

Driving heavy vehicle safety through technology: challenges, results and lessons learned at Toll Group: a contextual overview

by Sarah Jones¹

¹ Group Manager Road Transport Compliance, Toll Group

Information based on a symposium presentation facilitated by Sarah Jones at the Australasian Road Safety Conference (ARSC2015), 14 – 16 October, Gold Coast, Australia

Abstract

Toll Group operates nearly 3000 heavy vehicles in Australia. Those vehicles travel around 300 million kilometres delivering 54 million consignments each year. Speed, fatigue and driver inattention/distraction are key policy challenges in the heavy vehicle space. Toll Group has invested in technologies of various kinds to reduce crash and incident risk. This article will explore these technologies – including in the two articles to follow this one - which describe the use of in-vehicle cameras and driver-state sensing machines. It will explore why these technologies were adopted (the problems and risks they were designed to address); how they work; the results they have achieved; and the lessons learned along the way. It will also provide an orientation on the specific context and challenges of heavy vehicle operation in Australia; including the over-representation of heavy vehicles in crashes and on-road incidents and the legal, cultural and enforcement context of heavy vehicle operations.

Introduction

In 1898 delegates gathered at a conference in New York to find a solution to a most pressing problem: how to manage horse-drawn transportation. Horses and horse-drawn vehicles were responsible for 200 road safety fatalities each year. Their emissions were a public health and amenity nightmare, producing between 1.4 and 1.8 million kilograms of manure *every day*. ‘One New York prognosticator of the 1890s concluded that by 1930 the horse droppings would rise to Manhattan’s third story windows. A public health and sanitation crisis of almost unimaginable dimensions loomed’ (Morris, 2007, p. 2).

The conference was intended to run for ten days. It disbanded after three, conceding it had no solution to this seemingly intractable problem. Of course, what the conference organisers did not foresee was the invention of the motor car. A mere fourteen years after the conference ended in disarray, motor cars were more numerous than horses in New York. Somewhat ironically, the car was ‘widely hailed as an environmental saviour’ (Morris, 2007, p. 8).

This story illustrates how new technology can resolve road transport dilemmas and also how that technology generates its own set of challenges. This dialectic between transport problem, technological response and new issue is a recurring theme as this article explores how technology can deliver safety benefits, but also present difficult and contested questions around costs and who should bear them, legal defences, individual privacy, skills, leadership and accountability.

This paper seeks to contextualise and examine the interplay between technology and the heavy vehicle freight industry through a focus on three areas: (1) capacity to invest (2) fairness and competition, and (3) legal defence. The papers that follow are more specific, and speak to technologies used in different areas of Toll Group. They explain the rationale for adopting a technological solution in a given area, the results achieved, challenges faced and the lessons learned to date. This represents the first time Toll has shared the results of its technology journey in such a considered and comprehensive way.

Context: the heavy vehicle industry in Australia today

The road freight task

‘Heavy vehicles’ as defined in the heavy vehicle national law (HVNL) are those vehicles with a gross vehicle mass or gross combination mass of 4.5 tonne and above. These vehicles include rigid trucks, articulated trucks and buses. In 2014 there were 329,464 heavy rigid trucks, 90,904 articulated trucks and 94,131 buses in the Australian motor vehicle census (ABS, 2014).

Australia’s dispersed population and the vast distances between centres make it peculiarly reliant on heavy vehicles. Goods typically travel further and to fewer people relative to other comparable nations, so around 26,000 tonne kilometres of freight is moved annually for every person in Australia (ALC, 2014, p. 3). Between 1971/72 and 2012/13 the total road freight carted in Australia increased from 27 to 203.6 billion tonnes per kilometre (BITRE, 2014, p. 61). This trajectory is expected to continue, with the 2030 national road freight task expected to be 1.8 times its 2008 level (Infrastructure and Transport, 2010, p. 10) and three times the 2006 level by 2050 (Infrastructure Partnerships Australia, 2009, p. 29).

