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# Safety culture and speeding in the Australian heavy vehicle industry

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This paper is an extended version of an earlier conference paper that was presented at the ARSC 2015. It has undergone further extensive peer review; revised with additional material added.

## Abstract

Inappropriate speed and speeding are among the highest causes of crashes in the heavy vehicle industry. Truck drivers are subjected to a broad range of influences on their behaviour including industrial pressures, company monitoring and police enforcement. Further, drivers have a high level of autonomy over their own behaviour. As such, it is important to understand how these external influences interact with commonly shared beliefs, attitudes and values of heavy vehicle drivers to influence behaviour. The present study uses a re-conceptualisation of safety culture to explore the behaviours of driving at an inappropriate speed and speeding in the heavy vehicle industry. A series of case studies, consisting of interviews and ride-along observations, were conducted with three transport organisations to explore the effect of culture on

safety in the heavy vehicle industry. Results relevant to inappropriate speed are reported and discussed. It was found that organisational management through monitoring, enforcement and payment, police enforcement, customer standards and vehicle design factors could all reduce the likelihood of driving at inappropriate speeds under certain circumstances. However, due to weaknesses in the ability to accurately monitor appropriate speed, this behaviour was primarily influenced by cultural beliefs, attitudes and values. Truck drivers had a tendency to view speeding as relatively safe, had a desire to speed to save time and increase personal income, and thus often attempted to speed without detection. When drivers saw speeding as dangerous, however, they were more likely to drive safely. Implications for intervention are discussed.

## Introduction

Inappropriate speed and speeding are among the highest causes of crashes in the heavy vehicle industry. Driving above the posted speed limit and/or too fast for the conditions is a well-known risk factor for traffic incidents. Driscoll (2013) reported on 461 major heavy vehicle crashes in 2011, stating that inappropriate speed was responsible for 25.4% of these crashes. This figure was reportedly lower than in previous years. Chen and Chen (2011) examined 10 years of crash data from Illinois, USA, finding that speed influences the severity of outcomes in single-vehicle truck crashes, yet not multiple vehicle crashes (lack of an increase in severity in multi-vehicle crashes may be associated with the likely severity of a light vehicle crashing with a heavy vehicle, regardless of speed, due to the size and mass of the truck). Finally, Brodie, Lyndal and Elias (2009) analysed coroners' reports, finding that excessive and/or inappropriate speed was involved in 43.1% of fatalities in which speed was documented.

A number of researchers have indicated that safety culture could provide a useful avenue for improving safety in the heavy vehicle industry (Gander et al., 2011; McCorry & Murray, 1993; Short, Boyle, Shackelford, Inderbitzen, & Bergoffen, 2007). Safety culture has seen significant attention within the literature in recent years, and there is significant debate about the nature of safety culture and how it can be defined (see reviews by Choudhry, Fang, & Mohamed, 2007; Edwards, Davey, & Armstrong, 2013; Guldenmund, 2000). There are two major approaches to safety culture in the literature. One views safety culture primarily in terms of organisational structures and systems, and has been called a normative or functionalist approach (Edwards et al., 2013; Nævestad, 2009). The other, views safety culture primarily in terms of shared beliefs, attitudes and values, and is referred to as an anthropological or interpretive approach (Edwards et al., 2013; Nævestad, 2009).

In a previously published review, the authors examined journal articles about heavy vehicle driver health and safety identifying a broad range of influences on health and safety in heavy vehicle industries (Edwards, Davey, & Armstrong, 2014). These included government regulations and enforcement; organisational factors; customer pressures and requirements; and road/environmental factors. In addition to these external factors, it should be noted that heavy vehicle drivers have a high level of autonomy over their own behaviour (Arboleda, Morrow, Crum, & Shelley Ii, 2003). Further, Sully (2001) suggested that due to the amount of time heavy vehicle drivers spend away from their depot, they are more likely to associate themselves with an industry wide road culture than to a specific transport company. Thus, to understand speeding in the heavy vehicle industry, there is a need to explore both external and internal influences on speeding, and to look beyond the traditional boundaries of the organisation. This presents a barrier to the application of the two traditional approaches to safety culture, which typically focus on one of these aspects in isolation and within the confines

