Safety Alliance, American Transport Research Institute, and other members of the Transportation Research Board's Truck and Bus Safety Committee were examined. The websites of the European Transport Safety Council and the OECD International Transport Forum were explored as well.

4. The data collected was reviewed for relevance and helpfulness for the objectives of the Project. These were analysed and the analysis written into a report together with a key point summary, conclusions and recommendations that particularly focus on the development of a public education campaign on seatbelt usage in the heavy trucking industry. The report highlights the key elements from the review that should be taken into account when developing heavy vehicle seatbelt improvement strategies for NSW.

Results

The problem of non-restraint use by heavy truck drivers

Currently, wearing rates for light vehicle drivers in NSW are well over 90% but the rates of seatbelt use by truck drivers are generally considerably lower at around 75%.

The importance of wearing seatbelts for truck drivers has been highlighted in a number of studies. A study by Bunn et al (2013)[7], showed the injury severity for truck drivers unrestrained in crashes is considerably higher, and they have a much greater chance of being ejected from the vehicle if unrestrained[7]. A study by Porter (1998) of over 1,000 trucking crashes involving injury showed that seatbelt wearing was associated with higher risk of sternal injury but head injuries were much less likely compared to non-users. Another recent US study by Peng and Boyle (2012) found that using seatbelts substantially reduced the injury severity of run-off-road truck crashes[8].

Appendix A provides a summary of more research on seatbelt wearing rates.

Attitudes towards restraint use

A number of journal articles and reports relating to truck drivers' and others' attitudes to seatbelt use were sourced and reviewed.

The most relevant study to Australian truck drivers was the study by Haworth et al (1995) which found that reasons for not wearing seatbelts were the seatbelt being uncomfortable, especially for overweight drivers, that they did not confer a safety advantage and that they were inconvenient. The interview study of Australian truck drivers by Preece (2002) also highlighted the restriction of movement and discomfort of seatbelts as reasons for non-use. Similarly, most of the international studies of attitudes to seatbelt wearing by truck drivers also found comfort-related factors and the perception that they would be trapped in a crash were commonly cited. In the Haworth study,

most drivers who reported wearing seatbelts gave the risk of enforcement as their reasons for doing so, but other studies [9, 10] also found that social pressure from family and modelling of seatbelt using behaviour by other drivers were acknowledged as reasons for wearing seatbelts.

Overall, these studies indicate that drivers who do not like to use seatbelts claim that they are uncomfortable (rubbing the neck or shoulder) and that they restrict movement (required for adequate vision and operating the vehicle). Some studies also found that the need to buckle and unbuckle belts was perceived as inconvenient (although Haworth et al found that inconvenience was rarely given as a reason.)[4, 5]. Other indications are that the drivers do not have a habit of using the seatbelt and simply forget to fasten their seatbelts [4].

Table 1 provides a brief description of these documents.

Table 1 – Attitudes towards restraint use

Study/type	Research	Findings
Kim and Yamashita (2007)[11] Journal paper	Survey of 791 commercial truck drivers at weigh stations and trucking companies in Hawaii to study self-reported use of seatbelts, attributes of drivers who use an not use and attitudes to use	33% reported not always using seatbelts when driving commercial vehicles. Reasons for non-use were frequent stopping/inconvenience, not being safety conscious and discomfort.
Bergoffen, G. et al (2005)[4] Report	Surveys of US fleet managers (n=120) and truck drivers (n=238) on reasons for not using seatbelts and driver complaints about seatbelts.	List of managers' reasons that drivers don't wear seatbelts include: too much trouble & effort, they forget, habit, belt doesn't fit well, uncomfortable, restricts movements, infringes on personal freedom, worried about being trapped, don't believe seatbelts increase safety, don't like them, use only in bad weather conditions. Drivers' complaints include: belts rub or vibrate against neck or shoulder, seatbelt locks and restricts, uncomfortable, too tight, limit range of motion.
Preece, R. (2002)[3] Conference paper	In-depth interviews with 7 Australian truck drivers regarding reasons for non-use of seatbelts.	Reasons given were: restriction in use of side mirrors and exiting vehicle in a crash, discomfort, difficulty in accessing & unlocking seatbelt.
Calisir, F., Lehto, M. (1996)[12] Conference paper	Experimental US study on perceived importance of seatbelt use in various accident scenarios (n=50 male light vehicle drivers, 50 female)	Perceived risk & importance of seatbelt is influenced by accident situational factors, eg direction of crash, location and airbags.
Haworth et al (1995)[5] Report	Interviews of 184 Australian truck drivers in Melbourne and Western Sydney were conducted focused on finding out why truck drivers don't wear seatbelts.	72% of drivers said that they never wore a seatbelt. 35% of drivers didn't wear seatbelts claiming that they are uncomfortable. 27% said they thought there was no safety value or that wearing seatbelts was dangerous. Obese drivers were less likely to wear seatbelts. Of those that do wear seatbelts stated that safety and enforcement consequences were why they work them.

Bragg, B. (1985)[13] Journal paper	Experimental Canadian study of 25 pairs of young & old male light vehicle drivers/passengers, perceptions of risk while wearing and not wearing seatbelts while driving.	Young drivers perceive a lower accident risk than older drivers (though a bit higher as passengers) and initial seatbelt wearing is associated with perception of higher risk.
Jonah, B., Dawson, N., (1982)[14] Journal paper	A survey was conducted with Ontario light vehicle drivers (n=445 first sample, n=438 in second sample) to understand beliefs and attitudes to seatbelt use.	Favouring the seatbelt law was the biggest predictor of seatbelt use. Social pressure by family and friends as well as perceived seatbelt use by other drivers were also important predictors.

Strategies for improving seatbelt use by truck drivers

The review of strategies that have been implemented to improve seatbelt use by truck drivers showed three major groups of studies: specific strategies used in the workplace, in-vehicle technologies to improve seatbelt use (eg., seatbelt reminders) and public campaigns to promote seatbelt use by truck drivers. The evidence found for each type is shown in the next sections.

Relevant workplace policies, practices and strategies on restraint use

The workplace provides an opportunity for employers to encourage employee drivers to always use seatbelts. A few studies were found that formulated specific workplace-related strategies to enhance seatbelt use. This includes the use of seatbelt ignition interlock systems (preventing starting of the vehicle if the driver and front passenger were not belted).

A survey of US fleet managers [4] found that the greater majority do some sort of promotion of seatbelt use. Of the 120 operators they consulted, 87% of them do some kind of seatbelt use promotion, including establishing policies on seatbelt use, discussions with drivers on the use of seatbelts and observational monitoring of seatbelt use. This study did not evaluate the effectiveness of these strategies, however. In contrast, the study by Johnson & Johnson in the US incorporated seatbelt use as one of 13 health and wellness goals in the company and monitored the results [15]. The intervention achieved reductions in non-use of seatbelts to less than half of the prior non-use rates, although wearing rates were already very high. It is not clear, however, whether the increased wearing rates were the result of the intervention as the study did not include a control group.

In addition, there are examples from the grey literature on safety management systems in transport that suggest ways that transport companies can promote the use of seatbelts. The International Association of Oil & Gas Producers (OGP) have included seatbelt provision and use in an industry standard on (global) land transport safety practices [16]. Workplace methods include seatbelt promotion in safety meetings, policies, driver handbooks, incident investigations, knowledge tests, driver pledges, driver training, on-site observations and pep-talks¹. The US Federal Motor Carrier Safety Administration (FMCSA) has made a resource available on its website to guide employers to improving seatbelt use in their companies (obtain at <http://www.fmcsa.dot.gov/safety-security/safety-belt/increasing-safetybelt-usage-manual.htm>). Again, however, none of the methods have been evaluated.