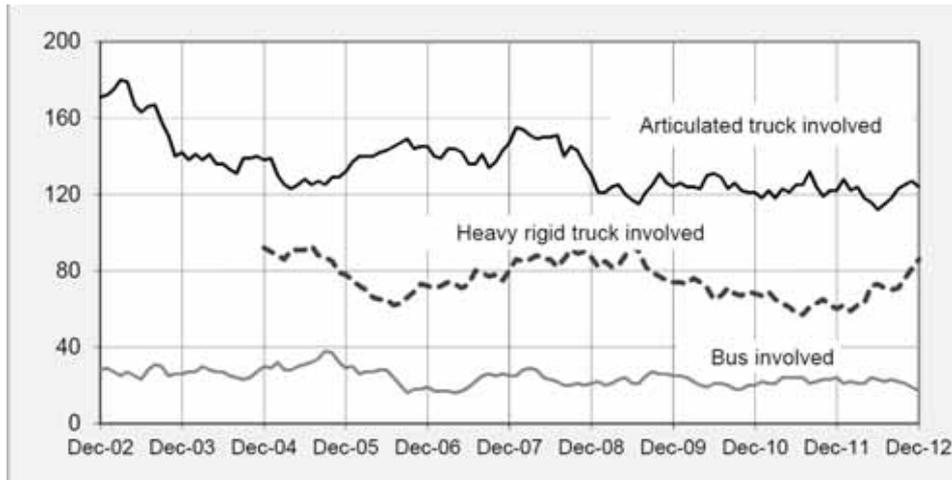


Figure 1. Fatal crashes involving heavy vehicles by type of vehicle (BITRE, 2012)

The contribution of the transport and logistics industry to the Australian economy is significant. The industry was estimated to account for 8.6% of gross domestic product in 2013 and to employ 1.2 million people (ALC, 2014, p. 29).

Safety

The industry's safety record has improved over the years and is generally trending in a positive direction, as illustrated in figure 1.

Data published by National Transport Insurance suggests that when the cost of major crashes is adjusted for net present value 'we could argue that the major crash rate per '000s units has improved by 42.7% since 2003. From a road safety major incident perspective, an unprecedented result' (NTI, 2013, p. 5).

Despite these gains, however, 'each year, heavy vehicles in Australia are involved in around 200 crashes resulting in fatalities, 1500 crashes resulting in hospitalisation, 11,000 crashes resulting in less serious injuries, and 32,000 crashes causing property damage. These events result in death, extensive medical costs, property damage...environmental contamination, and lost productivity (for the affected operator and other individuals) as a result of road blockages and lost time due to injuries, property damage and other factors' (NTC, 2015, p. 52).

Toll Group believes all injuries are preventable and that everyone has the right to go home safely. It is Toll's contention that more can and should be done to reduce the social and economic cost of road-related injury and death, and that technology has a significant role to play in this reduction.

Status of technology in the heavy vehicle industry

At present, innovations in vehicle design are introduced into the fleet through the Australian design rules (ADRs) and Australian vehicle standards regulations (AVSRs). The ADRs and AVSRs mandate the minimum standards acceptable for a vehicle's legal compliance. Manufacturers

can and do feature designs on their vehicles that go well beyond what government currently requires. This means that many heavy vehicle operators are deploying technological innovations to manage both the safety and productivity of their fleets without reference to government. In fact, a 2014 study suggested around 25,000 heavy vehicles (around 5% of the fleet) are already fitted with hardware which satisfies the requirements of the body that certifies telematics for regulatory purposes on government's behalf (Koniditsiosis, 2015).

Systems are readily available that track vehicles and drivers in real time. Governments have generally been reluctant to mandate such systems for industry, one exception being the intelligent access program (IAP) which is compulsory for operators wishing to access higher mass limits routes in NSW. The current Council of Australian Government (COAG) position on telematics and the use of co-operative intelligent transport systems (C-ITS) is that take-up should be voluntary.

Capacity to invest

Toll Group, with its 3,000 heavy vehicles and 25,000 staff in Australia, is a-typical of the heavy vehicle industry. The industry is dominated by small to medium enterprises. Approximately 70% of operators have only one truck, around 24% of operators have between two and four trucks and less than 0.5% of fleets have more than 100 trucks (NTI, undated, p.7). Owner/operators account for around 60% of the industry and around 11% of the profit (NTC, Quinlan and Wright, 2008, p. 11). These smaller operators may have limited resources and consequently limited capacity to invest in new technology. This may be a factor in the over-representation of small to medium enterprises in heavy vehicle incidents (NTI, 2015, p. 6).