of a single organisation. The authors previously presented an alternative approach to safety culture in which safety culture is viewed in terms of the combined impact of both external contextual elements and shared beliefs attitudes and values (Edwards et al., 2013). This framework held that safety related behaviours were influenced by the interactions between cultural and contextual factors. To date there is no strong evidence to suggest that culture can be deliberately changed (Edwards et al., 2013; Nævestad, 2009), however, by understanding the existing culture and how it interacts with contextual factors, it may be possible to change these contextual factors to work with the culture of a workforce to improve safety (Edwards et al., 2013, 2015). The present study uses this framework of safety culture to explore the effect of culture on speeding in the heavy vehicle industry, in order to identify potential approaches to reduce speeding.

## Method

A series of three qualitative case studies with transport organisations were conducted to investigate safety culture within the Australian heavy vehicle industry. These case studies formed a collective case study (Stake, 2005), in which the three organisations chosen for the research were selected to provide insight into the broader industry. The case studies were conducted using a combination of ethnographic methods (interviews and participant observations) and grounded theory analysis techniques (specifically those of Corbin & Strauss, 1990).

## Participating organisations

The three participating organisations (identified here as Company A, B and C), were selected on the basis of knowledge from a series of preliminary interviews. These interviews indicated that both safety and culture in the industry differed depending on location; type of vehicles used and goods transported; distance of haul; and size of employing company. After examining the results of these preliminary interviews, the researchers sought companies which would provide insight into these different sections of the industry. Through examining websites of transport companies, some of which had participated in the preliminary interviews, a shortlist of potential case study organisations was developed. Due to the duration of time required to collect and analyse data, recruitment emails were sent to managers of one company at a time (to avoid long delays between agreement to participate and participation). One company was unable to participate due to a depot closure, and another due to an ongoing investigation related to a fatal crash, however, the remaining approached organisations participated in the study. After initial consent was provided, a brief meeting was held with the company managers to ensure that the organisation was suitable for the study.

A total of three companies participated in case studies. The key differentiating characteristics, based on the preliminary interviews, for each company can be seen in Table 1.

**Table 1. Case study organisation characteristics**

	<b>Company A</b>	<b>Company B</b>	<b>Company C</b>
<b>Company Size</b>	Medium (~50 trucks)	Medium (~50 trucks)	Small (<10 trucks)
<b>Location Type</b>	Capital city	Capital city	Regional centre
<b>Major Freight Task</b>	General goods	Specialised freight	Livestock
<b>Typical Distance Carried</b>	Medium-long (intra- and inter-state)	Local (plus some medium-long)	Short-medium (within region)
<b>Main truck types</b>	Semi's and B-Doubles	Rigid, crane mounted, heavy haulage, long loads, semi's and B-doubles	Semi's, B-doubles and road trains

Company A was a medium-sized family-owned and operated transport company. The organisation employed approximately 100 staff and owned over 50 prime movers. Semi-structured interviews and observations were conducted with 10 staff members. Four managerial, administrative and operational staff (two managers, one health and safety officer and one operations manager), along with six heavy vehicle drivers, took part in interviews. Six observations were also conducted with heavy vehicle drivers.

Company B was a medium sized transport company, employing approximately 100 staff with over 50 trucks. Due to the diversity within Company B, the organisation had a number of managers overseeing branches within the company. Ten interviews were conducted within Company B. Participants consisted of the compliance officer, and part owner, of the company; two regional managers who each oversaw approximately half of the fleet; five branch or depot managers; two driver trainers; and an operational manager. Eight observations were conducted, typically covering a driver's shift.

Company C was a small-sized transport company based in a regional centre. Family owned and operated, the organisation consisted of six prime movers and various trailers, and employed between six and 10 people at any point in time. Five interviews were conducted with the owner/manager, compliance officer, two drivers, and the owner/driver/head-mechanic. Three observations were conducted.