¹ See <http://www.fmcsa.dot.gov/safety-security/safety-belt/index.htm> for more information and resources.

The Swedish Association of Road Transport Companies are promoting accreditation of the new Road Traffic Safety Management Systems Standard (ISO 39001). The adopters of the precursor Swedish Standard reported a systematic method of assessing and addressing risks including the non-use of seatbelts [17]. The results of a survey of accredited companies suggest that the participants believe that by implementing the Standard they have been successful in achieving targeted seatbelt wearing rates although again there has not been a formal evaluation of this workplace intervention.

Table 2 summarises the information found.

Table 2 – Workplace strategies

Study/type	Research/Reference	Findings
Johansson, M. (2011)[17] Report	Survey of Swedish Association Road Traffic Safety Standard (SA-RTS) accredited Swedish transport operators (n=93 accredited for at least six years) about profitability and fulfilment of road safety objectives including the use of seatbelts. The performance factors of the standard include the use of personal protective equipment, especially seatbelts.	The operators assessed their risk of road traffic injury related to non-use of seatbelts in terms of per cent chance of occurring and injury consequence on a scale of 1-10 with death being 10. They answered that there was a 30% chance of drivers not using seatbelts and a 3% chance of death from crashes involving non-use of seatbelts. Then in terms of success in reaching their goal of >85% use rates, 85% of them reported that they have met this goal.
International Association of Oil & Gas Producers [16] Industry standard	The major international Oil and Gas companies have come together to establish “recommended” safety management practices. The standards are not enforceable but the major companies use them for benchmarking purposes. The OGP Land Transport Safety Recommended Practice standard covers seatbelt provision and use as the first specific recommended practice.	Occupants of any vehicle shall use seatbelts at all times. All vehicles (owned, contracted or leased) must be fitted with seat belts for each occupant. Belts for all occupants shall be of the 3-point configuration, preferably incorporating automatic retraction and deceleration activated emergency locking mechanisms. It is recommended that belts incorporate pretensioners wherever possible. In vehicles equipped with sleeper berths, if the berth is to be used while the vehicle is in motion, some form of approved restraint shall be provided and used at all times the vehicle is in motion. Where it is impossible to implement the above seatbelt requirements for buses or coaches, the minimum requirements are that seat belts are fitted for the driver (3 point); and front seats and seats with an open space in front (such as a seat adjacent to a doorway) should not be occupied unless seatbelts are fitted. Personal vehicles used on company business should be consistent with the above specifications. Vehicles which are not capable of more than 10 mph (16 kph) may be exempted. Use of spot-hire vehicles not properly fitted with seat belts for all passengers shall be avoided when alternatives are available.
Bergoffen et al (2005)[18] Report	Survey of US heavy vehicle fleet managers (n=120) about what they do to promote seatbelt use by their drivers	87% discuss during safety meetings 79% include policy in driver handbook, 78% have written company policy, 75% include use of seatbelt in accident investigation processes, 73% observe belt use by drivers when in the

Study/type	Research/Reference	Findings
		terminal.
Goetzel, R. et al (2003)[15] Journal paper	A 4-page health assessment instrument was administered to Johnson & Johnson's (US) staff at the beginning and 33 months after a Health and Wellness program was introduced, including seatbelt non-use as one of 13 health risk factors (n=43,000 pre-, n=4,586 post-intervention). The intervention was primarily health education and self-responsibility.	Significant reductions in (light vehicle drivers') seatbelt non-use was reportedly achieved over the 33 month period as one of 8 of the 13 risk factors measured. Non-seatbelt use decreased from 4.5% of participants in the program to 2.7% after the program.

Prevalence and effectiveness of any relevant in-vehicle technology, such as seatbelt reminders and seat/seatbelt design

There are four types of seatbelt configurations in trucks, allowable under Australian Design Rules. These are:

1. B-pillar anchored (anchored to the cabin) seatbelts with a fixed seat;
2. B-pillar anchored seatbelt with a suspension seat (one where the cushion and back are connected to the chassis by a suspension system such as air suspension);
3. Integrated seatbelt with a suspension seat (one where the seatbelt is anchored to the seat); and
4. Integrated seatbelt with a fixed seat.

According to the National Transport Commission (NTC, 2005), the B-pillar anchored seatbelt and fixed seat offers comfort levels similar to light passenger vehicles. And the integrated seatbelt with a suspension seat offers comfort levels similar or better than a light passenger vehicle [19].

A discussion paper circulated by the NTC to consider improved truck designs for greater occupant safety advised that driver discomfort may arise when there is a seatbelt anchored to a B-pillar with a suspension seat (that goes up and down with the belt slowly tightening) [19]. There are devices that can be retrofitted to seats that encourage the driver/occupant to use a seatbelt. As discomfort is cited as a reason that drivers do not wear seatbelts, the NTC has reviewed seat and belt configurations and recommended changes to Design Rules and the retrofitting of integrated seat/belt configurations. They also provided information about retrofitting integrated seatbelt/suspension seat in trucks aimed at truck owners [20]. See Appendix B.

Seatbelt reminder systems, seatbelt ignition interlocks, high visibility seatbelts, and integrated seatbelt technologies are available to assist encouragement of seatbelt use. The NTC has produced guidelines² for retrofitting integrated seatbelt/suspension seats, to redress the resistance of drivers to use the less comfortable B-pillar anchored seatbelts with suspension seats [20]. EuroNCAP introduced, in 2003, additional points for vehicles fitted with seatbelt reminders to contribute to higher star safety ratings of new light vehicles. Of all light vehicles tested since 2003, 72% have seatbelt reminders[21]. ANCAP also awards points for seatbelt reminders³ for light vehicles only. As early as 1973 the US Government mandated that all new passenger vehicles

² Obtainable at <http://www.ntc.gov.au/DocView.aspx?DocumentId=1200>

³ See <http://www.ancap.com.au/starratings>

feature seatbelt ignition interlocks (preventing starting of the vehicle if the driver and front passenger were not belted). However, this was rescinded in 1975 due to public opposition [22].

Studies of light vehicles provide consistent support for the effectiveness of seatbelt reminders in increasing driver acceptance [18], wearing rates [20, 21] and achieving some decreases in road fatalities [19]. A US study by Eby et al (2005) found that the most acceptable and effective seatbelt reminder system would be adaptive, changing its signal type and intensity depending on passenger (non)response over time, distance or speed. In addition, Sivak et al (2007) carried out a review of effective countermeasures and opportunities for improving road safety in the US [22]. They also concluded that seatbelt reminder systems are effective as are seatbelt interlocks, but that interlocks are not well accepted by drivers. While the circumstances for commercial truck drivers would be expected to be different from light vehicle drivers, these studies provide some insights into the effectiveness and acceptability of seatbelt reminder technologies. Essentially, the seatbelt technologies were all found to be effective and cost effective in improving seatbelt use.

Table 3 provides a summary of some evidence that reminder systems and other technologies can improve seatbelt use by truck drivers. Unfortunately, although evidence from light vehicles has some relevance to trucking, only two studies were found on seatbelt-related technologies specifically addressing trucks. Both involved cost-benefit analyses of reminder systems [15, 17] and both demonstrated good cost-benefit from seatbelt reminder systems and one demonstrated that brightly coloured seatbelts had lower, but reasonable cost-benefit. While useful, neither study looked at the acceptability and usability of seatbelt reminders.