The nature of the industry and its capacity restraints naturally influences government policy, including the question of how far and how fast to mandate technology uptake. When new technologies are introduced into the fleet through ADRs, it takes time for those benefits to flow

through. Most operators do not rush out and purchase new vehicles to take advantage of new design features; nor does the law require them to do so.

Consequently, although electronic stability control (ESC) was mandated for new light vehicles from 1 November 2013, it will be 2018 before 50% of the light vehicle fleet is equipped with ESC (BITRE, 2014, p.33). ESC for heavy vehicles is included in the *National Road Safety Action Plan 2015-2017*, but it will take even longer for the technology to flow through the fleet because of the vastly greater costs of new trucks compared to light vehicles. (A standard prime mover costs around \$250,000).

Table 1 below shows the estimated impact on the road toll and economy through currently-available vehicle technologies.

Table 1. Road toll impact through currently available technologies (Hoelzl, 2015)

Technology	Lives saved per year	\$million per year
Autonomous emergency braking system	67	67-187
Lane departure warning system	16	45
Electronic stability control (ESC)	11	31
Fatigue warning system	10	28
Total	104	171-291

There are natural inducements to adopting such technologies, even without government intervention. Many operators value their social license to operate and aspire to be good corporate and community citizens. They value the health and safety of their drivers, and their reputations. Further, they recognise the productivity benefits derivable from reduced rollovers and other incidents. Similarly, many customers are mindful of their reputations and will select carriers on the basis of the safety of their fleet. However, the economic reality of the industry and its dominance by small to medium enterprises limits the capacity to maximally benefit from technology.

It is not simply financial capacity to invest that is an issue, but also community acceptance. High productivity vehicles (HPVs) are ‘next generation’ vehicles designed around performance outcomes rather than to prescriptive rules. This allows designers to innovate and maximise freight productivity while conforming to safety and stability outcomes. These designs need to be approved by a panel convened by the national heavy vehicle regulator (NHVR) and are permitted only on restricted networks.

A comprehensive 2014 Austroads study found that HPVs deliver markedly better safety, environmental and productivity benefits over conventional vehicles. The study found that there were 76% fewer accidents in HPVs than

would be the case for conventional trucks. ‘This will lead to an estimated saving of 96 lives and \$63 million in insurance claims by 2030’ (Austroads, 2014, p. 48).

Despite these benefits, there are pockets of community resistance to HPVs. Other road users can experience HPVs as intimidating, slow and dangerous to overtake because of their size, resulting in terms like ‘monster trucks’. Community concern promotes a conservative access regime, and limits the safety, environmental and productivity benefits possible from utilising the latest designs and innovations.

Fairness and competition

The role and function that technology should play in the heavy vehicle space is contested between government and industry, and within industry itself. There is an ongoing debate about whether telematics should have a regulatory function. In other words: should the data collected by in-vehicle systems be available to government to check that industry is compliant with the rules?

There are sectors within industry that fear the data from compulsory telematics would be used punitively to issue infringements and fines. This fear needs to be seen in the context of the economic and regulatory reality within which industry operates. Competition is fierce and margins can be tight. An average infringement can cost an owner/operator around \$600 – ‘sufficient to nearly wipe out an entire week’s wage’ (NTC, 2013, p. 37). This economic reality, coupled with privacy concerns, explains some of the resistance to compulsory telematics in the industry.

Sectors that might otherwise support compulsory telematics (perhaps in exchange for greater productivity concessions) question whether compliance is reasonably possible in the current regulatory regime. One of the industry’s operational challenges is the sheer breadth of legislation and policy with which it must comply. For a single freight task this could potentially include:

- the heavy vehicle national law
- individual state and territory road traffic law
- dangerous goods legislation
- animal welfare law
- occupational health and safety law
- the road safety remuneration tribunal orders
- the Western Australian fatigue code of practice
- Western Australian CoR laws
- the Federal Interstate Registration Scheme and;
- concessional schemes such as the national heavy vehicle accreditation scheme (NHVAS).

