

“O teach me how I should forget to think”¹; Safe Systems, human factors, institutions and a Montague Street bridge crash

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Abstract

Vision Zero and the Safe Systems approach are part of the recent shift in road safety engineering towards networks that are more forgiving of human errors. These new approaches challenge earlier attitudes where ‘driver error’ was considered a major, but unavoidable cause of road trauma. However, it is unclear whether the researchers and practitioners developing these new approaches have successfully engaged with the legal profession to bring traffic law along, together with the field of road safety, though this transition.

Traffic enforcement and the legal processes to deter and punish violations are an important input to the “alert and compliant road users” (PIARC 2015) at the centre of the Safe System approach. However, road rules exist in an adversarial justice system built on concepts of negligence and duty of care. Whether road safety thinking aiming to be “more forgiving of human error” (PIARC 2015) is compatible with, or is being adopted by, the current legal system remains unclear.

This paper explores a recent, high profile crash at the Montague Street bridge in South Melbourne. It uses case study methodology and a textual analysis of the judge’s sentencing remarks to explore how the laws of negligence might overlap or conflict with research knowledge about human factors and the driving task, and the Safe Systems approach.

The paper does not seek to judge, comment on or otherwise give detailed opinion on the legal system or the outcomes of the case in question. Rather, it finds that current road safety research may not be fully informing or have been fully incorporated into traffic law or the way the legal system generates outcomes. Conclusions and directions for further research are also detailed, including a suggestion for greater engagement by the field of road safety engineering with that of law.

(words 295)

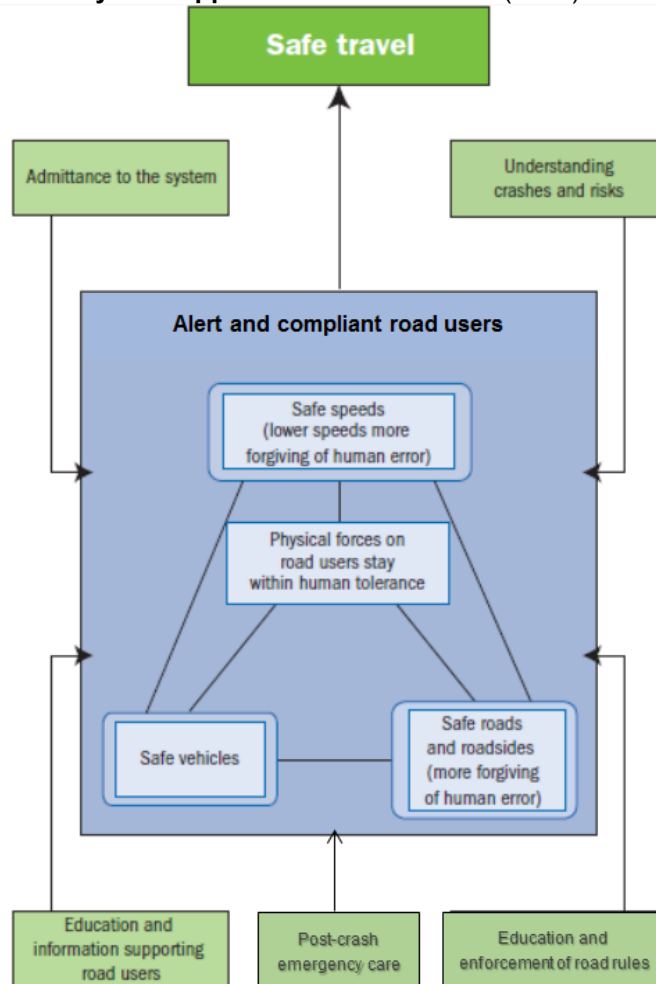
¹ Note to readers: please forgive the somewhat indulgent reference to Romeo and Juliet (Shakespeare 1594) in the title. However, in the context of the Montague(s) Street bridge, and themes related to fate, chance and human nature, it was just too hard to resist this allegory. Plus, a (hopefully) catchy and engaging title might just help to make you want to keep reading (Delbosc 2017).

1 Introduction

Death and injury resulting from driver error was previously thought to be an unavoidable cost of mobility. However, new concepts originating in the Netherlands and Sweden in the 1990s “...challenged the inevitability of road trauma, and placed responsibility for safety on the transport system builder and managers, not the individual road users” (Lyndon & Turner 2017, pp. 563, 70). The Towards Zero approach (Transport Accident Commission (TAC) et al. undated) is an example of this new direction, which perhaps reflects greater consideration of the limits of driver performance, and human factors such as fatigue, distraction, vision, information processing and reaction times (Cunningham et al. 2017, pp. 24-5) in the way the road system is operated and managed.

The focus of the Safe System approach (Figure 1) is on “alert and compliant road users”. However, it also emphasises systems that are “more forgiving of human error” (PIARC 2015). The widespread adoption of Wire Rope Safety Barrier in recent years provides an example of this shift in road network management approaches towards reducing the severity of crashes, given that driver error will inevitably occur.

