IMPROVING HEAVY VEHICLE SAFETY

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1. A BRIEF STATEMENT OF THE ISSUE

Approximately 330 people are killed each year in Australia in crashes involving heavy vehicles[1] (around 19% of the overall fatalities) and three times as many are injured – costing around $2 billion annually[1]. Over the six year period 1997-2002, in New Zealand there was an average of 93 fatalities per year from crashes involving trucks (19% of the overall total) and an average of 156 injured per year[2]. In both Australia and New Zealand, freight transport by road is expected to increase dramatically in the future, outstripping growth in other transport and vehicle sectors, and in road infrastructure construction and maintenance.

This paper presents some of the key issues associated with improving vehicle safety. It is also recognized that there are other issues and viewpoints that have not been treated in any detail.

2. AN ASSESSMENT OF THE ROAD SAFETY ISSUE

2.1 Size of the problem

Heavy vehicles comprise a relatively small percentage of registered vehicles, but a heavy vehicle travels further per year (on average) than a light vehicle. In 2001, articulated and rigid trucks and buses made up only 4% of registered vehicles in Australia, but they travelled 8% of the total kilometres per registered vehicle, and heavy vehicles travelled more than twice as far as lighter vehicles (28.24 and 13.93 thousand kilometres per registered vehicle respectively)[3]. In New Zealand, 6.2% of all travel is truck travel: all trucks travelled 24,080 km (45,661 km for articulated trucks and 23,237 for rigid trucks)[4].

Heavy vehicle travel has been steadily increasing in recent years, commensurate with increasing road freight movement, with significant projected increases in the near future. In the period 1972-2000, inter-capital non-bulk freight flows (essentially non-commodity freight) grew 1.3-1.5 times – faster than national income[5]. On current trends, Bureau of Transport Economics projections predict that road freight will grow 2.2 times by 2020[5]. However, vehicle kilometres are expected to grow only 50% for all Australian road freight and 75% for inter-capital freight[6]. It is expected that there will be a greater number of trucks overall and a greater number of larger articulated trucks. Rail transport is expected to handle only a small percentage of the increased freight task.

2.2 Improving safety

The Australian Transport Council (ATC) recently released a safety strategy (2003-2010) and action plan (2003-2005) aimed at crystallising efforts to improve heavy vehicle safety[7]. Eight primary issues were identified, along with associated fatality reduction targets:

[1] In both Australia and New Zealand, heavy vehicles are defined as vehicles greater than 4.5 tonnes gross vehicle mass (i.e. the maximum loaded mass of the vehicle).

- increased seatbelt use by heavy vehicle drivers – 9% reduction in driver fatalities
- safer roads (e.g. shoulder sealing, audible edge lines, passing lanes, rest areas) – 38%
- more effective speed management (eg effective use of speed delimiters) – 30%
- reduced driver impairment (especially through better management of fatigue) – 18%
- safer heavier vehicles (e.g. integrated seat belts, improved cabin strength, underrun protection) – 5%
- enhanced driver and industry management (e.g. chain of responsibility legislation)
- effective enforcement
- targeted research and education.

2.3 Seatbelts

Under the Australian Road Rules, wearing a seatbelt while driving a heavy vehicle is compulsory. However, compliance is low – 25% for heavy rigid truck drivers and 17% for articulated truck drivers[8], and possibly as low as 4-10%[9]. Further evidence for low compliance is reflected in crash analyses:

- around 40 drivers are killed annually because they are not wearing a seatbelt[7]
- two-thirds of articulated truck drivers and one-half of heavy rigid truck drivers killed in single-vehicle crashes were not wearing a seat belt[10]
- around 90% of heavy vehicle occupants killed in NSW (around 20 occupants per year) were not wearing a seat belt[11].

Preece[8] quotes an unpublished RTA report that suggests that 40%-50% of fatalities could be prevented by seatbelt use at similar levels to that found for light vehicles in NSW (upwards of 97%), that is, 10 lives per year.

As an arising issue, there is the need for further research into the reasons for heavy vehicle drivers' non-use of seat belts.

2.4 Driver fatigue

Due to the long hours and long distances heavy vehicle drivers travel in their vehicles, fatigue is a major concern. Estimates of the involvement of fatigue (on the part of the heavy vehicle driver) in heavy vehicle-related crashes vary – 15% of fatal heavy vehicle crashes, 10% of serious crashes and 7% of other crashes, with an overall annual cost of around $250 million[12]; 8% of NSW heavy truck fatal crashes[11 13]; a contributory factor in 19.8% of crashes (Feyer, Williamson, Friswell & Sudural, 2001 in[14]). Additionally, stimulants may be used in an attempt to ward off fatigue, although this is not as common as thought by the public[7], and the incidence is declining[15].