### Data collection and analysis

The interviews lasted between 30 minutes and two hours, and covered a variety of topics. The first questions were typically aimed at eliciting information regarding the history of the individual and identifying major safety concerns. Later questions sought to identify contextual, cultural and behavioural factors which influence these safety concerns. Participants were asked about specific behaviours and outcomes which were not spontaneously discussed. Prompts were seldom required as participants appeared eager to share their perspectives on safety.

Typically conducted after the interviews, observations of drivers occurred during drivers' usual shifts. Most observations lasted the duration of the shift; although some lasted for a portion of the shift (range of durations was 4-15 hours, with the exception of two which occurred to take the researcher to another depot). During observations the researcher conducted informal interviews similar in nature to the staff member interviews. Additionally, questions were asked which specifically related to tasks witnessed.

The collected data was analysed with the NVivo software package, using the grounded theory analytical techniques outlined by Corbin and Strauss (1990). Traditionally, three levels of coding are used, including open coding (identifying key broad categories), axial coding (identifying sub-categories and the relationships between them) and selective coding (associating the identified categories and sub-categories around a key theme). For the purpose of this study, it was necessary to ensure that the research was approached in an open and inductive manner; however, it was also important to ensure that the findings accurately reflected the theoretical constructs of safety culture. As such, open coding in this study consisted of identifying where participant responses referred to cultural (shared beliefs, attitudes and values), contextual or behavioural factors. Axial coding for this study involved identifying key categories and sub-categories within these broader factors (e.g. government enforcement and speed cameras, within the broader 'contextual factors'). Finally, selective coding involved identifying how these categories and sub-categories were associated with speeding behaviour, through links made by participants, and responses which were coded for both speeding behaviour and specific cultural and contextual factors.

### Results and discussion

Throughout the case studies a significant degree of congruence was found across members of the three companies. As the case study companies were selected to provide a broad overview of perceptions within the industry from differing subsections, this congruence allowed the case studies to be interpreted collectively as originally intended. This gives support to the notion of an industry wide culture. For the purpose of this paper, differences

between companies will be noted where relevant, however, the majority of discussion will incorporate responses from members of each company to shift focus from specific companies toward the broader industry. It should be noted that during observations and interviews with drivers only hand written notes were taken, reducing the possible length of quotes. Conversely, during interviews that occurred with staff members, audio recordings were made. As such, the majority of large quotes are from managers. Nonetheless, the quality of hand-written notes permitted analysis to be conducted both on verbatim quotes from audio recordings and written notes. As such, while the majority of reported quotes are from managers, the analysis allowed equal voice to drivers and staff members.

Participants generally acknowledged speeding to encompass both driving at an unsafe speed for the conditions and exceeding the posted speed limit. Heavy vehicles are legally required to be speed limited to prevent speeds exceeding 100km/h. As such, this limiting technology only reduces speeding on highways with a posted speed limit of 100km/h or greater. Thus, it was concerning that many participants tended to define speeding as exceeding 100km/h. When asked about speeding one Company B driver stated, due to the speed limiter, “I can’t speed”. Similarly, the driver/manager of Company C (He both managed the company and drove a truck) said that their drivers “can’t speed because they’re limited”. Given that heavy vehicles can easily exceed lower posted speed limits this perception is clearly flawed, but highlights that some participants thought speeding was not a possibility.

There were a broad range of factors suggested by participants to be associated with speeding behaviour and the likelihood of outcomes. These included both contextual and cultural factors. For the purpose of the present discussion contextual factors will be discussed in brief, leaving room for a greater discussion of cultural beliefs, attitudes and values.

### Contextual factors influencing speeding

Many of the contextual factors identified by participants as being related to speeding and speed-related crashes were commonly known risk factors. These included factors such as inclement weather reducing the safe speed of travel, and other vehicles and road works causing delays which lead to increased work pressures. Of particular importance however were the roles of law enforcement, organisations and customers.

### Law enforcement and speeding

Traffic law enforcement is a cornerstone of road safety strategies worldwide. With regards to heavy vehicles and speeding, there were three main methods of monitoring and enforcement. These were (1) speed limiters (on all heavy vehicles except those too old for the technology), (2) fixed camera enforcement (standard and point-to-point), and (3) mobile enforcement. Whilst each of these has some merit, there were weaknesses identified by participants which reduce their deterrent effect.