Figure 1: Model of the Safe System approach. Source: PIARC (2015).



However, road network management is influenced by more than just traffic engineers and road safety professionals. Traffic laws and road rules are governed by legal systems and institutions, including the courts who interpret, develop and extend statutory and common law (De Gruyter 2017). Education and enforcement of road

rules are a key input to the Safe System approach, but this is largely delivered by police officers, lawyers, juries, judges and others who are not from a road safety engineering background.

Road safety engineering now places less emphasis on individual road users' responsibility and culpability for crashes and their outcomes, but it is unclear whether legal institutions do the same. Road safety researchers and professionals may now recognise that drivers will inevitably make errors, and that roads should be forgiving. However, it is unclear whether the researchers and professionals behind the Safe System, Towards Zero and other similar new approaches have sufficiently engaged with legal institutions to include them in the shift to this greater understanding of how driver error is not necessarily always caused by negligence, but potentially also by 'normal' mistakes due to human factors and the difficulty of the modern driving task.

This paper does not aim to criticise legal processes, systems or judgements. Rather it aims to explore whether greater engagement with legal institutions is needed by engineering professionals if the new approaches to road safety are to be fully introduced into legal practices. It adopts a case study methodology to test whether a recent high profile case related to traffic law reflects current understandings about human factors and the Safe System approach. The sentencing remarks of one judge are examined in detail. However, the aim is not to examine or critique that particular judge's understanding of traffic law, human factors and road safety, or comment on the quality, fairness or otherwise of the sentencing remarks or outcome of that one case. Rather, the paper seeks to explore whether current road safety engineering and human factors theory is evident in the legal system's outcomes, and hence whether Safe Systems thinking is helping the legal system deliver its key role in road safety of enforcing and encouraging compliance with road rules.

The paper is structured as follows: the next section outlines the background of the three areas of research underpinning this paper: institutionalism; traffic law and negligence; and human factors and the Safe System approach. The adopted case study methodology is then described in Section 3, including a discussion of why studying a single case in detail is a valid research approach. Section 4 presents the results of the case study, which are then discussed in Section 5. The conclusions of this paper are presented in Section 6, along with suggested directions for future research. Finally, there is a short "Afterword" highlighting how some of the judge's comments, when combined with human factors theory, might help suggest alternative treatments for this crash location.

2 Research Background

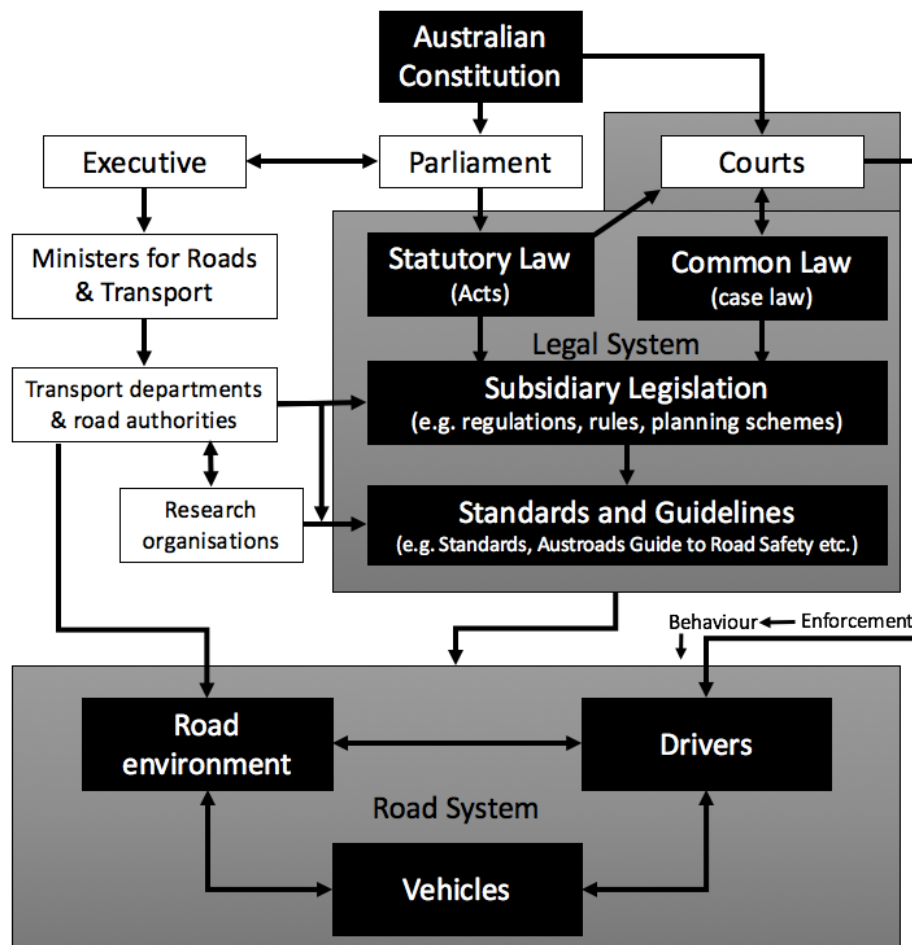
2.1 Institutionalism and institutions involved in the road system