2.5 Speed

Heavy vehicles exceeding the speed limit is another issue identified by the Safety Strategy. According to Austroads, 23% of heavy vehicles exceed the posted speed limit, and 3.2% exceed it by more than 10%[7]. In the period 1995-2000, in 100km/h and 110 km/h speed-limit zones in NSW, Queensland, SA, Tasmania and Victoria, 17% of rigid trucks and 26% of articulated trucks were found to be speeding by weigh-in-motion devices[16]. Additionally, 2% of the rigid trucks and 13% of the articulated trucks were overloaded, and 0.6% and 5% (respectively) were both overloaded and speeding. The majority of the vehicles were within 10% of the limits for both transgressions. The estimate for the involvement of speeding in heavy vehicle crashes varies: 12% of NSW heavy truck fatal crashes[11]; 10% of articulated truck crashes and 3% of heavy rigid truck crashes[10].

3. CURRENT POLICIES AND PRACTICES IN AUSTRALASIAN JURISDICTIONS

There are a number of road regulations that apply specifically to heavy vehicle drivers. For example, the BAC limit for drivers of heavy vehicles is either 0.00 or 0.02, depending on the jurisdiction.

3.1 Hours of work

Both Australian and New Zealand authorities specify the number of hours a heavy vehicle driver can work continuously (including driving), within a 24-hour period and within a week. For example, in most Australian States, a 30-minute break must be taken after every five hours of work; in New Zealand it is 30 minutes every 5.5 hours. Work and driving periods are entered into a driver's logbook and compliance can be checked at roadside stops by enforcement officers. There is concern, however, that these records are not always accurate. Feyer et al. (2001, in[14]) found that 56.9% of drivers breached working hour regulations on at least half of their trips. Additionally, the regulations do not really address the complexity of the fatigue issue[12]. In 2003, the NRTC released a Draft Code of Practice for fatigue in heavy vehicle drivers.

3.2 Speed limiters

An Australian Design Rule has required since 1991 that all new heavy vehicles (GVM>12 tonnes) must be fitted with a speed-limiting device. Other heavy vehicles detected exceeding the speed limit a certain number of times (depending on the jurisdiction) are required to retro-fit a speed-limiting device. These devices set a single maximum speed (the national speed limit for heavy vehicles is generally100 km/h in Australia; and in New Zealand, 90 km/h). In NSW, the penalties for speeding 15 km/h or more above the limit increase with the size of the truck and the degree to which it is exceeding the limit. The third time a heavy vehicle is detected so exceeding the limit within a three-year period, the vehicle's registration is suspended for 28 days. For fourth and subsequent offences the registration is suspended for three months.

There are at least anecdotal reports that speed limiters are frequently tampered with – thus suggesting the need for more secure design and installation systems.

3.3 Regulatory reforms – chain of responsibility and performance-based standards

There are currently two major regulatory reforms in progress in the Australian road freight industry – chain of responsibility provisions, and performance-based standards (with the latter also being used in New Zealand). At various stages of development and implementation, both provisions aim to improve road safety and better mediate the negative effects of road transport.

In the past, the truck driver was generally held solely responsible for the truck's road safety contributions while driving. However, other parties can influence the safety of a particular trip through factors, such as including the mass or dimensions of a load, how the load is restrained, and the imposition of tight deadlines. Chain of responsibility regulations, essentially, allow these other parties to be held liable for their part in causing or allowing an unsafe act to take place on the road. Any party who can exercise any control in the transport chain, and who should have had knowledge of, or control over, any actions that resulted in a breach of the law, can be liable for that breach, even if they were not directly involved in committing the breach. For example, a consignor or receiver who does not allow sufficient time for their goods to reach their destination without the driver speeding or exceeding driving hours' requirements, can be held accountable. The individual (and the employer) in charge of rostering drivers may also be implicated if they required, encouraged or allowed the driver to speed or exceed mandated driving hours. Loaders, operators and drivers must not allow a truck to be overloaded (overall or individual axle weights), or the load to be restrained improperly, and receivers must not accept overweight or unsafely restrained loads. Each state has responsibility for its own traffic regulations, and each state has responsibility for registrations. Accordingly, provisions such as chain of responsibility must be enacted on an individual basis by each state. At the end of 2003, the Australian Transport Council approved a set of model provisions in the "Road Transport Reform (Compliance and Enforcement) Bill". This document provides a set of "essential" and "desirable" provisions that should provide a nationally consistent legislative framework. It includes offences, enforcement regimes and powers, penalties and sanctions.