Speed limiters were seen as easy to tamper with for those who wish to do so. In addition to the fact that speed limiters only set a maximum speed, which does not adapt to varying speed zones, it was noted that the mechanism by which speed limiters operate does not prevent speeding downhills.

*The road speed is gutted at 100km/h. They will go faster than that off a hill because they’re not gear-bound at 100km/h but I think they’ll top out at just over 120 or something like that, 130. (Company A Manager One)*

Standard speed cameras were generally seen as ineffective because truck drivers become familiar with the roads they travel and know the exact locations of each camera. Thus, drivers only need to watch their speed in these locations. Further, point-to-point speed cameras were seen as easy to overcome, as truck drivers are aware of the legal time-limits and many will time their trip and wait before passing the next camera. Additionally, delays afford additional time for drivers, allowing them to speed through lower speed limit sections without triggering fines.

*SAFE-T Cams don’t stop you from speeding. There are hills between the cams so you lose speed up the hills and can go like hell down them... Going through towns slows you down so you go like stink on the highway and at daytime you hit traffic lights which can add five minutes to your time. (Company A Driver Six)*

Finally, while mobile enforcement has benefits, the use of UHF radios allows truck drivers to be aware of police locations at all times on the road. Overall, these issues mean that there is an absence of certainty of punishment for speeding, and thus limited deterrence. As such, it is seen as unlucky to be caught for speeding.

*I have had two speeding tickets from running off hills in the past seven months... just my bad luck that when I did it there was a cop down the bottom, plus I was on the wrong radio station so I didn’t hear about them. (Company A Driver Six)*

### Transport organisations and speeding

The organisation’s primary roles related to speeding come from the method in which they pay drivers, and the approaches used to monitor and enforce speed-limit compliance. Starting with the payment of drivers, hourly rates were associated with safer behaviour, as driving slower results in greater income. Conversely, as stated by one Company B driver, payment by the kilometre or load is a “good incentive to drive fast”, as travelling the same distance in less time is a more efficient way to earn money. Among the three participating companies, Company A paid a km rate for all long distance drivers, but an hourly rate for local drivers, Company B paid all their drivers an hourly rate, and finally Company C drivers are paid a salary (which was comparable to a load rate due to the inability to earn overtime if the load takes longer than expected).

*Basically the drivers over at (previous employer location), they're getting paid a kilometre rate. So it's in their own interest to go like gun it all the time and they do gun it all the time... Over here they get paid on an hourly rate so they're not actually achieving anything by speeding and obviously our trucks are regulated to down to 95km and theirs are still 105, 110km. (Company B Branch Manager Two)*

Each company relied on two primary means to monitor speed compliance – satellite tracking and speeding infringement notices from government departments. The satellite tracking methods of each company were capable of reporting current speeds and sending alerts to managers when vehicles exceed a chosen speed limit. Though they can be used to alert managers to different speeds in different locations, thus monitoring all speeding above the posted speed limit, they were typically only used to detect speeds in excess of the speed limiter. Company C managers did indicate that they will on occasions actively watch the tracking monitor to (from memory) determine whether the vehicle was speeding on a given road, however, this only occurred sporadically. Company B did implement specific speed zones in two locations, due to either past speeding fines or complaints by local residents regarding their trucks. As such, while there are cases of satellite tracking being used more thoroughly, satellite tracking was predominantly only used to detect speeding down hills, or speed limiters that have been subjected to tampering.

*Tampering with speed limiters is easy, you just put a wire or a box over it but you can't do it without being caught. Satellite tracking shows vehicle over limited speed for an extended period of time and you know they have tampered. People are sacked immediately for it, has happened a few times. (Company A Driver Three)*

Enforcement of speeding in each company was largely through non-conformance notices. For first offences and minor breaches, non-conformance notices were typically used to inform the driver that they were detected and to remind them to comply with the upper speed limit. Within Company A, one driver suggested that individual offences go unpunished, and that drivers will be reminded to slow down, yet that repeated offences are followed by non-conformance notifications, and/or one week without work and payment. However, one Company A driver stated that he had driven at “120m/h downhill but it was never followed up”.