Institutionalism was one of the early public policy analysis approaches through which researchers sought to understand organisational and governmental decision-making. It focuses on how institutional structures influence decisions and outcomes, but public policy analysis moved away from institutionalism in the middle of the 20th century to focus more on the behaviour of individual decision-makers (Huber 1981, p. 4; Lyles & Thomas 1988; Parsons 1995, p. 17; Das & Bing-Sheng 1999, p. 759; Fitzgerald 2002, p. 2; Turpin & Marais 2004, p. 145; Caramani 2011, pp. 5-6; Peters 2011, p. 41). However, there has recently been a resurgence in ('new') institutionalism and organisational behaviour research, which again looks closely at how governmental

structures and boundaries influence policy and decision-making (see Greenwood (2008); Greenwood et al. (2017)).

Figure 2 illustrates the governance, legal and institutional structure related to the road system in Australia. The Constitution provides the framework through which Parliament can pass statutory law, which is then interpreted by the courts. The courts also use, interpret and develop common law during the process of hearing and adjudicating individual criminal and civil cases. Subsidiary legislation, standards and guidelines may also influence court decisions, and are typically controlled by government departments and road authorities.

Figure 2 Institutional structure surrounding the road system in Australia (for illustrative purposes only). Source: Author, based on De Gruyter (2017) and Reynolds et al. (2017).



Of course, Figure 2 is a simplification and in reality there is a much more complex arrangement of institutional bodies involved in managing the road system, with overlapping responsibilities between local, state and federal levels of both the governmental and legal systems. However, in general, the road system – made up of the road environment, road users, and vehicles – is influenced by laws, legislation and standards, driver behaviour, and road managers. Road authorities tend to have fairly direct input into the road environment conditions, but the behaviour of road users tends to be less directly influenced through enforcement by police officers and the courts, and education and encouragement programs amongst many other factors.

2.2 Negligence, road rules and duty of care

Negligence is where a defendant is found to have caused harm through a breach of a duty of care, regardless of their intent (Clarke 2003; Bermingham & Brennan 2008). Civil law often considers matters where one party has been harmed by the *negligence* of another, and decides cases on the balance of probabilities. Criminal law instead decides cases based on proof beyond reasonable doubt, and a finding of guilt typically requires some form of intent. However, criminal law can also involve matters of where a defendant has breached a duty of care through negligence, rather than necessarily intending to cause harm.

To provide an acceptable level of safety the road system relies on drivers driving in accordance with the road conditions and operating their vehicles in a way that reduces the risk of a crash. There is a duty of care for drivers to act as would a hypothetical 'reasonable person' in the same circumstances. Drivers are also required to obey traffic signals and regulatory signs.

While road rules and traffic enforcement are typically criminal rather than civil matters, there is some overlap between intent and negligence in traffic law. For example, traffic laws tend to have strong penalties for those found to have intentionally driven dangerously or travelled significantly over the speed limit (e.g. hoon laws). However, speeding fines are also issued for breaching the limit by a small amount, regardless of a driver's intent, as drivers are required by law to travel below the limit and hence speeding is a form of negligent driving.

Full exploration of traffic law is beyond the scope of this paper. However, the Safe Systems and Towards Zero approaches that are emerging out of road safety research organisations, transport departments and road authorities suggest a shift away from strict reliance on drivers to ensure safety on the road system. These new approaches instead emphasise a system that fails safely and accounts for the inevitability of driver error, and a perspective that zero deaths is the only morally acceptable outcome for the road system.

2.3 Safe Systems and human factors relevant to the driving task

The Safe System approach (Figure 1) defines "safe road users" as those who are "alert and unimpaired, and who comply with road rules" (PIARC 2015). However, the boundaries between 'alert' and 'not alert' and between 'unimpaired' and 'impaired' are not clearly defined. A driver under the influence of drugs or alcohol may be obviously impaired. It may not be as clear exactly when a driver might shift from being slightly fatigued yet still alert and compliant, to being so fatigued that they would be negligent if they attempted to (continue to) drive.

Edge cases are typically dealt with in legal institutions by reference to what the hypothetical "reasonable person" would have done in the same circumstances. However, human factors and driver behaviour theory suggests that even a reasonable person might fail at the driving task some of the time, and research has found that over 50% of fatal and 90% of serious-injury crashes resulted from "normal mistakes" that drivers often make (Lyndon & Turner 2017, p. 570)². Crashes are fortunately rare events, and these normal mistakes made by drivers do not always, or even very often, have such serious consequences.

² Citing Wundersitz and Baldock (2011).