Performance-based standards (PBS) in the road transport industry seek to better match regulatory requirements to the real characteristics of vehicles and the conditions under which they are operated. Minimums and maximums are specified for a range of variables, such as mass, turning circle and swept path. The performance of critical elements is specified to maximise safety and minimise the impact the vehicle has on infrastructure, such as roads, but to allow for innovative vehicle improvements designed to increase efficiencies and productivity. PBS systems have been shown to have crash advantages[17], and to result in positive benefit-cost ratios[18]. PBS systems are currently being trialled on a voluntary basis.

3.4 Heavy vehicle operator accreditation and fatigue management schemes

Accreditation schemes allow operators an official safety accreditation related to their willingness to operate under certain conditions. Fatigue management schemes operate in a broadly similar manner, with operators allowed some extra operating flexibility if they comply with specified conditions.

4. A REVIEW OF THE RESEARCH

Even though heavy vehicles have relatively low crash rates, their high mileage exposures, long operational lives and high crash severities produce very high crash costs, particularly when economic costs, pain and suffering, and loss-of-life costs are considered[19]. Accordingly, on a per-unit basis, truck-based countermeasures have the potential for large savings, even if they are relatively expensive. For example, there is currently no ADR regarding cabin strength or padding (for the cabin or steering wheel) for heavy vehicles, and few trucks are fitted with devices such as airbags.

An analysis based on NSW data estimated that universal fitting of rigid underrun protection barriers on the front of heavy trucks would save 22% of fatalities and 53% of serious injuries to car occupants in head-on crashes with a heavy truck (28% and 66%, if the protection is energy absorbing) (Gibson, 2001 in[13]). The severity of other types of crashes may also be reduced with these barriers, along with further savings if barriers are fitted to the rear and sides of the truck. Haworth and Symmons[20] found that the road safety benefits of fitting underrun protection in a variety of scenarios significantly outweighed the costs. At the same time however, it needs to be noted that in designing underrun protection devices, ready access to underneath the vehicle will be required for both regular maintenance and emergency roadside repairs.

Other heavy vehicle-based countermeasures revolve around monitoring the movements of the vehicle. The Safe-T-Cam system is a network of fixed cameras (22 across NSW and several others in other states) that can determine whether a heavy vehicle has been speeding, or the driver has not had the required rest within a trip (both based on time taken to cover the distances between cameras). Other options include using satellites to continuously monitor speed and rest stops. Heavy vehicles can also be monitored to ensure that they do not use roads/bridges deemed unsuitable, or enter restricted areas or areas with restricted truck access times (the Intelligent Access Project[21]).

Winkler[22] discusses ITS devices that aim to prevent truck rollover crashes. Road-based warning signs on freeway exit ramps have been demonstrated to be effective, including a device that provides variable feedback based on the truck's approach speed, height and weight. There are also a number of truck-based devices in development that can modify the suspension when the vehicle is leaning at a pre-determined angle, or selectively apply braking to reduce roll or slow the vehicle. In a less active device, in-cabin warnings (audible and/or visual) alert the driver when the vehicle is approaching a critical angle.

Moses and Savage[23] conducted a cost-benefit analysis of two U.S. programs: inspectors auditing the operating bases of firms to investigate safety management practices; and roadside inspections. Businesses targeted for enforcement and education as a result of the audit program improved their accident rate by 43%, resulting in a benefit-cost ratio of over 4:1. Benefits may not exceed costs (or at least not substantially) for the roadside program, depending on the circumstances and the degree of general deterrence generated. A 1998 roadworthiness survey found that 6% of articulated trucks and 9% of rigid trucks had a major defect that presented an imminent and serious safety risk; 35% of articulated trucks and 34% of rigid trucks had a minor defect[13].

5. POLITICAL, SOCIAL AND OTHER FACTORS

As a road safety concern, heavy vehicles generate significant public interest because, when they crash, the level of damage and injury severity is likely to be very serious, at least on the part of the occupants of any lighter vehicles involved. Additionally, while relatively rare, news items of crashes in which a heavy vehicle driver was under the influence of drugs or fatigued generate a lot of public concern.

As the heavy vehicle itself is a workplace for the driver and the core of a business, a number of other issues that, at first glance, may not appear related to road safety should be addressed. One such issue relates to the competitiveness of the industry and payment practices, particularly for subcontractors.

Other than the outlay of often a large amount of capital to purchase a heavy vehicle, there are no restrictions in Australia as to who can enter the road transport industry, particularly for new small players. In New Zealand transport firms are required to obtain a permit, licence or certificate to set up a business supplying road freight services (OECD, 2000 in[24]). Around 70% of hire and reward fleets in Australia consist of a single vehicle[24], while in New Zealand it is about 67%. In order to make vehicle repayments, operators may accept unsustainable rates simply to generate a monthly cash flow. Shortage of funds and the need to keep a vehicle on the road can mean irregular and/or lack of thorough maintenance, and safety can suffer. Insecure rewards and access to work contribute to hazardous practices such as speeding, fatigue, and drug use by some drivers[13].