Table 3 – In-vehicle technologies to improve seatbelt use

Study/type	Research	Findings
Kid, D. (2012)[23] Journal paper	US study into optimal types of seatbelt reminder systems in light vehicles (n=80 part time belt users).	Those that experienced the enhanced seatbelt reminder (EuroNCAP protocol) reported that they would be more likely to put on their seatbelts than the group with the reminder system that just meets Government requirements.
Freedman et al (2009)[24] Report	Observation study of 40,567 US light vehicle drivers, 9,907 drivers with passengers and 9,911 passengers to determine the odds ratio (OR) of using a seatbelt in vehicles with a seatbelt reminder system versus those without reminder systems.	The driver belt use OR in vehicles with a reminder system was 1.275 times larger than driver belt use OR in vehicles with a baseline system.
Bahouth et al (2007)[25] Report	An exploration of benefits of 4 types of technologies for improving seatbelt use by truck drivers: audible reminders, brightly coloured belts, belt tension adjusters and seat integrated restraint systems.	Both the brightly coloured belts (BCR = 1.70) and the audible reminder systems (BCR = 2.60) are cost beneficial for improving truck driver wearing rates.
Regan, M., et al (2006)[26] Journal paper	Before and after measurement of seatbelt wearing rates per trip to examine the effectiveness of seatbelt reminder systems in light vehicles.	The decline in the percentage of trips where seatbelts were not worn was 48% - down from 32% of trips before to 16% of trips after the seatbelt reminders were operating. The time

Study/type	Research	Findings
		taken to buckle up was also reduced from 30 seconds to 7 seconds. And the percentage of time driving unbelted reduced from 5% to less than 2%.
Kullgren, A. et al (2005)[27] Report	A review of in-vehicle technologies for improving road safety by the European Transport Safety Council. Light vehicle focus	If seatbelt reminders were fitted to 2 million Swedish cars, road fatalities would decrease by 7% per annum. Reminder devices with both audio and visual messages are more effective than other reminder devices.
Eby et al (2005) [28] Conference paper	Telephone survey of 1,100 US part time seatbelt users to determine reasons for wearing and not wearing seatbelts. In addition, focus groups were consulted on the type of seatbelt reminder system that would be most effective and acceptable.	An optimal seatbelt reminder system should not be noticed by fulltime users; be more difficult to cheat the system compared with using the seatbelt; disconnection of the system should be difficult; should be reliable; injury risks should not be increased; should be based on acceptability and effectiveness; and should be compatible with the manufacturer's intended purpose for the system.
Fildes, B., et al (2004)[29] Report	Cost-benefit analysis of retrofitting seatbelt reminder systems in all – light and heavy - motor vehicles in Australia	Retrofitting driver seat seatbelt reminders at \$35 a unit would be cost beneficial if wearing rates improved by 20%, or if \$45 and a 30% improvement was achieved.
Eby et al (2004)[30] Report	Telephone survey (n = 683 US part-time seatbelt users in light vehicles) and focus group (n = 87) discussions to determine the effectiveness and acceptance of seatbelt reminder systems	While participants indicated opposition to seatbelt interlocks, the study concluded that the more intrusive seatbelt reminder systems should be used for headstrong non-users. Less intrusive reminders could be effective for low risk or part-time users.

Effective campaign approaches to improve wearing rates

The vast majority of published seatbelt campaign evaluations were from the US and all focussed on all vehicles, not heavy vehicles specifically.

Neither TruckSafe, nor the National Logistics Safety Code explicitly mention seatbelt use or seatbelt policies. The TWU has supported seatbelt campaigns by TfNSW and RMS, and advise members to use seatbelts, but their website does not indicate that they have been especially proactive. The ATA and ARTIO could have been more active in promoting seatbelt use. However, the ATA Chairman called for more research into seatbelts in a media release in 2011. The only references to seatbelts on the NSW WorkCover site are in relation to forklifts and moving plant on construction sites. However WorkCover's draft industry action plan 2012-2013 suggests that they would include driver fatigue, seatbelts and occupational disease risks in "demonstration and solution field days" and in targeted media and social media.

In the United States, the Federal Motor Carrier Safety Administration (FMCSA) partners with a range of organisations to promote seatbelt use. In fact there is a formal Commercial Motor Vehicle Safety Belt Partnership Pledge with signatories from the US Department of Transportation, Commercial Vehicle Safety Alliance, National Private Truck Council, FMCSA, Motor Freight Carriers Association, Owner Operator Independent Drivers Association, and the American Trucking Association (Appendix C). In addition, evaluation of the campaigns conducted in a number of US (State and County) jurisdictions has been made available through conference and journal papers (cited in this paper) for sharing knowledge of what has worked and why. In addition, as discussed in the section on workplace strategies, the FMCSA has produced a guide for conducting successful seatbelt campaigns targeting truck drivers⁴.

Most of the evaluations of campaigns involved the Click it or Ticket campaign in various states of the US [28, 29, 30, 31]. All evaluations showed increased wearing rates for seatbelts, with the states that fully implemented the campaign showing strongest effects pre and post implementation. Two evaluations showed greater improvements during the day compared to night, which was interpreted as being due to reduced enforcement activity at night. Two other campaigns in the US combined public education of all drivers with enforcement [26, 32] and both showed strong improvements pre and post over time and in one case in comparison with control sites that showed a reduction in wearing over the same time. Another study by Geary et al demonstrated a dose-response effect with better wearing rates at sites that implemented a greater number of waves of the campaign [31]. The Hunter et al (1986) evaluation study used small monetary incentives to encourage wearing and showed a doubling in wearing rates that were sustained over six months [32]. In contrast an evaluation of the effect of a fear campaign emphasising the potential for injury if seatbelts are not worn also showed improvements in wearing between exposed and control groups. It seems that all types of campaigns, education, incentive, enforcement and fear-related messages that encourage seatbelt wearing can result in improvements. Comparatively large benefits of seatbelt wearing campaigns might be expected in many states of the US as wearing rates for general road users are considerably lower than in Australia. These studies may be more relevant to truck drivers in Australia than might be expected due to the overall lower wearing rates of this group amongst other Australian road users.

Most of the seatbelt campaigns in the literature have been conducted or led by government agencies and been directed at all road users. For the trucking industry, industry associations could

⁴ Find this at <http://www.fmcsa.dot.gov/documents/increasing-safety-belt-use-in-your-company-manual.pdf>

play a strategic role in encouraging drivers to comply with the seatbelt regulations, but they have done very little to promote seatbelt use by heavy vehicle drivers. However, the Queensland Trucking Association who partnered with the Queensland Government in 2009 to promote seatbelt use[33] conducted a campaign using an image of a spine X-Ray with a buckle to hold the torso and hip sections together. It also conveyed myths and misconceptions about seatbelts. However, there is no evaluation of this campaign available. Also, the 3rd Transport Industry Advice bulletin promoted seatbelt use to heavy vehicle drivers[34].

Consistently public education messages about the need for seatbelt requirements and concerted enforcement efforts have been shown to be effective in improving wearing rates. The evaluations suggest, however that improving night-time wearing rates may be more of a challenge, perhaps because drivers know that police cannot necessarily see whether the belts are being worn at night. There has been little emphasis in any seat belt campaigns on the responsibility of drivers to act to keep themselves safe under occupational health and safety regulation. This is another aspect of the argument that could be used to encourage truck drivers to use seatbelts.

Table 5 provides a summary of findings as well as details of a number of non-evaluated seatbelt promotions.