The modern driving task is quite complex and includes route-finding, route-following, velocity control, collision avoidance, complying with the road rules, and vehicle monitoring (Cunningham et al. 2017, pp. 26-8). Fuller (2007) discusses how drivers might increase or decrease their workload to more closely match their capabilities. To avoid boredom a driver might turn on the radio, talk to a passenger or otherwise engage in non-driving activities, but if the driving task becomes more difficult and approaches the limit of their capabilities they will shift more attention to the road ahead.

Driver reaction time is often examined through the 1. *perception*, 2. *intellection*, 3. *emotion* and 4. *volition* model (Layton & Dixon 2012). Under this model, drivers must first (1) perceive something that they need to react to, then (2) intellectually recognise a need to react, then (3) decide to react, and then actually act (4). Without all four steps occurring in sequence a driver might fail to react to a hazard entirely (Cunningham et al. 2017, pp. 30-1).

The extensive research and development efforts currently going into autonomous vehicle technology point to the expected safety benefits of removing humans from the driving task (Young et al. 2017, pp. 90-3). Fully and partially autonomous vehicles may themselves bring new challenges in safely integrating human factors into the road system (Cunningham et al. 2017, pp. 53-5), and some doubt whether fully-autonomous vehicles will really deliver the utopia that is sometimes claimed (Currie 2018). Regardless, the significant interest in automation points to the safety benefits that are expected if human inattention, error and negligence could be removed from the road system.

3 Methodology

Case study methodology is an approach that can be used to generate new theory, or to test or expand on existing knowledge. It does not involve random sampling, large sample sizes or a search for statistical significance, although this is sometimes misunderstood by people unfamiliar with case study research techniques (Eisenhardt & Graebner 2007, p. 26). Rather, it is a scientific method that involves examining a small number of cases in great detail (Ketokivi & Choi 2014, p. 233), with cases selected because “they are unusually revelatory, extreme exemplars, or opportunities for unusual research access” (Eisenhardt & Graebner 2007, p. 27).

Case study methodology and its merits as a research approach are discussed in detail in broad range of literature, including Eisenhardt (1989); Cavaye (1996); Yin (2009); Ketokivi and Choi (2014); Yin (2014). It is often used in social studies and related research areas (Denscombe 2007, p. 4; Alasuutari et al. 2008, p. 2; Pierce 2008, p. 2; Bickman & Rog 2009, pp. 2-5; Cecez-Kecmanovic & Kennan 2013), but does not appear to be often used in transportation research. However, Marsden and Reardon (2017) have identified that transport policy research should “pay greater attention to context, politics, power, resources and legitimacy”, which may imply the need for a greater use of social research methods, such as case studies, to examine institutions involved in the road system.

This paper investigates the sentencing remarks (Stuart 2018) from a single case to explore whether the existing research knowledge about human factors and the driving task, and the Safe System approach, are present in legal system outcomes. Sentencing remarks are the eventual output of large and complex system involving a great many people. Various officers, lawyers and others are responsible for the gathering of evidence, a decision to lay charges, presentation of the evidence in a

court of law, deliberations, and the delivery of a verdict and sentence. It is unlikely that many of the people involved are experts in road safety engineering or human factors. While Australia's adversarial legal system allows prosecution and defence to call expert witnesses³, these specialists are not always part of proceedings, and it is likely that many other factors besides road safety research theory and understanding drive the outcomes of traffic related court cases.

The aim of this paper is to examine the extent to which the Safe Systems approach, the four step model of driver reaction (1. *perception*, 2. *intellelection*, 3. *emotion*, and 4. *volition*), and other elements of current road safety understanding have been communicated by engineering practitioners and researchers in a way that consistently inform the legal system. It does not seek to determine this by examining a large number of cases. Rather, it examines just a single, relatively high profile case in greater detail. By selecting this relatively high profile case the aim is to strengthen any findings, given that **if modern road safety engineering theory is not influencing a high profile matter**, it would seem **unlikely that it is consistently influencing other**, less visible, matters before the courts related to traffic law.

The selected case relates to a bus crash involving the Montague Street bridge in South Melbourne in February 2016. Imagery from the crash (Figure 3) was visually striking, and the events of the crash, subsequent road environment changes, and the five year jail term received by the driver were widely reported (ABC News 2016; ABC Radio Melbourne 2016; Lee 2016; Percy 2018).

Figure 3: Bus crash at the Montague Street Bridge. Source: Winter (2016).



³ Note, the author is not an expert witness nor should the material in this paper be relied on in a court of law. The primary purpose of this paper is research into the road safety system, to which the legal system provides input. It is not the aim of this paper to comment on or express opinion on the circumstances of, or judgements in, any individual case (especially the case that is studied).

