Submission
No 18

INQUIRY INTO HEAVY VEHICLE SAFETY

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Submission to Staysafe (Road Safety) Committee Heavy Vehicle Safety Inquiry

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SAFE SYSTEMS APPROACH

We thank the committee for this opportunity to comment on heavy vehicle driver safety.

Whilst the terms of reference are focussed on OH&S and fatigue issues, this enquiry provides an opportunity to point out to the Committee other truck related road safety deficiencies that have resulted in the majority of truck related fatalities and serious injuries. They essentially occur to vehicle occupants and vulnerable road users that are struck by the truck.

The Safe Systems approach has been adopted in the national road safety strategy as well as by the RTA and now internationally at UN forums. Safe systems moves away from the economic-rationalist 'cost-benefit' models, which are used widely in transport and engineering design arenas, to a more humanistic rational model. This is indeed a move that should be much applauded.

The model shown in Figure 1 explicitly recognises that responsibility for safety is shared between the system designers and the road users. The underlying premise is

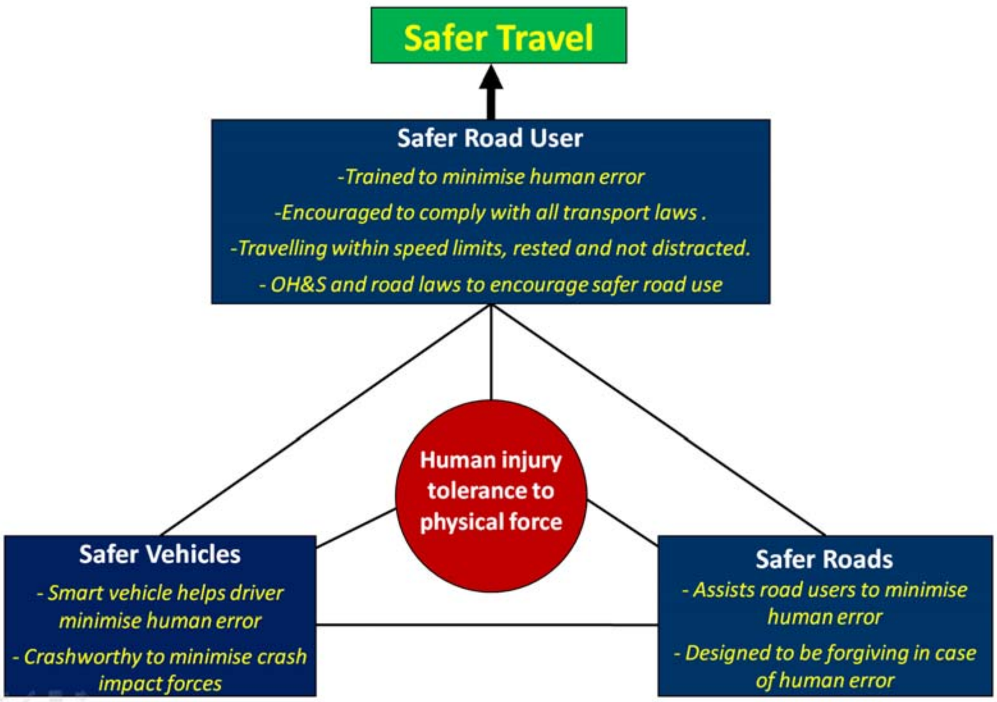

Figure 1: Safe Systems approach to road safety

that no foreseeable crash should be more severe than the tolerance of the human in order not to receive an injury that causes long term health loss. Human body tolerance to injury also assists with setting of survivable speed limits, i.e. if a crash occurs and the vehicle is travelling at or below the speed limit, then the occupants will survive the crash without permanent injury.

Truck Crashworthiness

Crashes involving heavy vehicles (trucks and semi-trailers) and other road users such as cars and vulnerable road users have resulted in an over-representation of this vehicle type in fatal and serious injury crashes. Over 80% of the victims in these crashes are the other road user [Grzebieta R.H. and Rechnitzer G.(2001), Rechnizter and Grzebieta (1999)]. The major factor in the significant over-involvement is the incompatible and aggressive design of heavy vehicles for all crash modes. In frontal crashes bad geometry is aggravated by the significant mass difference.