Table 5 – Campaign approaches to improve seatbelt use (targeting all vehicles)

Study/type	Research	Findings
Brijs K., et al (2011)[35] Journal paper	Evaluation of a Belgian seatbelt campaign targeting light vehicle drivers that used a “soft fear” approach about likelihood of being hurt if the belt isn’t worn. The study also examined the motivations for use using the Theory of Planned Behaviour (TPB) model. (n=311 male, 264 female – mean age 20)	There were differences between the control and exposed groups in perceived behavioural control, habit, past behaviour, intentions and behaviour. The likely reason for the effect is that behaviour was influenced by a reminder of past reasoned behaviour – without going through the reasoning again.
Thomas, A. et al (2011)[36] Journal paper	Observational studies before and after the <i>Click it or Ticket</i> Campaign, targeting light vehicle drivers and passengers, was conducted in Utah (n=23,550).	An overall 8.3% improvement on seatbelt use was achieved with 7.8% during the day and 9.7% at night. The rate of improvement for males (9.9%) was greater than that for females (5.7%)
Vivoda, J. et al (2007)[37] Journal paper	Pre- and post-campaign seatbelt use observation studies to evaluate the Indiana <i>Click it or Ticket</i> Campaign, targeting light vehicles, (n=22,973 pre- and n=24,937 post).	Daytime wearing rates improved while night-time wearing rates were less than before the campaign. This may be explained by reduced enforcement at night due to shifting night-time patrols to daytime during the campaign.
Bergoffen, G. et al (2005)[4] Report	Surveys of US fleet managers (n=120) and truck drivers (n=238) on reasons for not using seatbelts and driver complaints about seatbelts.	List of managers’ reasons that drivers don’t wear seatbelts include: too much trouble & effort, they forget, habit, belt doesn’t fit well, uncomfortable, restricts movements, infringes on personal freedom, worried about being trapped, don’t believe seatbelts increase safety, don’t like them, use only in bad weather conditions. Drivers’ complaints include: belts rub or vibrate against neck or shoulder, seatbelt locks and restricts, uncomfortable, too tight, limit range of motion.

Study/type	Research	Findings
Reinfurt, D. (2004)[38] Journal paper	Examination of elements of the <i>Click it or Ticket</i> Campaign, targeting light vehicle drivers that a number of US States have sustained over time.	The National Highway Traffic Safety Administration NHTSA estimates that the 10-year campaign has contributed to increased seatbelt wearing rates from 65% to 86%. Key elements retained in successive campaigns include: a coalition of public-private agencies, top-down commitments, innovative media use, well-publicised enforcement, feedback on results state-wide and local activities and continuous funding.
Geary, L., et al (2005)[31] Journal paper	Pre- and post-campaign light vehicle seatbelt observation studies in Connecticut, before and after successive 'waves' (26) of the "Selected Traffic Enforcement Programs (sTEPs)" campaign involving publicity and highly visible enforcement, targeting all motorists with the message that they will be punished for law violations.	The average belt use increased from 64% before the first wave, to 78% in the last post-wave survey. The towns and agencies that implemented greater numbers of waves achieved higher belt use rates.
Solomon, M. et al (2004)[39] Journal paper	This study compared the outcomes of the <i>Click it or Ticket</i> Campaign, targeting light vehicle drivers, implemented in various degrees in 18 US States.	The States that most fully implemented the Campaign achieved the best results in terms of improved seatbelt wearing rates.
Williams, A. et al (1987)[40] Journal paper	Before and after campaign observation study of light vehicle occupant seatbelt wearing rates in Elmira, New York. The campaign combined public education, with messages that seatbelts save lives and that a special program to enforce the seatbelt law would be happening, and enforcement operations over a 3-week period.	Wearing rates in Elmira increased from 49% to 77% just after the campaign and were at 66% two months after the campaign. This compared to a control site where seatbelt-wearing fell from 43% to 37% over the same period.
Hunter, W., et al (1986)[32] Journal paper	Pre- and post-campaign light vehicle seatbelt observation studies in the US to test whether small incentives (worth \$3-5) would improve wearing rates.	The overall driver wearing rate increased from 24% to 41% in the last week of the program, then held to around 36% in the 6-month follow up period.
Kaye, B. et al (1995) [41] Journal paper	Evaluation of a campaign involving police in 2 counties in Florida giving motorist a "thumbs up" when they used seatbelts and tugged at their belts when (light vehicle) motorists did not have seatbelts done up. (n= 30,930 observations)	There was no overall increase in seatbelt wearing rates. The county where seatbelt citations increased also had increased seatbelt wearing rates (whereas the other county had reduced wearing rates). Concluded that enforcement should be coordinated with public education.

Discussion

An obvious first step in attempting to tackle the issue of noncompliance with seatbelt regulation by heavy vehicle occupants is to understand why they do not comply. This review demonstrated a remarkable consistency in the reasons for non-use of seatbelts by truck drivers across studies, across time and across countries.

Understanding the barriers and motivators that influence the choice of truck drivers to use or not use seatbelts while working provides some clear directions for action. Issues relating to discomfort and the restrictive nature of seatbelts need to be addressed by ergonomic evaluations of the suitability of seatbelts for the truck driver population. In Australia, truck drivers are typically male, aged in their 40's and 50's and many are likely to be in the upper end of the anthropometric range of human sizes. This means that for many, seatbelts may not be a comfortable fit, especially over long hours of sitting at the steering wheel. The nature of the driver complaints about seatbelts (chaffing around the neck, for example) are consistent with this issue. Seatbelt design may also not be suitable for many of the tasks of truck driving such as the need to move in and out of the vehicle many times. Seatbelts, that are difficult to locate in the truck or difficult to fasten, will become impediments and will be avoided under those circumstances.

Issues relating to driver perception of the safety value of seatbelts will be best overcome by education campaigns specifically targeting truck drivers and the nature of their perceptions. Obviously, the statistical evidence supporting the value of seatbelts for reducing the extent and severity of injury is strong. Ensuring that drivers are aware of this information is an obvious target for attempting to change their behaviour. Also, ensuring that drivers are aware that seatbelt use is required by law is an important prerequisite for achieving this behaviour change. There is good evidence of benefits of public education campaigns for seatbelt use even in populations, such as the US, where seatbelt wearing is not mandated or even very common.

It is important to be aware, however, that Australian truck drivers who currently hold the view that seatbelts compromise their safety are likely to hold this view very strongly. Drivers who resist and do not wear seatbelts are in the minority and many may already be aware of the existence of some safety benefits of seatbelts. This means that education campaigns need to be very carefully targeted at misperceptions about the particular circumstances where they believe seatbelts are a disadvantage, such as during a rollover. Given that one of the motivators for some truck drivers to wear seatbelts is the concern for safety, there is a strong likelihood that educational approaches will increase wearing rates.

The threat of enforcement is another strong motivator for wearing seatbelts in truck drivers. The public campaign evaluations also make clear that enforcement together with public education is an effective approach. Conventional enforcement through observational means, however, is not easily achieved for truck drivers as it can be difficult to see whether or not drivers are complying. A novel approach to enforcement may be to employ workplace-based enforcement and incentive approaches. Unfortunately, few workplace measures were found in the literature. A Johnson & Johnson seatbelt initiative for their employees was integrated with a health and wellness program and achieved improved wearing rates. But these employees were mostly light vehicle drivers. Swedish transport operators accredited by an industry association for having a safety system reported good results from applying the accreditation standards including improved seatbelt use. But the report of this study was lacking in detail regarding what was done and how results were linked to the actions. In Australia, accreditation standards are used for many other aspects of the trucking industry so it should be a simple matter to extend seatbelt use to this system. In view of

the fact that seatbelts are a very well-established road safety countermeasure it seems that pressure should be exerted on trucking-related road safety and industry bodies to take action on mandating seatbelt wearing by truck drivers and taking appropriate action to ensure that it occurs.