Despite the introduction of the heavy vehicle regulator (NHVR), state-based variations from the national law remain; so vehicle combinations, conditions and loads which are legal in one state are proscribed in others. To further complicate matters, there is no single, comprehensive repository of the rules with which industry must comply on a given route at a given time. This makes it difficult to know with certainty what the law requires. Hence, there is a view within the industry that the greater surveillance and enforcement enabled by telematics is unfair in the absence of a clear and unambiguous picture of what compliance looks like.

A counterargument is that telematics may achieve what other policies have so far failed to do; that is: ensure a level playing field. Investment in safety and compliance costs operators money that must be recouped from consumers and customers through higher prices. What's more, responsible operators do not overload vehicles, run without permits or flout speed and fatigue regulations, leaving them at a competitive disadvantage against operators who do.

Australia's regulatory framework implies, though does not explicitly state, that road transport customers must make their choice of carrier on factors other than price alone. For example, consignors and consignees are required to make 'reasonable inquiries' of the scheduling process to ensure that drivers are not incentivised to speed, drive while impaired by fatigue or otherwise act in ways that might compromise safety. But how many of them do this? And is it policed?

Australia's unique geography makes catching operators who flout the law particularly challenging. It is unrealistic to police our vastly dispersed network using traditional enforcement methods. The corollary of this is fairly low chances of detection and correspondingly low levels of deterrence. A 2013 NTC report found that 'more than 11 billion vehicle tonne kilometres were travelled by heavy vehicles but only 332,214 on-road intercepts occurred' (NTC, 2013, p. 38). Enforcement innovations such as point to point cameras are successfully utilising technology to enforce heavy vehicle safety, but are only deployed on certain routes (Soole, 2011). Mandatory telematics can assist in levelling the playing field and promoting competition based on factors like service and safety rather than price alone.

Supporters of mandatory telematics also point to the fact that a voluntary, rather than mandatory, regime is likely to entrench a 'two-tier' industry: one that invests in technology and whose operating data is transparent to enforcement bodies and, indirectly, customers; and one that operates more traditionally and can 'fly under the radar' of police and regulatory authorities. The debate about electronic work diaries (EWD) is a neat illustration of the dichotomy. Work diaries are a means for drivers to record their work and rest hours to promote compliance with the law. Although electronic work diaries are included in the heavy vehicle national law and are entirely technologically possible, they have no statutory recognition.

One of the reasons for this is that the written work diary (WWD) records time in fifteen minute increments, while EWDs record time precisely. This precision means there's a potential for inequity between the two systems. A driver using an EWD is visible, and potentially infringeable, from the second he/she exceeds allowable hours whereas a driver using a WWD has a fifteen minute window within which to 'hide' and may, in fact, never be pulled over and checked. The debate is currently centred on whether allowing users of EWD an eight minute 'tolerance' would build equity into the system and encourage uptake.

Implementation of EWDs is not expected until 2018, by which point many operators will simply have instituted their own electronic fatigue management systems. After all, an EWD can assist drivers in taking the 'guess work' out of a complex set of fatigue rules and provide advance warning of pending rest breaks. If coupled with advice about available space at upcoming rest bays (as happens on some routes in the United States), this could be a practical and valuable fatigue management tool.

The risk is that by the time the regulatory framework catches up with the operational reality, the gulf will be unbridgeable; or bridgeable only at considerable cost. The photograph below illustrates what can happen when regulatory frameworks are disconnected from industry. This is the interior of a German-registered heavy vehicle. The console includes a digital tachograph to record driving hours, the road pricing black box for Germany, the road pricing black box for Austria and the black box for the European Union: all installed and maintained at operator expense.



Figure 2. Interior of German heavy vehicle (Koniditsiosis, 2015)

Toll Group believes that telematics should be mandatory in the Australian freight industry and that this is the most effective way of taking reasonable steps to meet safety obligations and of ensuring competitive neutrality.