*...we normally ring up the driver and say: Oh what's the problem how come you put your foot down or what happened there? And we try and monitor that as well... Of course then we sort of have to say: Right, you know you're going to get chastised for it. You know you're not in deep shit just keep it down, keep your speed back like don't run it off the hills. (Company A Operations staff member)*

Finally, infringement notices provided to companies by police grant an additional monitoring method to

organisations. In the few cases where drivers trigger a point to point or fixed camera the infringement is sent to the company, who may then reprimand the driver as desired.

## Customers and speeding

Whilst customer pressures may encourage speeding, it was generally stated that customers seek to ensure driver speed compliance due to their chain of responsibility requirements. This primarily occurred through auditing company records of traffic infringements and satellite tracking, and how the company manages these. However, it should be again stated that there are weaknesses in these methods of detecting speeding.

*We're closely monitored ... there's a lot of trucks here that are painted (colour with customer name) on the side. We do a lot of work for them. We're very closely monitored and essentially they even do their own audit on us every six or 12 months... To make sure we're not breaking the law. (Company A Manager One)*

## Contextual factors: summary

From the above contextual factors it can be seen that there is a relative lack of successful monitoring and enforcement of speeding in the heavy vehicle industry. Police enforcement was only seen as effective in the immediate presence of fixed cameras or mobile enforcement (as drivers know their location), and had limited lasting influence on behaviour. Similarly, the three organisations only successfully monitor tampering with speed limiters or running off hills. Finally, while customers may require evidence of the management of speed, due to limitations in organisational monitoring, this is not sufficiently beneficial. On the other hand, payment methods used by the company can provide incentive to either speed or drive slower. Overall this means there is an absence of sufficient external motivation to adhere to speed limits, and in some cases there is incentive to speed.

## The influence of culture on speeding

A number of common beliefs, attitudes or values were identified throughout the case studies as having relevance to speeding. These broadly included seeing speeding as unintentional, viewing speed limiters as unfair, the value placed on time, and a collection of traits related to learning styles and the results these have on behaviour.

## Speeding as unintentional

Generally speaking, there was a tendency to excuse speeding behaviour as merely unintentional. As stated by one manager from Company A, “everyone does it, it's not a purposeful thing”. One health and safety officer, who previously worked in road design, even indicated that truck drivers may miss the posted speed limit and drive at the speed that ‘feels’ right for the road. This unintentional speeding was linked to the need for drivers to measure travel time between point to point cameras, even though

this was also linked with deliberate punishment-avoidance strategies. Though it is clear that such behaviour can occur unintentionally, it is concerning that one of the major risk factors for crashes could be simply dismissed as unintended, and there is a need to address this issue. To prevent unintentional speeding, the use of GPS systems which inform drivers when they exceed the speed limit could be beneficial for the industry.

## Speed limiting as unfair

Throughout the case studies it was evident that drivers also placed a high value on fairness, thus disliking rules or regulations that they thought were not fairly implemented. The requirement of trucks to be speed limited was often deemed unfair. While it was not suggested that cars be speed limited to the same extent as trucks, it was argued that cars should not be designed to travel as fast as current designs permit. For this reason one Company B manager stated that truck drivers feel like ‘sitting ducks’. That is, truck drivers felt that they were being unevenly regulated when compared to other vehicle drivers. This perception of unfair treatment has the potential to develop an ‘us and them’ mentality leading to feelings of hostility and resistance to regulations. Importantly, it should be noted that this feeling that regulations are unfair does not indicate disagreement with the regulation’s principles, only its application.