Engineering approaches to encourage and remind drivers to use seatbelts are also widely advocated. A total of seven studies were found on the effectiveness of seatbelt reminders and related approaches, although only two involved trucks. Nevertheless the results indicated that seatbelt reminder technologies are effective means of improving wearing rates. Although there is a cost to purchasing and fitting these devices, this is found to be a cost effective measure. These technologies may not be very suitable for use during work-related truck driving, however, especially delivery driving. Some types of common reminders, such as audible tones, or reminders that commence too soon may only serve to cause annoyance if they occur often as drivers frequently move in and out of the vehicle and do not buckle up immediately. There is considerable scope for the development of user-friendly but effective devices to encourage truck drivers to use seatbelts, but as for the design of seatbelts themselves, this should take in account the needs of truck drivers and the truck-driving task with the comparatively long periods of time a truck driver is sitting in the same seat.

Key point summary and recommendations

The conclusions that can be drawn from review are the following:

1. Seatbelt comfort and design is an important factor in seatbelt use

Truck driver comfort is a primary factor in tackling the problem of non-use of seatbelts. The seatbelt discomfort issue should be addressed by ergonomic evaluation studies of the most suitable seatbelt design for the truck driver population. While seatbelts are uncomfortable for truck drivers, any of the other approaches will be less likely to be effective. Enforcing truck drivers to use seatbelts that chafe or cause discomfort over a long trip is unlikely to be successful. Encouraging drivers to wear seatbelts using education approaches alone are even less likely to be successful.

While seatbelt reminder systems can improve wearing rates, drivers may disable the devices especially where they still hold the belief that wearing seatbelts pose additional crash risks to them. Seatbelt reminder or ignition interlocks are likely to be much more effective, especially in the longer term, if these myths are dispelled, and the seatbelt comfort issue is addressed effectively.

Improved comfort of seatbelts can be achieved by promoting the practice of retrofitting integrated seat/seatbelt technologies, and by promoting the assessment of seat/seatbelt configurations suitable for drivers, particularly for drivers who are overweight or obese such as was recommended in the NTC review (2005).

2. Driver misconceptions about seatbelts and safety are still factors in non-use

Some truck drivers think that seatbelts do not improve safety. Indeed, some believe that wearing seatbelts reduces their safety by restricting their movement and vision, or preventing them from escaping harm.

There is a weight of evidence to the contrary. But if drivers aren't aware or convinced that seatbelts improve safety they are not likely to use them no matter what is tried.

Educational campaigns targeted directly at truck driver perceptions of the safety implications of seatbelts are likely to help encourage seatbelt use. There are some educational materials that have been used for this purpose in campaigns and workplace programs in the US. For example, the US Federal Motor Carrier Safety Administration (FMCSA) provides an internet accessible video produced by Volvo that illustrates what happens to restrained and unrestrained truck occupants in a rollover crash⁵. Perhaps this could be utilised in a New South Wales initiative subject to permissions obtained from Volvo or FMCSA.

A campaign should primarily include messages that dispel the specific myths about negative safety consequences of seatbelts for truck drivers and about the need for the law mandating their use. Truck drivers should be informed about the true safety value of seatbelts. There may also be benefits of campaign messages that include advice that drivers are less likely to lose control of the vehicle if restrained, as recommended by Haworth et al (1995), based on their study of truck driver attitudes [5].

3. Improving driver perceptions that they will be caught and penalised for non-use is effective

Publicity-backed enforcement campaigns have consistently been found to be an effective way to increase seatbelt wearing rates among the general driving population. These campaigns aim to convince drivers that if they don't use a seatbelt they will be caught and penalised. This is a more motivating incentive for some. The best outcomes from education campaigns targeted at truck drivers are likely to be achieved if campaign message occur in concert with enhanced enforcement of seatbelt use by authorities.

Industry associations should be encouraged to partner with the Centre for Road Safety in promoting these messages. However, the high-risk segments of the industry may well be non-members of these associations. So, other ways of targeting them could be more effective. For example, truck owners could receive campaign messages with registration renewals and messages at weigh stations and truck stops could be posted. In addition, high profile visible enforcement should be publicised in the media. The recent practices of the Roads and Maritime Services together with Police of advising the media of truck drivers and operators being caught may be an effective deterrent to other operators not wanting to have their reputations tarnished in this manner.

4. Industry involvement in seatbelt promotion could be improved

Employers, industry associations and unions could be encouraged to further promote seatbelt use. Induction or safety training and education materials could be supplied to heavy vehicle transport operators, such as fact sheets, videos, and posters. The industry associations and unions, such as the TWU, could be encouraged to advocate seatbelt use among their constituents.

Most safety accreditation schemes applicable to the trucking industry omit seatbelts as a safety standard. The new ISO 39001 is one of the few that does include a specific reference to provision and use of seatbelts. The Australian Trucking Association could be encouraged to explicitly include seatbelt use in TruckSafe, the industry safety accreditation scheme. And the Australian Logistics Council could be similarly encouraged to include seatbelt use in the National Logistics Safety Code.

Recommendations

⁵ See <http://www.fmcsa.dot.gov/images/volvo-crash-large.wmv>

It is recommended that the following interventions be considered.

- 1. Improve seat/seatbelt configurations to assure greater comfort for truck drivers**
 - a. Promote retrofit of integrated seat/seatbelt configurations recommended by the NTC.

- 2. Dispel the myths that truck drivers have about the safety value of seatbelts**
 - a. Educate drivers about the safety benefits of seatbelts.
 - b. Dispel the myths about negative safety consequences of seatbelt use in trucks.
 - c. Provide education materials to the trucking industry and encourage workplace education programs.

- 3. Promote the perception that truck drivers will be caught and penalised for not wearing seatbelts**
 - a. Conduct coordinated seatbelt enforcement publicity campaigns together with highly visible police enforcement operations targeting truck drivers.
 - b. Encourage trucking companies to put in place policies and enforcement regimes to meet their duty of care.

- 4. Encourage industry involvement in promoting the use of seatbelts by truck drivers**
 - a. Encourage employers to remind truck drivers that their responsibility to ensure their own safety at work includes wearing a seatbelt.
 - b. Encourage the Australian Trucking Association to include seatbelt provision and policy enforcement in TruckSafe accreditation criteria.
 - c. Encourage the Australian Logistics Council to include seatbelt provision and policy enforcement in the National Logistics Safety Code.
 - d. Encourage trucking companies to be accredited to ISO 39001.
 - e. Encourage unions, like the TWU, to promote seatbelt use by their members.
 - f. Encourage the ATA, ALC and other trucking industry bodies to actively and visibly promote seatbelt use.