Legal defence

The rapid evolution of technology and its deployment in the freight industry poses a very specific policy quandary for heavy vehicle operators. The heavy vehicle national law incorporates the concept of ‘chain of responsibility’ (CoR) which imposes duties and obligations on all parties in the supply chain to ensure safe on-road outcomes. The law gives parties in the supply chain the benefit of the ‘reasonable steps defence’ which applies where:

You did not know, and could not reasonably have been expected to know, of the contravention concerned; and

either, (1) you took all reasonable steps to prevent the contravention; or (2) there were no steps you could reasonably have been expected to take to prevent the contravention.

The real-time and continuous monitoring capacity made possible by technology creates a perverse disincentive to adopt it from a ‘reasonable steps’ perspective. After all, effective monitoring will identify patterns of non-compliant behaviour on which an operator should act. If the operator doesn’t act and enforcement ensues, it makes it very difficult to argue that one couldn’t ‘reasonably have been expected to know’. Traditional, paper-based systems make for more credible ‘I didn’t, and couldn’t, know’ arguments.

In deciding whether operators have taken reasonable steps to manage their CoR obligations, regulators and enforcers are required to consider the ‘measures available’ and the ‘measures taken’ to manage those risks (S. 620 and 622 of the HVNL). Presumably, if there is a large gap between what is possible to be done and what *has* been done to manage a serious risk, then the prosecution’s case is strengthened.

As noted in Table 1, there are measures available to manage risk through technology. However, they are not mandated and – where they are – there is a ‘grace’ period for adoption. This creates a tension for operators: on the one hand rapid adoption of new technologies narrows the gap between ‘measures available’ and ‘measures taken’ and thereby demonstrates ‘reasonable steps’. On the other hand, the rapid adoption of these technologies can be commercially unviable. Further, if a vehicle is imported with an array of safety features that are not technically required by law (i.e. the ADR/AVSRs) and an operator does not enable or use them, can that operator be said to have taken ‘reasonable steps’? The vehicle may be compliant with design and standards laws, but the operator has elected not to take a ‘measure available’.

The ‘reasonable steps’ implications are likely to loom even larger given the likelihood that the United States will mandate cooperative intelligent transport systems (US DoT, 2014). The US will probably mandate vehicle to vehicle (v2v) C-ITS in 2016, though a start date hasn’t been determined. Cadillac has already announced that its 2017 model will be C-ITS enabled, making it the first manufacturer to incorporate the new technology

into its fleet. If this technology is available on vehicles imported into Australia from the USA, what will this mean for ‘reasonable steps’? A broader question is whether Australian infrastructure and policy frameworks will be mature enough to realise the potential benefits of C-ITS.

References

- Australian Bureau of Statistics (ABS). (2014). *Motor Vehicle Census*, 9309.0, 31 January.
- Australian Logistics Council (ALC). (2014). *The Economic Significance of the Australian Logistics Industry*, Canberra.
- Austroroads. (2014). *Quantifying the Benefits of High Productivity Vehicles*, Research Report AP-R465-14.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE). 2014. *Australian Road Freight Estimates: 2014 Update*, Canberra.
- Bureau of Infrastructure, Transport and Regional Economics. (2012). *Fatal heavy vehicle crashes Australia quarterly bulletin*, Oct-Dec, Canberra.
- Bureau of Infrastructure, Transport and Regional Economics (BITRE). (2014). *Impact of Road Trauma and Measures to Improve Outcomes*, Canberra.
- Department of Infrastructure and Transport. (2012). *Road freight estimates and forecasts in Australia: interstate, capital cities and rest of state*, research report 121, Canberra.
- Hoelzl, R. (2015). ‘An update on road freight network access’, presentation to the Roads Australia network reliability workshop, Brisbane.
- Infrastructure Partnerships Australia. (2009). *Meeting the 2050 Freight Challenge*
- Koniditsiotis, C. (2015). ‘The future of freight – integration with ITS and intelligent logistics’, presentation to the Roads Australia Network Reliability Workshop, Brisbane.
- Morris, E. (2007). ‘From horse power to Horsepower’, *Access*, 30, 2-9.
- National Transport Insurance (NTI). (undated). *NTI’s Guide to the Trucking Industry*.
- National Transport Insurance (NTI). (2015). *2013 Major Accident Investigation Report*, Brisbane.
- National Transport Commission (NTC). (2015). *Heavy Vehicle Roadworthiness Program: Consultation Regulatory Impact Statement*, Melbourne.
- National Transport Commission with Wright, L. and Quinlan, M. (2008). *Safe Payments: Addressing the Underlying Causes of Unsafe Practices in the Road Transport Industry*, Melbourne.
- Soole, D., Fleiter, J.J. and Watson, B. (2011). *Point-to-Point Speed Enforcement: A Technological Overview, Review of the Empirical Evidence and Recommendations for Better Practice*, Draft final report for the Austroroads Steering Committee.
- Transport and Infrastructure Council. (2014). *National Road Safety Action Plan 2015-2017*.