This particular crash resulted in many serious injuries. However, the Montague Street bridge is well known for frequently being hit by high vehicles⁴ and there have been many calls for the bridge to be removed, increased in height, or otherwise altered (Brown 2016). After the 2016 bus crash VicRoads, the road authority, installed additional warning systems including “hanging paddles that would hit the top of a vehicle before it reached the bridge” (ABC Radio Melbourne 2016).

The sentencing remarks were analysed using the NVivo software program, with text coded at the sentence level. The nodes used for coding are based on the key themes of *negligence*, *human factors related to the driving task*, and the *Safe Systems approach* discussed in Section 2. A three level coding hierarchy was used, as detailed in Table 1⁵. There is some subjectivity associated with the textual coding given the qualitative nature of this research. However, the structured system of nodes means that using this approach other researchers would likely achieve broadly similar results. Additionally, the NVivo coding file is available on request from the author for review or use in further research.

4 Results

Table 1 presents the percent coverage of node coding. Twenty eight percent of Stuart (2018) is coded as relating to *negligence*. Much of this is related to how the bus driver has not made a ‘*perfect*’ *response to signs, warnings and road conditions* when approaching the bridge (15% of the total), and failed to *adhere to the road rules* (13%).

Thirty seven percent of Stuart (2018) relates to *human factors*. Much of this relates to *reaction* (26% of total), in particular the driver not seeing the bridge or warning signs (1. *perception*, 25% of total). Only a small amount of the sentencing remarks relates to the driver’s failure to decide to stop or actually stop (i.e. nodes 3. *emotion* and 4. *volition*, which are just 5% and 4% of total respectively).

Thirty one percent of Stuart (2018) relates to *Safe Systems*. Much of this is about *alert and compliant road users* (29% of total) and *safe roads and roadsides* (17%). This is unsurprising given that the crash involved a driver failing to stop prior to a road hazard, or be alerted by or comply with warning signs on the approach to the bridge.

Figure 6 presents the percent coverage for each node graphically, while Figure 7 shows the coding frequency. Notably, there are a large number of individual codings related to *human factors* (72), while the next most frequent coding categories relate to *negligence* (34), *Safe Systems* (33) and *reaction* (32). In contrast, in the percentage coverage graph (Figure 6) there is a much smaller difference between *human factors* (37%) and the rest of the coding categories (*safe systems* is second at 31%), showing how *human factors* related nodes are present in the text many more times than other nodes, but not necessarily for long sections of text.

⁴ Vehicles impacts are so frequent that a website (Waller 2019) currently tracks the number of days since the Montague Street bridge was last hit. When last checked on August 23, 2019 the website stated that it had been 122 days since the bridge was last hit on April 23, but there had also been crashes on April 8, February 11, and January 23, 2019.

⁵ For example, 1. *perception* is a level 3 child-node of *reaction*, which is a level 2 child-node of the level 1 node *human factors related to the driving task*.

Table 1: Percent coverage of node coding in Stuart (2018). Source: Author's analysis.

Node (lvl. 1)	(lvl. 2)	(lvl. 3)	Coverage		
Negligence	duty of care		8%		28%
	reasonable person test		5%		
	adherence with road rules ³		13%		
	'perfect' response to signs, warnings, road conditions etc.		15%		
Human factors related to the driving task	reaction	1. perception	25%	26%	37%
		2. intellection	11%		
		3. emotion	5%		
		4. volition	4%		
	driving task	route-finding	2%	22%	
		route-following	3%		
		velocity control	0%		
		collision avoidance	7%		
		complying with the road rules ³	13%		
		vehicle monitoring	1%		
	driver performance	workload and capabilities	6%	11%	
		familiarity with the road environment	6%		
		fatigue and alertness	2%		
		level of impairment	5%		
Safe Systems approach	admittance to the system		2%		31%
	understanding crashes and risks		1%		
	post-crash emergency care		2%		
	education and enforcement of road rules		2%		
	alert and compliant road users	safe roads and roadsides (more forgiving of human error)	17%	29%	
		safe vehicles	3%		
		safe speeds (lower speeds more forgiving of human error)	0%		
		physical forces on road users within human tolerance	7%		

Notes:

1. Coverage figures for parent nodes include aggregation of child nodes.
2. Many node codings overlap, so cumulative percent coverage values are greater than 100%.
3. *Adherence with road rules* and *comply with the road rules* are considered equivalent.

Figure 6: Percent coverage by node. Source: Author's analysis using NVivo.