With respect to truck into car crashes the techniques used for designing car occupant crashworthy systems are not filtering through to designers of heavy vehicles. Whilst mass is an issue for frontal impacts with respect to survivability in crashes it is less of an issue in other crash modes such as under-run crashes and cyclist pedestrian impacts as a result of turning. Often good vehicle geometry and energy absorbing interfaces are overlooked in developing a heavy vehicle that is crash compatible with the average car fleet and vulnerable road users. Massive head and chest injuries to the occupants of a car and vulnerable road users impacted by a heavy vehicle are common. The mass difference between the impacting truck and the lighter struck vehicle or vulnerable road user, is often blamed for such injuries. However, in a large number of cases incompatible heavy vehicle geometry and high stiffness characteristics has often led to an unnecessary fatality. This is because the design requirements do not include the whole system or environment where the heavy vehicle needs to operate in nor are there any injury performance requirements (Figure 1).

Studies have identified that the front, side and rear design of heavy vehicles can be effectively modified to significantly reduce the harm potential of heavy vehicle crashes [Grzebieta R.H. and Rechnitzer G.(2001), Rechnizter and Grzebieta (1999)]. A major design feature of heavy vehicles identified as significantly exacerbating the injury risk to pedestrians, cyclists and vehicle occupants, is the high stiffness and aggressiveness of the front structures of heavy vehicles. A common feature is the use of heavy bullbars on the front of heavy vehicles (Figures 2 and 3). These designs because of their high stiffness, unyielding characteristics (not energy absorbing) and small contact areas are the antitheses of designs aimed at reducing injury risk. Moreover, the designs of these bars negate any car designs aimed at reducing injury risk. While there is a recent design rule for over-ride for the front of heavy trucks, it is not injury performance based and hence a hard facia would still be allowable.

Considering the case of the urban environs, presently bullbars (Figures 2 and 3) only provide a degree of protection to vehicle body damage and not occupant protection or protection to vulnerable road users such as pedestrians, cyclists, etc. When a pedestrian or cyclist is struck they are thrown forward and the truck usually breaks and stops before running over the pedestrian or cyclist. Prof. Grzebieta provided evidence at a West Australian Coroner’s inquest in September 2006 where a pedestrian, Karl Anthony Liedel, was struck by a truck travelling at a low speed at a pedestrian crossing and killed. Figure 3 shows how Mr. Liedel was likely struck in the head by the bulbar and received his lethal head injury.

Thus in these situations, one group of road users (the truck bullbar owners) jeopardise the safety of other road users solely for convenience, and minimising parking type damage to their vehicles. The overall solution is to require crashworthiness injury performance criterion for the front of vehicles for their system compatibility with other road users. Padding could be used to reduce head injuries in the case of side impact crashes into cars and in pedestrian and cyclist impacts.

Similarly Figure 4 shows how side skirting is now being used in Europe to protect against under-run into the side of trucks and also to prevent pedestrians, cyclists and motorcyclists from being caught under the tray of a turning truck. No legislation exists requiring side skirting protection.

Of considerable concern are under-run crashes where cars impact the rear end of trucks. Rear under-run crashes involving heavy vehicles with rear overhangs represent the most extreme examples of the system incompatibility between heavy vehicles and passenger cars (Figure 5). This type of crash often causes severe or fatal injuries to car occupants due to the mismatch in mass ratio, stiffness ratios and geometry. Under-run protection systems have been legislated in the ECE, USA and Brazil though the performance requirements set out are still inadequate. Even though considerable work has been carried out at in Australia investigating and mitigating such crashes with cost effective solutions, a design rule requiring trucks to carry rear energy absorbing under-run protection systems has not been introduced.

We are happy to present more information concerning crashworthiness issues to the committee if requested.

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Figure 2: Over ride and hard front facia result in serious head and chest injuries. In the lower picture the occupant survival space is maintained but impact to the head of the driver results in fatal injuries.