References

1. Taverner Research, *Heavy vehicle seatbelt observational study*, 2011, NSW Centre for Road Safety: Unpublished.
2. NSW crash data, Centre for Road Safety.
3. Preece, R., *The safety benefits from seatbelt use by heavy truck occupants*, in *Australasian Transport Research Forum (ATRF)2002*: Canberra, ACT.
4. Bergoffen, G., Knipling, R., Tidwell, S., Short, J., Krueger, G., Inderbitzen, R., Reagle G., Murray, D., *Commercial motor vehicle driver safety belt usage*, in *Commercial Truck and Bus Safety Synthesis 82005*: Washington DC.
5. Haworth, N., Bowland, L., Foddy, B., Elliott, B., *Seat Belts for truck drivers*, 1995.
6. Raftery, S., Grigio, J., Woolley, J., *Heavy vehicle road safety: a scan of recent literature*. Journal of the Australasian College of Road Safety, 2011(August).
7. Bunn, T., S. Slavova, and M. Robertson, *Motor vehicle injuries among semi truck drivers and sleeper berth passengers*. Journal of Safety Research, 2013. **44**(0): p. 51-55.
8. Peng, Y., Boyle, L., *Commercial Driver Factors in Run-off-Road Crashes*. Transportation Research Record: Journal of the Transportation Research Board, 2012: p. 128–132.
9. Bunn, T.L., et al., *The Effects of Semi Truck Driver Age and Gender and the Presence of Passengers on Collisions with Other Vehicles*. Traffic Injury Prevention, 2009. **10**(3): p. 266-272.
10. Vivoda, J., and Eby, D., *Factors influencing safety belt use*, in *Handbook of Traffic Psychology* B. Porter, Editor 2011, Elsevier. p. 215-248.
11. Kim, K. and E.Y. Yamashita, *Attitudes of commercial motor vehicle drivers towards safety belts*. Accident Analysis & Prevention, 2007. **39**(6): p. 1097-1106.
12. Calisir, F., Lehto, M., *Drivers' risk assessments and their impact on seat belt use*, in *19th Conference on Computers and Industrial Engineering 1996*, Computers and Industrial Engineering. p. 495-498.
13. Bragg, B.W.E. and P. Finn, *Influence of safety belt usage on perception of the risk of an accident*. Accident Analysis & Prevention, 1985. **17**(1): p. 15-23.
14. Jonah, B., Dawson, N., *Predicting seat belt use from attitudinal and normative factors*. Accident Analysis & Prevention, 1982. **14**(4): p. 305-309.
15. Goetzel, R., Ozminkowski, R., Bruno, J., Rutter, K., Isaac, F., Wang, S., *The long-term impact of Johnson & Johnson's Health & Wellness program on employee health risks*. Journal of Occupational and Environmental Medicine, 2002. **44**(5).
16. OPG, *Land transportation safety recommended practice*, 2005 (updated July, 2011), International Association of Oil and Gas Producers.
17. Johansson, M., *ISO 39001 Road Traffic Safety (RTS) Management Systems - Experiences from early adopters in the Swedish transport industry*, in *International Symposium on Heavy Vehicle Transport Technology 122011*.
18. Bergoffen, G.S., J. Inderbitzen, B. Daecher, C., *Commercial Motor Vehicle Carrier Safety Management Certification: A Synthesis of Safety Practice*, in *Commercial Truck and Bus Safety Synthesis Program 12*, T.R. Board, Editor 2007, Transport Research Board: Washington DC.
19. National_Transport_Commission, *Seat and belt configurations for heavy vehicles: discussion paper on options for improved design requirements*, 2005: Melbourne.
20. National_Transport_Commission, *Integrated seatbelt/suspension seat: Retrofit guidelines for truck owners*, 2005, NTC: Melbourne.
21. EuroNCAP. *Seat Belt Reminders*. 21 March, 2013]; Available from: <http://www.euroncap.com/Content-Web-Page/028478a4-b05d-4136-b06b-4a02d5643b54/seat-belt-reminders.aspx>.
22. Sivak, M., et al., *Traffic safety in the U.S.: Re-examining major opportunities*. Journal of Safety Research, 2007. **38**(3): p. 337-355.
23. Kidd, D.G., *Response of part-time belt users to enhanced seat belt reminder systems of different duty cycles and duration*. Transportation Research Part F: Traffic Psychology and Behaviour, 2012. **15**(5): p. 525-534.
24. Freedman, M., Lerner, N., Zador, P., Singer, J., Levi, S., *Effectiveness and Acceptance of Enhanced Seat Belt Reminder Systems: Characteristics of Optimal Reminder Systems*, 2009.
25. Bahouth, G., Langston, E., McKnight, J., Zaloshjna, E., Robin, J., Kumer, J., *Safety belt technology countermeasures study*, D.o. Transportation, Editor 2007, FMCSA: Washington DC.

26. Regan, M., Triggs, T., Young, K., Tomasevic, N., Mitsopoulos, E., Stephan, K., Tingvall, C., *On-road evaluation of intelligent speed adaptation, following distance warning and seat belt reminder systems: Final results of the TAC SafeCar project*, 2006, MUARC.
27. Kullgren, A., Stigson, H., Achterberg, F., Townsend, E., *In-car enforcement technologies today*, J. Crettaz, Editor 2005, European_Transport_Safety_Council: Brussels.
28. Eby, D., Molnar, L., Kostyniuk, L., Shope, J. *Developing an effective and acceptable safety belt reminder system*. in *Proceedings of the 19th Technical Conference on the Enhanced Safety of Vehicles*. 2005. Washington DC: US_Department_of_Transportation.
29. Fildes, B., Fitzharris, M., Vulcan, P., Koppel, S., *Benefits of retrofitting seat belt reminder systems to Australian passenger vehicles*, 2004, Australian Transport Safety Bureau: Civic Square, ACT.
30. Eby, D.W., Molnar, L. J., Kostyniuk, L. P., Miller, L. L. , *Developing an Optimal In-Vehicle Safety Belt Promotion System*, 2004.
31. Geary, L.L., K.A. Ledingham, and S.C. Maloney, *Connecticut statewide sSTEP wave evaluation*. Journal of Safety Research, 2005. **36**(4): p. 333-340.
32. Hunter, W.W., B.J. Campbell, and J.R. Stewart, *Seat belts pay off: The evaluation of a community-wide incentive program*. Journal of Safety Research, 1986. **17**(1): p. 23-31.
33. Queensland_Trucking_Association. *Seatbelt myths and misconceptions*. 2009 21 March, 2013]; Available from: <http://www.qta.com.au/index.cfm?MenuID=186>.
34. Tasmanian_Transport_Safety_Group, *Transport Industry Safety Advice: Seat Belts in Heavy Vehicles*, 2001.
35. Brijs, K., et al., *An experimental approach towards the evaluation of a seat belt campaign with an inside view on the psychology behind seat belt use*. Transportation Research Part F: Traffic Psychology and Behaviour, 2011. **14**(6): p. 600-613.
36. Thomas, A.M., L.J. Cook, and L.M. Olson, *Evaluation of the Click It or Ticket intervention in Utah*. Accident Analysis & Prevention, 2011. **43**(1): p. 272-275.
37. Vivoda, J.M., et al., *A Direct Observation Study of Nighttime Safety Belt Use in Indiana*. Journal of Safety Research, 2007. **38**(4): p. 423-429.
38. Reinfurt, D.W., *Documenting the sustainability of a mature Click It or Ticket program: The North Carolina experience*. Journal of Safety Research, 2004. **35**(2): p. 181-188.
39. Solomon, M.G., R.P. Compton, and D.F. Preusser, *Taking the Click It or Ticket model nationwide*. Journal of Safety Research, 2004. **35**(2): p. 197-201.
40. Williams, A.F., et al., *Results of a seat belt use law enforcement and publicity campaign in Elmira, New York*. Accident Analysis & Prevention, 1987. **19**(4): p. 243-249.
41. Kaye, B.K., B.S. Sapolsky, and D.J. Montgomery, *Increasing seat belt use through PI&E and enforcement: The Thumbs Up campaign*. Journal of Safety Research, 1995. **26**(4): p. 235-245.
42. Federal_Motor_Carrier_Safety_Administration, *Safety Belt Usage by Commercial Motor Vehicle Drivers (SBU CMVD) 2010*, 2011: Washington DC.
43. Brodie, L., B. Lyndal, and I.J. Elias, *Heavy vehicle driver fatalities: Learning's from fatal road crash investigations in Victoria*. Accident Analysis & Prevention, 2009. **41**(3): p. 557-564.
44. Cook, L.J., J.L. Hoggins, and L.M. Olson, *Observed seatbelt usage among drivers of heavy commercial vehicles in Utah*. Accident Analysis & Prevention, 2008. **40**(4): p. 1300-1304.
45. Federal Motor Carrier Safety Administration, *Large truck and bus crash facts 2007*, 2009: Washington DC.
46. Steinhardt, D., Watson, B., *Nighttime seatbelt non-use in serious crashes: A comparison of contributing factors in rural and urban areas of the United States and Queensland*, in *2007 Road Safety: Research, Policing, Education Conference 2007*, CARRS-Q: Melbourne.
47. Stearns, D., *Heavy vehicle seat belt wearing compliance in New Zealand*, 2007: Auckland, New Zealand.
48. Charbotel, B., et al., *Severity Factors for Truck Drivers' Injuries*. American Journal of Epidemiology, 2003. **158**(8): p. 753-759.
49. Lin, L.-J. and H. Harvey Cohen, *Accidents in the trucking industry*. International Journal of Industrial Ergonomics, 1997. **20**(4): p. 287-300.
50. Hagenzieker, M.P., *Drivers' opinions of enforcement and incentive strategies to promote safety belt use*. Journal of Safety Research, 1992. **23**(4): p. 199-206.