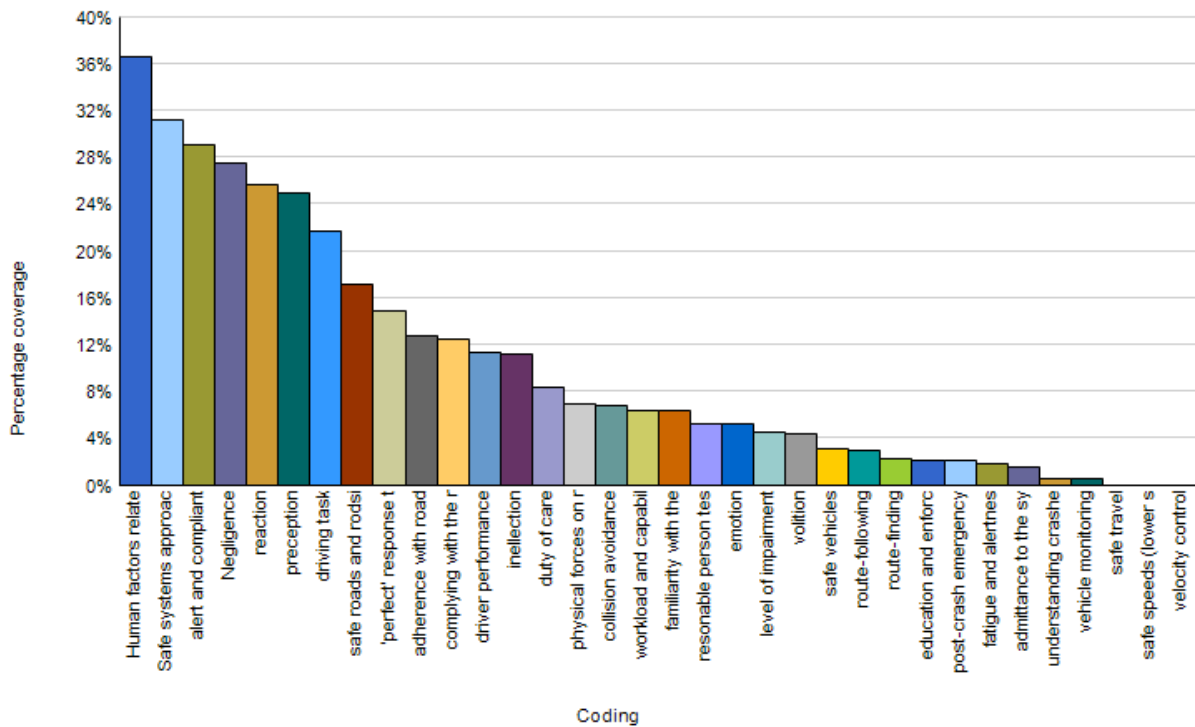
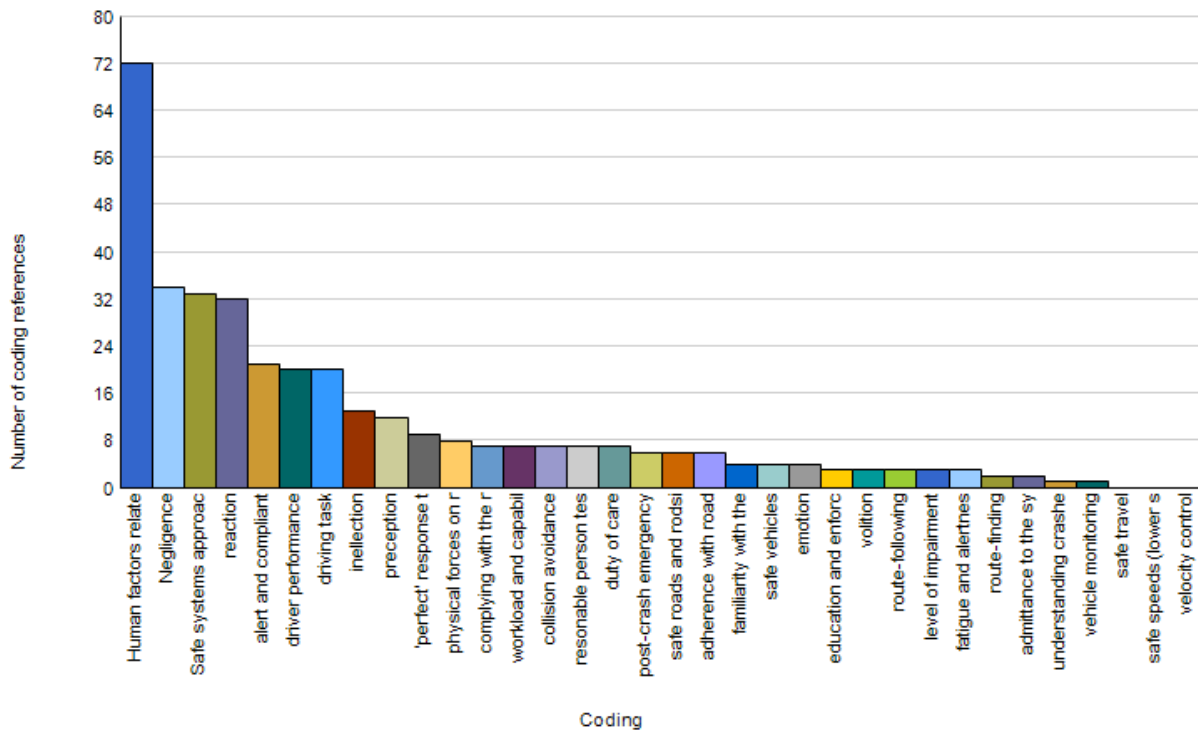


Figure 7: Coding frequency by node. Source: Author's analysis using NVivo.