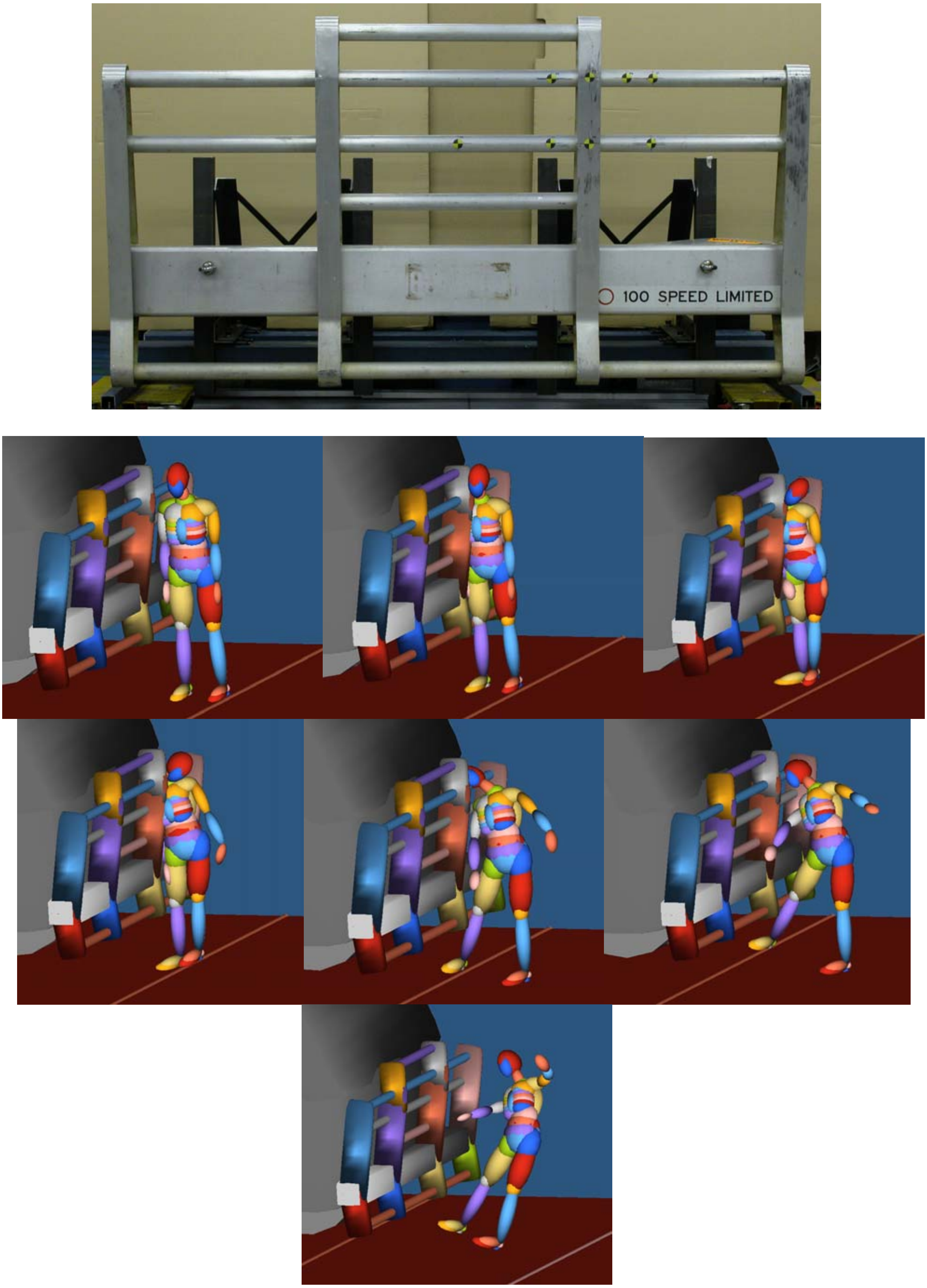

Figure 3: Fatal head strike on truck bulbar (top). Truck travelling at around 15-20 km/hr at pedestrian crossing.

Figure 4: Side skirting to help prevent under-run in car collisions and over-ride of cyclists and motorcyclists during turning manoeuvres.

Figure 5: Under-run crash test demonstrating incompatibility between car and rear of truck.

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