Seatbelt wearing rates

Study/type	Research	Findings
Bunn, T., Slavova, S., Robertson, M. (2013)[7] Journal paper	Matched cohort study of Kentucky truck crashes to determine the injury odds ratio of being restrained or unrestrained in a crash.	Drivers and sleeper berth passengers were 2.25 times more at risk of being injured if they were not restrained.
Raftery, S., Grigio, J., Woolley, J. (2011)[6] Journal paper	Review of the literature on heavy vehicle road safety.	Restraint use among truck drivers is estimated to range from 4-30% in Australia.
Federal Motor Carrier Safety Administration (2011)[42] Report	As part of an annual seatbelt observation survey total of 26,830 Commercial Motor Vehicles (CMVs), 26,830 drivers, and 1,929 other occupants were observed at 998 US sites.	The overall safety belt usage rate for drivers of all medium and heavy duty trucks and buses rose from 74% in 2009 to 78% in 2010. The usage rate for CMV other occupants also increased from 61% in 2009 to 64% in 2010. Safety belt use was higher in states governed by primary belt use laws (80%) than secondary belt use laws (72%). Safety belt usage among drivers and other occupants in units identified as part of a fleet (80%) was observed to be higher than for independent owner-operators (71%).
Brodie, L., Bugeja, L., Ibrahim, J. (2009)[43] Journal paper	Study of Victorian coronial data into factors in fatal truck crashes. 61 cases of crashes between 1999 and 2007 were examined.	Only 25 of the 61 drivers were wearing a seatbelt at the time of the fatal crash.
Cook, L., Hoggins, J., Olson, L. (2008)[44] Journal paper	Observational study of seatbelt use by truck drivers in Utah.	Truck drivers had a usage rate of 64%, which was 20% lower than the national (US) average.
FMCSA Analysis Division (2009) [45] Report	From the Fatality Analysis Reporting System (FARS) an analysis of drivers ejected from the truck wearing seatbelts and not wearing seatbelts was carried out.	Of those truck drivers who wore full lap/sash seatbelts, 79% were not ejected. Of those drivers who did not use any type of seatbelt, 72% were ejected.
Steinhardt, D., Watson, B. (2007)[46] Conference Paper	Examination of Queensland and US crash data to determine differences in urban vs rural and night-time versus daytime wearing rates.	Both jurisdictions showed similar patterns of lower wearing rates at night and in rural areas. (NB vehicle types included in data sets were "Car/Truck & derivatives".)
Kim, K., Yamashita, E. (2007)[11] Journal paper	Questionnaire survey of 791 truck drivers in Hawaii on attitudes and self-report seatbelt use.	Approximately 67% of truck drivers reported that they always use a seatbelt when driving.

Study/type	Research	Findings
Stearns, D. (2007)[47] Government report	Observational survey in 4 large and 2 small cities in New Zealand.	An average national seatbelt wearing rate for truck drivers is 43%.
Charbotel, B., Martin, J., Gadegbeku, B., Chiron, M. (2003)[48] Journal paper	Study of trauma registry data to assess driver injury severity factors in truck (300) and car (9,488) crashes in France.	Truck drivers were 1.87 times more likely to have an injury score of 9 or more than car drivers. Seatbelts were worn by only 14% of truck drivers versus 72% of car drivers.
Preece, R. (2002)[3] Conference paper	Observational study on seatbelt wearing rates (n=1,357 Australian truck drivers)	Only 32% of drivers wore lap/sash seatbelts. (But the rate of wearing lap only belts – available in an estimated 37% of trucks - could not be determined.)
Lin., L., Cohen, H. (1997)[49] Journal paper	Using data from 24 US trucking companies (n= 3,053 accidents) an examination of causes was conducted.	In cases of motor vehicle collisions the average cost of the collision was less when the injured worker was restrained by a seatbelt.
Hagenzieker, M. (1992)[50] Journal paper	Survey of Dutch military personnel from 12 bases (n=1,097) on motivations to use a seatbelt.	Of the sample, 64% self-reported that they always use a seatbelt, 8% often, 6% seldom, 4% never.

Appendix B
NTC Guidelines on Retrofitting Integrated Seatbelt/Suspension Seat



www.ntc.gov.au

Integrated seatbelt/ suspension seat

Retrofit Guidelines For Truck Owners

Why Retrofit Integrated Seatbelt/ Suspension Seats?

Seatbelts Save Lives
It's estimated that 40 unbelted heavy vehicle drivers lose their life every year. This could be reduced substantially if seatbelt wear rates were improved. Currently, only 50 percent of drivers wear seatbelts (NSW Roads & Traffic Authority 2003) and driver discomfort is often cited as a contributory factor.

Driver comfort
Suspension seats are designed to dampen vibration over rough roads and improve driver comfort. However, if the seatbelt is anchored to the truck's side column (B-Pillar) and floor, the seat's vertical travel over rough roads can cause the belt to lock and tighten across the driver's neck, throat, chest and abdomen.

Some drivers resist wearing B-Pillar anchored seatbelts with suspension seats because they are considered uncomfortable. This combination is fitted to about 30 percent of trucks sold (ERG Truck Tracker 2004) and is commonplace in the Australian heavy vehicle fleet.

In contrast, the integrated seatbelt/suspension seat allows the driver's relative position to remain constant with the seat and seatbelt. This option is often available at a small cost premium to the truck's retail price and can also be retrofitted to many existing vehicles.

Note: wearing a seatbelt in any configuration is better than not wearing a seatbelt at all and is required by law.



NTC
AUSTRALIA
National Transport Commission

Integrated seatbelt/suspension seat

Retrofit guidelines for truck owners

Why retrofit integrated seatbelt/suspension seats?

Seatbelts Save Lives

It's estimated that 40 unbelted heavy vehicle drivers lose their life every year. This could be reduced substantially if seatbelt wear rates were improved. Currently, only 50 percent of drivers wear seatbelts (NSW Roads and Traffic Authority 2003) and driver discomfort is often cited as a contributing factor.

Driver comfort

Suspension seats are designed to dampen vibration over rough roads and improve driver comfort. However, if the seatbelt is anchored to the truck's side column (B-pillar) and floor, the seat's vertical travel over rough roads can cause the belt to lock and tighten across the driver's neck, throat, chest and abdomen.

Some drivers resist wearing B-pillar anchored seatbelts with suspension seats because they are considered uncomfortable. This combination is fitted to about 30 percent of trucks sold (ERG Truck Tracker 200) and is commonplace in the Australian heavy vehicle fleet.

In contrast, the integrated seatbelt/suspension seat allows the driver's relative position to remain constant with the seat and seatbelt. This option is often available at a small cost premium to the truck's retail price and can also be retrofitted to many existing vehicles.

Note: wearing a seatbelt in any configuration is better than not wearing a seatbelt at all and is required law



What Can Vehicle Owners Do?

Installing an aftermarket integrated seatbelt/suspension seat can overcome drivers' comfort arguments and save lives. These guidelines aim to outline a clear process in retrofitting integrated seatbelts and suspension seats.