5 Discussion

The subject crash involved a bus driven directly into a bridge without prior braking. Therefore, it is not surprising that much of the sentencing remarks relate to: *human factors*; *safety*; *alert and compliant road users*; *negligence*; *reaction*; and *perception*. However, a closer examination of the topic coverage and the text suggests that human

factors knowledge and the Safe Systems approach may not be fully evident in the source material coded in this analysis.

Much of the content that relates to *negligence* focuses on the driver not making a 'perfect' response to signs, warnings, road conditions etc. For example, Stuart (2018, p. 3) addresses the defendant and states:

“...you had the responsibility...to keep a proper look out at all times...you did nothing of the sort...observing nothing of the signage...and apparently not even making any observation of the Montague Street bridge itself”.

Likewise, quotations from a police interview that are referenced in the sentencing remarks (Stuart 2018, pp. 9-11) focus on the driver's failure to see or respond to the warning signs and other measures. Despite relating to *human factors* and a failure in the 1. *perception*, 2. *intellection*, 3. *emotion*, and 4. *volition* chain of driver *reaction*, the general direction of the sentencing remarks appears to focus on this failure being the result of *negligence* rather than the difficulty of the driving task.

Of particular note is the relative coding percent of *reaction* (26%) and 1. *perception* (25%). This suggests that throughout much of the sentencing remarks the focus when discussing driver reaction is on whether the driver **should have seen** the warning signs, **rather than on the two other intermediate steps** of 2. *intellection* and 3. *emotion* that road safety and human factors theory suggest are **necessary to successfully react** (4. *volition*) to a hazard. For example Stuart (2018, p. 12) states:

“I don't know how you could possibly have been confused...the road was straight, the weather was fine, three of your passengers and two other drivers saw what you did not” (i.e. the warnings and the bridge).

This passage appears to suggest that some passengers successfully made it through all four steps of *reaction*, particularly as they “...may have shouted, ‘we’re going to hit it’”. Likewise, two following drivers “...saw the danger and tried to warn you but to no avail” (Stuart 2018, pp. 5-6), suggesting these other drivers (1) perceived the danger, (2) understood the danger, (3) decided to react to the danger, and (4) reacted.

Quoted sections from the police interview that are included in the sentencing remarks suggest that the driver did not get past the 1. *perception* or 2. *intellection* stages. When shown photos of the various warning signs and the approach to the bridge the bus driver repeated responded “...I don’t recall seeing any of them” or words to that effect (Stuart 2018, pp. 9-11). Here, the sentencing remarks again speaks to the reasonable person test, suggesting that to have **not seen** the signs was **clear negligence**.

The fact that the bus passengers noticed the bridge is highlighted in the sentencing remarks as illustrating the driver's *negligence*. As other **reasonable people on the bus saw and reacted** to the bridge, the general point made is that the **bus driver should also have seen and reacted** to the bridge. However, the driver was the only person on the bus engaged in the task of driving, and presumably had been doing so for a considerable period of time. Hence, the **passengers who saw the bridge were not actually under the same circumstances as the driver**.

This may suggest that some of those involved in legal processes **may view driving as a relatively easy task**, not much different from being a passenger. This is perhaps

due common experiences of generally crash-free car driving⁶. It also appears reminiscent of the perspectives that saw drivers, rather than system builders and managers, as being the primarily responsible for safety on the road system (c.f. Lyndon and Turner (2017, pp. 563, 70)), particularly in the statements that the bus driver “had the responsibility...to keep a proper look out at all times” (Stuart 2018, p. 3).

Much of the latter part of the sentencing remarks refer to character references and the mental effect of the crash on the driver (Stuart (2018, pp. 13-7)). Of note is one reference that states:

“...I have never known him (the bus driver) to speed or break any road laws, it’s just not in his nature.....for someone so careful and cautious the accident has been truly life changing...” (Stuart 2018, p. 14).

The judge also notes that:

“...detering other drivers from being inattentive in serious breach of their duty of care to other road users and their passengers, is the principal sentencing factor I must take into account”.

This is perhaps where the greatest difference between the outcomes of the legal process and the Safe System approach is evident. Many “normal mistakes” often made by drivers are similar to those that cause death or serious injury, and “responsibility for safety (is now) on the transport system builder and managers, not the individual road users” (Lyndon & Turner 2017, pp. 563, 70)⁷. Crashes into the Montague Street bridge are a common occurrence (Brown 2016; Waller 2019). Detering drivers from **non-intentional inattention and failure** at the driving task may be inconsistent with the new approaches and understandings in road safety engineering where the focus is on being **forgiving of inevitable human error**.