*From the truck driver’s perspective I guess he feels like a bit of a sitting duck. you know. It is hard to control but...governed, trucks are governed to 90, cars can do 220. Why do they need to do 200? Why on earth do we have a car that does 220km/h and gets sold to a 17-year-old on his birthday? There’s nowhere in Australia you can do 220km/h, doesn’t need to go that fast. (Company B Branch Manager Four)*

## Value placed on time

Truck drivers commonly placed a high value on time. This has clear implications for speeding, as driving faster reduces travel time. The effect of payment was seen to have a direct impact on driver’s perceptions of the importance of time. In fact, drivers from company A (where local drivers are paid an hourly rate) commonly indicated that “on local time doesn’t matter coz you’re paid by the hour”. However, non-financial motivations for saving time also had an influence on speeding. For example, one Company A driver stated that it is beneficial to reach a destination sooner in order to sleep before the sun rises. Point-to-point speed cameras that have short intervals (e.g. 30 minutes maximum between cameras, can reduce this effect, as speeding would result in regular stopping. Nonetheless, as drivers experience delays between many cameras, it was indicated that they speed to catch up on lost time. Further, it was highlighted that in order to make up for delays and save time, truck drivers may speed through lower speed limit zones.

*So they get to an 80km/h zone or a 70 or a 60 and they just keep on going. They come into an 80km/h zone and say keep doing 100. And I’m sure you’re guilty of doing it... you know you go down the road and it drops back to 80 for a section or whatever and you just keep it at whatever was the cruise control was set at. And it’s the same as truck drivers that have been stuffed around for the last hour by someone so they just hold it flat through a village to make up that time. (Company A Manager One)*

## Is speeding safe or dangerous?

It was evident that every truck driver who participated in the study placed a very high priority on safety. That is to say, when drivers felt that a particular course of action could lead to a crash or injuries for themselves or others, they would avoid the action. Conversely, they would always seek to conduct a behaviour they felt would improve safety. A large number of participants indicated that they perceived speeding to be a hazardous behaviour. As stated by the driver/manager of Company C “it’s dangerous to speed, shit yeah”. Similarly one Company C driver stated that another driver involved in a crash “was lucky he wasn’t going faster”. More generally, one Company A driver said “these things (trucks) are too dangerous (to speed) as far as I’m concerned”. Conversely, a number of drivers did not hold these views. For example, one Company A driver disregarded the effects of speed by suggesting that speed was irrelevant if someone cuts in front of you. As this driver believed that most incidents were caused by other vehicles, speeding was not considered dangerous. The primary mechanism through which truck drivers determined what was safe and dangerous was their own experience and stories of other drivers. It was common throughout the observations for drivers to explain why they believed a specific action either increased or decreased safety from their own experiences as well as stories of other drivers. This may have a long historical foundation in the industry as, in past years, truck drivers were often left with the sole responsibility of safety, while managers and organisations gave little priority to safety. While this has shifted, there is still a reliance on personal experience and being told stories by other drivers.

*It wouldn’t even be the last 20 years where there’s been a big focus on safety and I’m not saying it’s wrong, I totally agree with it. But before that, like when I was driving... your mate might come along to you and say oh just be careful tying that down it might slip and that sort of thing but there’s no real focus on safety. (Company B Region Manager Two)*

‘Normalisation of deviance’ was a phrase first used to describe a process evident in the challenger space shuttle disaster. Vaughan (1996) argued that after successive disaster-free flights involving shuttles with the same flaws present in the Challenger shuttle, members of NASA began to believe the flaws were acceptable. This process of past experiences justifying unsafe acts was referred to as normalisation of deviance. In the case of the heavy vehicle industry, while crashes are far too common at an industry

wide level, for the individual driver or company, crashes are very rare. Thus, the reliance on stories and experience creates a vulnerability to normalisation of deviance within the industry. One Company A manager stated that their organisation had experienced very few speed-related crashes, as they were mostly related to other causes. This was immediately preceded with discussions regarding truck drivers choosing to speed through towns. The lack of experienced incidents that were attributed to speed in this case led to a false confidence in the safety of speeding.