UK Traffic Commissioner Press Release ‘Changes to operator licence financial standing limits to apply from 1 January’, <https://www.gov.uk/government/news/changes-to-operator-licence-financial-standing-limits-to-apply-from-1-january>

United States Department of Transport and National Highway Traffic Safety Administration. (2014). *Vehicle-to-vehicle communications: Readiness of V2V technology for application*.

US Department of Transportation issues advance notice of proposed rulemaking to begin implementation of vehicle-to-vehicle communications technology, 18/8/14 (<http://www.nhtsa.gov/About+NHTSA/Press+Releases/NHTSA-issues-advanced-notice-of-proposed-rulemaking-on-V2V-communications>).

Vlaskovits, P. (2011). ‘Henry Ford, innovation, and that ‘faster horse’ quote’, *Harvard Business Review*, 29 August.

In-truck cameras at Toll NQX

Greg Smith¹ and Sarah Jones²

¹ General Manager, Toll NQX

² Group Manager Road Transport Compliance, Toll Group

Information based on a symposium presentation facilitated by Sarah Jones at the Australasian Road Safety Conference (ARSC 2015), 14-16 October, Gold Coast, Australia

Introduction

Toll NQX is a business unit within Toll Group that specialises in long distance road freight solutions for Australia’s northern routes. The operating environment is characterised by remoteness, harsh conditions, limited supporting infrastructure such as rest bays, and longer response times if things go wrong. Long distance, or ‘linehaul’, operations utilise high productivity vehicles such as B-doubles and road trains. It is not unusual for vehicle combinations to weigh up to 130 tonnes and represent a million dollar investment. Typically, vehicles are loaded within Toll NQX depots (of which there are 24) by loading staff, leaving drivers fresh for the task of driving. Unlike pick-up and delivery work which has the inherent stimulus of multiple drop-offs, interaction with customers and urban traffic flows, linehaul driving involves long stretches of one, single task: driving.

It is common for Toll NQX linehaul drivers to clock up 1000 kilometres over a 24-hour period and around 220,000 kilometres in a year. In comparison, Australian motorists drive an average of 15,530 kilometres per year (Roy Morgan, 2013). Professional freight drivers generally do not receive enforcement concessions because of their increased

exposure relative to other (non-professional) drivers. They have the same demerit point thresholds and incur traffic infringements at the same or higher penalty levels than general motorists. (Professional drivers in New South Wales have a higher demerit point threshold than other drivers, RMS, 2015).

Linehaul driving is a solitary task without the myriad of workplace interactions many of us take for granted. This solitariness is often an attraction for linehaul drivers, but it creates unique managerial and safety challenges. For example, how can schedulers judge the fitness for duty of drivers they cannot physically see and assess? How can restorative rest be promoted in remote areas with limited facilities? What is the most effective and efficient response in the event of mechanical failure, rollover or weather event? Such challenges made the risk management opportunities afforded by technology deeply attractive to Toll NQX, and the business unit was an early adopter of GPS-enabled telematics (or “black boxes”) for this reason.

In-truck monitoring for speeding events

Toll NQX introduced in-truck monitoring for speed management purposes in 2001, two years before the

	Moderate speed breach	Major speed breach	Critical speed breach
First offence	Formal verbal counselling to restate company policy	First and final formal written warning stating a further breach will result in termination	Termination of employment
Second offence	First formal written warning issued stating that two (2) further breaches will result in termination	Termination of employment	
Third offence	Final formal written warning stating a further breach will result in termination		
Fourth offence	Termination of employment		

Table 1. Toll Group’s consequence table for speed breaches