6 Conclusions

This paper has explored a single crash through the sentencing remarks of a single judge in a matter of criminal negligence while in charge of a vehicle. Notably, it has not attempted to review the outcome of the case or the judge’s remarks from a legal perspective. Rather the paper has considered the sentencing remarks through the lens of theoretical knowledge and emerging trends in road safety engineering, in particular those related to human factors and the Safe System approach. The objective of the paper is not to critique the legal process in this case, but to explore whether existing institutional boundaries between the legal system and the field of road safety engineering may limit the transition towards Vision Zero, the Safe Systems approach, and road systems that are more forgiving of human error.

The paper has found that aspects related to *negligence*, *human factors* and the *Safe Systems approach* are all present to roughly the same extent (in the order of 28-37% coverage) in the sentencing remarks. However, it is noted that the findings suggest:

- an emphasis on road users being *negligent* unless they *respond perfectly to the road environment*;

⁶ See Dunning (2011) for discussion of the challenges associated with people assessing their own expertise in subject matters with which they have general familiarity, but not expert training or knowledge.

⁷ Citing Wundersitz and Baldock (2011).

- a focus on the 1. *perception* of warning measures rather than all four of the steps in the *driver reaction* chain of 1. *perception*, 2. *intellection*, 3. *emotion* and 4. *volition*; and
- an emphasis on *compliance and adherence to the road rules*.

These appear at odds to the emphasis in the Safe System approach on being forgiving of driver mistakes. However, it is unclear whether these Safe Systems approaches should be adopted into traffic law. In particular, being forgiving of driver mistakes may itself be inconsistent with existing understandings of driver negligence and the role of enforcement in ensuring alert and compliant road users.

There are many avenues for further research into the institutional boundaries and overlaps between traffic law, legal processes and the new directions in road safety and traffic management. A more detailed study of this individual case, including review of the entire trial transcripts, might highlight whether an expert witness on human factors or road safety engineering was called to give evidence⁸, or how interpretations of driver negligence versus driver error were interrogated in court.

Similarly, there appears to be the need for broader research considering more than just the single case examined here. Case study research allows for detailed examination of a single or small number of cases. Further research that instead uses a quantitative approach might allow the extent to which road safety engineering engages with the legal process and legal professionals to be examined statistically across a broader number of traffic related cases.

The title of this paper starts with a quotation from tragedy, “O teach me how I should forget to think”, taken from Romeo and Juliet (Shakespeare 1594). The crash examined in this case study certainly “...demonstrates the duties every driver has and the terrible consequences where that duty is breached...” (Stuart 2018, p. 12). However, this analysis suggests that newer theoretical knowledge about the way that drivers think (i.e. perceive, recognise and react to hazards), the workloads on and the capabilities of drivers, and the need for forgiving road environments may not yet have been fully passed onto the legal system by researchers and practitioners in road safety.

The findings of this paper suggest that institutional boundaries may limit the adoption of Safe System approaches by all organisations that have input into the road system. This may be a particular issue with traffic enforcement as it is predominantly a function of the legal system, while the Safe Systems approach is emerging from road safety engineering. Regardless of institutional boundaries, however, human factors related to the driving task may help to explain why a driver might “...forget to think” and how clashes with the Montague Street bridge may continue to occur.

(Words: 4,920 including figure and table text)

Afterword

This paper has focused mostly on the legal aspects of the crash at the Montague Street bridge. In the meantime VicRoads has installed hanging paddles to warn drivers

⁸ However, the lack of any description of expert evidence in the sentencing remarks suggest that this did not happen in this particular case.

of high vehicles of the low bridge ahead (ABC Radio Melbourne 2016). However, collisions with the bridge continue to occur (Waller 2019).

The concept of “self-explaining roads” (Cunningham et al. 2017, pp. 42-3) suggests that designers should treat similar situations consistently. When a similar action is required of the driver they should receive similar or identical stimuli. For example, a red traffic signal means stop, so if a vehicle should stop then ideally a traffic signal head displaying red should be shown to the driver.

Stuart (2018, pp. 7-8) notes that prior to impacting the Montague Street bridge the bus driver at the centre of this crash successfully stopped at a traffic signal controlled intersection and waited for the lights to change to green. Shortly thereafter the bus was driven through a height sensor that triggered two flashing red lights mounted on the bridge. Notably, the flashing red lights are not identical to a traffic signal head displaying red.

From this information (provided by the legal system) the author might suggest that setting the height detection device to instead trigger a standard traffic signal (green, yellow, red), mounted to appear like a pedestrian operated traffic signal might be a potential option to improve safety at the Montague Street Bridge. Standard traffic signals generally obtain the desired result successfully in other instances (such as at intersections) where a vehicle needs to stop prior to an unforgiving hazard (cross-traffic). Adoption of this familiar approach in advance of the Montague Street bridge, albeit with a bespoke connection to a height sensor, might help decrease the chances of high vehicles coming into contact with this unforgiving hazard in the future.

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