*A lot of the highway is 100 but through the towns and that it is somewhat of an issue because blokes like to make up time so of course they speed through towns. We have very, very few speed-related crashes. They're normally road condition-related or stupidity-related or fatigue-related.* (Company A Manager One)

The same manager indicated that one driver from the company had previously spun a truck on a highway at high speeds in the wet, yet attributed this not to speed but to the stupidity of the driver. This view was mirrored in the perspectives given by many drivers regarding speed, and highlights how false causal attributions can shape beliefs regarding the dangers associated with speeding. It should be noted however, that the reliance on stories and personal experience indicates the use of stories could present an avenue for effective training. Incident reports were used by company B in their training for a variety of safety behaviours (no specific examples of speeding were discussed by participants), and with these behaviours, there was seen to be a high level of compliance due to a belief that these behaviours were important to safety. As such, it may be possible to use this reliance on experience and stories to promote safety.

## The results of seeing speeding as safe

Regarding government legislation and rules, a number of Company B drivers suggested that speed limit compliance held significant safety benefits. One driver in particular stated that “you do the speed limits for a reason, the signs are on the road for a reason, they're there for safety”. This belief that the rules exist for safety extended to many drivers with a belief that speeding was dangerous. Unfortunately, however, many drivers did not hold positive views towards speeding regulations due to a belief that speeding is relatively safe. For these drivers, they would speed, if they could do so without being detected. That is, when a driver views speeding as relatively safe, their own speeding behaviour is predominantly modified by a desire to avoid punishment, either through avoiding detection, or where not possible, temporary compliance. Given the findings with relation to monitoring and enforcement, it can be inferred that this means that drivers have the ability to regularly speed in zones with a posted speed limit lower than the 100km/h speed limiter installed in the vehicle, or when going down hills. This again highlights the need for drivers to believe that speeding is relevant to safety.

## Conclusions

The case studies reported in this paper were conducted with three transport organisations taken from distinct sections of the industry, which according to industry members should have been quite different. The high level of congruence between each company gives some support to Sully's (2001) assertion that there may be a broad industry wide culture, pervading beyond the traditional organisational boundaries used in safety culture research. Nonetheless, it should be recognised that without further research confirming these findings apply more broadly throughout the industry, the results of this paper should be interpreted with caution and not generalised across an entire industry. While the findings do indicate potential for generalisation, the data was drawn solely from qualitative sources, preventing estimation of average population views, and from only three companies out of a much larger industry. Additionally, each of the companies had trucksafe accreditation, which is a voluntary accreditation scheme. This may indicate that the participating companies are a biased sample of safety-conscious organisations.

A broad range of cultural and contextual factors were identified which were relevant to speeding. Consistent with past research, there were influences from government departments, organisations and customers which had the ability to influence aspects of speeding (Edwards et al., 2014). Additionally there were a number of cultural beliefs, attitudes and values which were identified in the responses of participants. Whilst these included specific attitudes towards speed limiters and a view that speeding was at times unintentional, they also included the value placed on time and a series of beliefs and attitudes related to the value drivers place on safety and the tendency to learn primarily through experience and stories. While these beliefs, attitudes and values can be seen as being at times contradictory, collectively they reveal a consistent story. It was indicated that speeding can occur unintentionally; however, this explanation appeared to be used at times to justify behaviour that was actually intentional. When speeding was intentional, it was clear that the desire to save time and make money contributed to the occurrence of speeding, conversely, for drivers who did not intentionally speed, the value placed on safety was an important motivation. In both of these later cases, it was evident that there were interactions between cultural and contextual factors which led to specific behavioural patterns, supporting the use of the current framework (Edwards et al., 2013).

It was evident that drivers placed a high value on time, and that this could lead to choosing to speed to save time, or make up for delays. Some of the reasons for this highlighted by participants could be seen as common for many light vehicle drivers (such as a desire to get home quickly), while others were specific to heavy vehicle driving (such as wanting to get to a safe rest location in time to sleep before the sun rises, making sleep difficult). That unsafe behaviour can be associated with an attempt to make up lost time is not new, and was also notably

demonstrated by Snyder (2012) in an ethnographic study of a driver persisting through fatigue in order to make up for loading delays. Importantly, the current study demonstrated the relationship between payment models and speeding to make up time. Participants clearly stated that payment by the km or load (which is interchangeable, as a given load has a predetermined location and thus distance to travel) incentivised speeding to make the same amount of money in less time. Conversely, payment by the hour was seen to reduce the value placed on time, as delays and slower travel times actually increase the driver's income for the same load.