Retro-fitting is easy

Most B-Pillar anchored seatbelts can be retro-fitted with an integrated seatbelt/suspension seat replacement; however, some vehicles require engineering and cab modification. The driver's seat is typically replaced up to three times over the vehicle's life.

A reputable seat supplier will inspect your vehicle to ensure the structural integrity of the cab and report any deficiencies. Market research indicates that integrated seatbelt and suspension seat configurations can be installed in heavy vehicles up to 20 years of age.

Installation of an integrated seatbelt/suspension seat through a reputable seat manufacturer is easy - they can supply the kit, all the paperwork and professional installation. Other alternatives include: the vehicle manufacturer or a reputable heavy vehicle engineer (request an engineering certificate).

Certification and verification

To certify the retrofit installation of an integrated seatbelt/suspension seat in a vehicle, you should obtain appropriate documentation from the seat manufacturer and installer. This will provide assurance that the seat and seatbelt conforms to *Vehicle Standards Bulletin 6 Heavy Vehicle Modifications* and local jurisdiction requirements.

More information on vehicle standards at:

<http://www.dotars.gov.au/transreg/vsb/index.aspx>

**Protect a Precious Resource:
Encourage Seatbelt Use in Trucks**

What can vehicle owners do?

Installing an aftermarket integrated seatbelt/suspension seat can overcome drivers' comfort arguments and save lives. These guidelines aim to outline a clear process in retrofitting integrated seatbelts and suspension seats.

Retro-fitting is easy

Most B-pillar anchored seatbelts can be retro-fitted with an integrated seatbelt/suspension seat replacement, however, some vehicles require engineering and cab modifications. The driver's seat is typically replaced up to three times over the vehicle's life.

A reputable seat supplier will inspect your vehicle to ensure structural integrity of the cab and report any deficiencies. Market research indicates that integrated seat and suspension seat configurations can be installed in vehicles up to 20 years of age.

Installation of an integrated seatbelt/suspension seat through a reputable seat manufacturer is easy – they can supply the kit, all the paperwork and professional installation. Other alternatives include: the vehicle manufacturer or a reputable heavy vehicle engineer (request an engineering certificate).

Certification and verification

To certify the retrofit installation of an integrated seatbelt/suspension seat in a vehicle, you should obtain appropriate documentation from the seat manufacturer and installer. This will provide assurance that the seat and seatbelt conforms to Vehicle Standards Bulletin 6 Heavy Vehicle Modifications and local jurisdiction requirements.

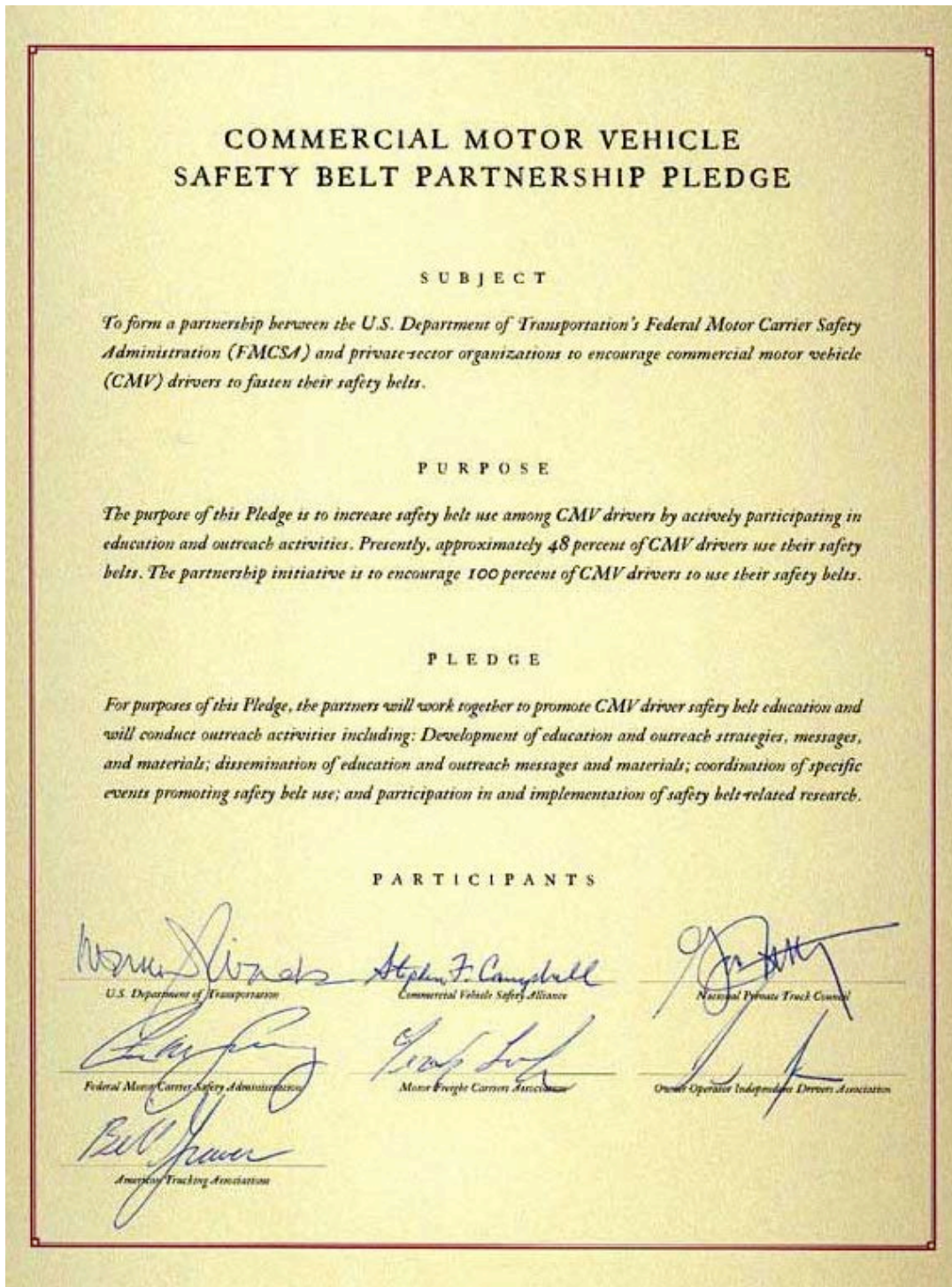
More information on vehicle standards at :

<http://www.dotars.gov.au/transreg/vsb/index.aspx>

Protect a Precious Resource:

Encourage Seatbelt Use in Trucks

US Agency Partnership Pledge



Commercial Motor Vehicle Safety Belt Partnership Pledge

Subject

To form a partnership between the US Department of Transportation's Federal Motor Carrier Safety Administration (FMCSA) and private sector organization to encourage commercial motor vehicle (CMV) drivers to fasten their safety belts.

Purpose

The purpose of this Pledge is to encourage safety belt use among CMV drivers by actively participating in education and outreach activities. Presently, approximately 48 percent of CMV drivers use their safety belts. The partnership initiative is to encourage 100 percent of CMV drivers to use their safety belt.

Pledge

For purposes of this Pledge, the partners will work together to promote CMV driver safety belt education and will conduct outreach activities including: Development of education and outreach strategies, messages, and materials; dissemination of education and outreach messages and materials; coordination of specific events promoting safety belt use; and participation in and implementation of safety belt-related research.

Participants

(Signed by)

US Department of Transportation, Commercial Vehicle Safety Alliance, National Private Truck Council

Federal Motor Carrier Safety Administration, Motor Freight Carriers Association, Owner-Operator Independent Drivers Association

American Trucking Association