The issue of freight rates has also been interpreted as having safety implications. Truck operators – particularly long-haul operators – are usually paid a rate per trip based on kilometres travelled and weight carried. In addition, there may be delivery time bonuses or penalties and other performance-based incentives. Accordingly, these drivers/owners are not paid for "waiting time". Trucks may have to wait hours to load or unload, and this time cannot usually be used for sleep or maintenance tasks or the drivers may risk losing their place in line. While a number of large dispatchers and receivers allocate timeslots for loading or unloading to discourage speeding and driving excessive hours, this is often the time that a vehicle is expected to be on-site; it does not necessarily indicate the time that the truck will be loaded or unloaded. Additionally, the driver may endeavour to arrive as soon as possible in case of unforeseen hold-ups along the way (and possibly nap upon arrival), so the temptation to speed or exceed driving hours during the journey still exists. However, it must be stressed that a review of the literature on the subject concluded that while some international studies have found links between freight rates and safety performance, Australian studies are less conclusive[25] and accordingly, this interpretation requires further empirical evidence before it can be accepted fully.

According to Moore[24], both the Quinlan Report (2001) and the Neville Committee (a 2000 House of Representatives Standing Committee) addressed the issues of entry to the industry and rates, with the former suggesting a licensing system and minimum enforceable safe rates of pay for licensed operators, and the latter proposing an accreditation scheme for entry into the industry. Moore[24] points out, though, that this would impose another level of compliance costs on the operator, and whether such schemes actually lead to an improvement in safety is questionable.

Other countermeasures can focus on drivers of other vehicles. Australian research[7 26] indicates that, in crashes between trucks and lighter vehicles, the latter is more likely to be at fault. For example, 40% of NSW crashes are head-on, and in 80% of these cases the vehicle on the wrong side of the road is not the truck[11]. Additionally, all driver-related crash factors (failure to give way, failure to obey traffic device, inattention, driving too fast, ran off road/lane, and erratic/reckless driving) are substantially more likely to be on the part of the car driver than the truck driver[27]. Drivers of lighter vehicles are generally unfamiliar with the performance limitations and capabilities of large trucks – limited acceleration, braking and visibility constraints, and the relationship between mass and velocity and the potential consequences of that relationship to safety[28].

Stuster[28] recommended that unsafe actions performed by other motorists in the presence of trucks should be made offences or, where a general offence already exists, a separate penalty should be applied when in the vicinity of a truck. Stuster[28] also suggested that publicity campaigns should be used to educate drivers of lighter vehicles about the specific dangers of driving in the vicinity of trucks. For example, the U.S. "No-zone" campaign targets areas around a heavy vehicle where a crash is most likely to occur. Information is provided about stopping distance requirements, mirror blind spots, turning requirements and overall limitations.

As a final issue, chain of responsibility legislation is (or will be) one of the most far-reaching reforms to occur in the Australian road transport industry for some time. As no similar scheme has been used elsewhere[24], an important issue will be its evaluation for road safety benefits. There is currently a paucity of data for carrying out such evaluations. Each state maintains its own crash database and they are not compatible in terms of what is recorded and how the data are coded. The ATSB maintains a national database of fatalities that result from heavy vehicle crashes, but other less severe crashes are not collated, although the ATSB is developing the Australian Truck Crash Database to include serious crashes[29].

6. CONCLUSIONS

Heavy vehicles are already associated with a substantial proportion of the road toll, including around one in five fatalities. With there being an expected doubling in road freight by 2020 with an accompanying increase of 50-75% in heavy vehicle kilometres travelled, the issue of safety is given added impetus. The ATC has moved to address this issue by identifying five primary sets of countermeasures, each with fatality reduction targets. The countermeasures are: increased seatbelt use by heavy vehicle drivers – 9% reduction in driver fatalities; safer roads (e.g. shoulder sealing, audible edge lines, passing lanes, rest areas) – 38%; more effective speed management – 30%; reduced driver impairment – 18%; safer heavier vehicles (e.g. integrated seat belts, improved cabin strength, underrun protection) – 5%[2]. In addition, the ATC pointed to three further avenues for change through enhanced driver and industry management (e.g. chain of responsibility legislation), effective enforcement, and targeted research and education.

[2] In addition, other vehicle factors such as dynamic stability, offtracking and roll stability, also identified by the ATC, may result in further savings once implemented.

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