The relationship between payment and safety is also not new. The Australian Transport Workers' Union (TWU) has long lobbied for 'safe rates'. Of particular note, the TWU placed a submission to the Road Safety Remuneration Tribunal arguing that drivers are often not paid for waiting times, and feel pressured to speed (Transport Workers' Union, 2012). Past research has also supported the link between payment and safety. Belzer, Rodriguez and Sedo (2002) found that within the USA's heavy vehicle industry higher levels of payment were associated with lower crash rates. Williamson (2007) found that Australian heavy vehicle drivers were more likely to use illegal stimulants if they were paid a distance rate, or were paid below the award rate. Further, Williamson and Friswell (2013) found that incentive payment, particularly where there is no payment for waiting time, was associated with increased hours worked, kilometres travelled and greater levels of fatigue among Australian long-distance truck drivers. The current findings support the need for pay which doesn't provide an incentive to speed. The findings from this study add to the arguments that the TWU have offered, and show similar trends to that which Williamson revealed with stimulant use and fatigue, indicating that regardless of the amount of pay received, payment per km gives incentive to travel faster and avoid delays. Thus to limit the incentive to speed, it is recommended that distance and load based payment be eliminated in favour of an hourly payment.

The second series of interactions were based around the priority drivers give to safety and the tendency for drivers to learn what is safe through experience and stories. The findings highlighted that drivers can be vulnerable to normalisation of deviance (Vaughan, 1996). When this occurs, resulting in drivers viewing speeding as safe, they will seek to avoid punishment through either driving at the legal speed limit when in the presence of police enforcement, or speeding while avoiding detection. Existing monitoring techniques were found to be insufficient to regularly detect and deter speeding. While there is a need to improve these methods of monitoring, without passing legislation to download vehicle data, or force organisations to monitor speed in all zones, it may be difficult to truly ensure speeding doesn't go undetected and develop sufficient deterrence. However, as was briefly indicated, it may be possible to increase internal motivation to drive at a safe speed through the use of speed-related incident reports in training. There is a clear need to ensure drivers have a firm belief that speeding is dangerous. While this

study indicates that the use of stories could be a beneficial method to improve compliance it is not clear how this could be directly applied. Further research is needed to identify effective methods through which to increase the perception of danger associated with speeding.

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## A road safety risk prediction methodology for low volume rural roads

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### Abstract

The roads of New Zealand's Eastern Bay of Plenty region have relatively low vehicle volumes and experience a number of rural road safety issues, including inappropriate speed, the use of drugs and alcohol, low levels of restraint use and young/inexperienced drivers. Over half of all rural crashes are loss-of-control crashes on curves. Due to low network traffic volumes, crashes tend to be sporadic and difficult to predict using risk assessment techniques that rely on crash histories.

This paper introduces a new risk prediction methodology that identifies high-risk curves independent of crash history. Using geospatial data and innovative analysis techniques, existing methodologies for identifying curves and calculating vehicle operating speeds were modelled and automated to undertake a network-wide assessment of high risk curves.

The new methodology extracted and classified almost 7000 curves across 1500km of road network. When compared to the location of loss-of-control crashes, it was found that 66.6% of crashes occurred on 20.3% of curves classified as 'high risk' in at least one direction. These results have been

shared with road controlling authorities and will support prioritised road safety improvements targeting high risk curves.

This methodology is the first network screening tool that has been specifically developed to address road safety risk in low volume rural areas in New Zealand or Australia. The methodology demonstrates how existing research into vehicle operating speed behaviour can be applied to identify high risk road elements and support targeted improvements that have the potential to significantly reduce road safety risk.

### Introduction

Safer Journeys, New Zealand's Road Safety Strategy 2010-20, has a vision to provide a safe road system increasingly free of death and serious injury (Ministry of Transport, 2010). This Strategy adopts a safe system approach to road safety focused on creating safe roads, safe speeds, safe vehicles and safe road use. These four safe system pillars need to come together if the New Zealand Government's vision for road safety is to be achieved.