Contributed Articles

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Interface Design: The Next Major Advance in Road Safety

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Abstract

Road safety initiatives over the years have been heralded by concepts such as behavioural issues, new safety features in vehicles and road improvement projects. These have progressively reduced the road toll by targeting high priority issues, but without new directions the initiatives may have diminishing returns over time. Furthermore, it is well known to engineers that holistic and system wide approaches such as Vision Zero are fundamentally more powerful as they target elimination with a coordinated approach to the problem rather than progressive reduction with isolated actions.

This paper identifies the concept of "Interface Design" as a potential catalyst for the next major advances in road safety. Interface Design is a holistic approach which encourages players in the development of systems to consider all possible interfaces of their project. The authors show some examples of interface design and in the process hope to highlight how this design and engineering approach represents a new frontier.

Introduction

There are various paradigms in Road Safety, including Vision Zero [1, 2]; the Safe Systems approach - safer people, in safer vehicles on safer roads [3]; and Crashworthy Systems [4, 5]. The authors advance the concept of "Interface Design" [6, 7, 8] which can be applied to all facets of road safety, from behavioural through to road and vehicle design. Interface design draws from and extends previous road safety system paradigms; in doing so, it provides a powerful conceptual framework for road safety analysis and countermeasure development, as well as an equally powerful applied methodology to ensue effective outcomes for a safer road transport system.

In Interface Design, we explicitly recognise that failures in our road safety system occur because of breakdowns in system safety at various interfaces. These inadequately designed interfaces either cause collisions to occur, or cause them to occur in a way which increases the risk of injury. Through proper attention to interface design at all levels of the transport system we can reduce crash risk, crash severity and injury risk.

While various aspects of Interface Design have been applied and can be arrived at through other road safety paradigms [compatibility, crashworthy systems, intersection conflict analysis, Vision Zero; behavioural change, etc], Interface Design requires a more detailed and systematic examination of the effectiveness of the design and implementation of road safety measures at all levels.

The authors in this paper argue that further significant advances in road safety will arise from the understanding and purposeful incorporation of Interface Design in road safety programs. By paying due attention to interface design we open up our thinking to an increased range of countermeasures possibilities, and provide opportunities for improving road safety and reducing risk.

The interface design paradigm is fully compatible with the Vision Zero philosophy, as it explicitly recognises that responsibility for safety is shared by the system designers and the road users. A key principle from Vision zero is that [1]:

"The designers of the system are ultimately responsible for the design, operation and use of the road transport system and thereby responsible for the level of safety within the entire system".

Interface design occurs at three main levels:

1. **Behavioural interfaces.** Interface design when applied to the vehicle operator is concerned with vehicle control and crash avoidance by the vehicle operator or independently. This includes the gamut of behavioural issues, including: the fundamentals of driver attitudes and training; the area of ergonomic and human factors (man-machine interface); in-vehicle systems interfaces (GPS, mobile phones etc.); vehicle control systems (such as ABS, ESC etc.); and through to the interaction with the road environment (road design, signage etc.), and other road users (other vehicles, cyclists, motorcyclists, pedestrians

etc.). Operator vigilance and effects of alcohol, drugs and fatigue as well as personal factors must also be considered. Similarly motorcyclists, bicyclists and pedestrians are faced with a range of interface issues regarding their behaviour in traversing the road transport system.

2. **Vehicles and Road interfaces.** This relates to the opportunity available in the road transport system for collisions of all sorts. Interface design for vehicle crashworthiness includes vehicle-to-vehicle crashes as well as compatibility with heavy vehicles and road infrastructure, level- crossings and so on. An example of a typically effective road-vehicle-driver interface design is the roundabout. This provides an effective interface for vehicles changing direction at an intersection, as it reduces both crash risk and injury risk due to the intersection design and reducing driver vehicle speeds (in the form of reduced conflicts, simplified driver decision making, reduced crash speeds). Another example is heavy vehicle design where energy-absorbing underrun barriers are fitted which provide an improved geometric and stiffness interface in crashes with other vehicles or other road users.

3. **Human-impact interface.** Injury prevention in a crash is a function of the interface between the human and whatever is impacted or restrains the human during an impact. In this sense, we need to differentiate the macro (vehicle) level impact interface from the micro (human – object contact or restraint) level interface where injury actually arises. For example, at the macro level we are concerned with maintenance of vehicle structure and occupant compartment integrity as key criteria, such that the human-vehicle-outside environment interface is kept viable. At the micro level, safety systems such as airbags typically provide an interface between a person's head and vehicle internal (e.g. front airbag and steering wheel) or external (e.g. side airbag and pole) structure. Airbags provide both very good load distribution and good deceleration or 'crush' characteristics. On the other hand for pedestrians, the micro level can be important such as head impact with a steel bull bar fitted to the front of a truck or car, with such structures representing an incompatible interface.

The following sections present a series of examples to illustrate the application of the Interface Design method to various areas of road safety. The consideration of the practicality or otherwise of the various interface design examples presented is not the focus of this paper, and hopefully will not distract the reader from appreciating the method and wide range of utility. We trust that this paper will motivate a strong interest in the use of the Interface Design approach in road safety (and indeed in other areas).

Level Crossing Crashes

Crashes at level crossings provide a good illustration for application of the Interface Design method, as interface issues range from driver behaviour, human factors, road and rail track design and train-vehicle interfaces.

Clearly, the most effective interface between trains and other road users is to have no interface at all – i.e. complete separation, by underpass or overpass. In the absence of complete separation, we are left with dealing with level crossings. One approach relates to crash severity reduction by altering the interface between the impacting objects. We argue that even the most extreme crash scenarios can be ameliorated by applying the appropriate interface [7, 8, 9].

An extreme example used to demonstrate these principles is the case of an unprotected pedestrian standing on a railway track in the path of a train travelling at 100km/h [Figure 1]. Simply put, if the so called 'mass effect' had any significance, it should be in this scenario. In this case the use of a large airbag (the interface) fitted to the front of the train could, in principle, render survivable this seemingly unsurvivable impact [8, 9].

In reality, such an outcome for this train example should not be surprising. It clearly follows the laws of physics and use of frames of reference. In the above example, by changing the frame of reference to the train instead, the train would appear 'stationary' and the 'pedestrian' would be moving at 100km/h, running into the front of the train. The issue of injury prevention can then be seen more clearly as one of putting something 'soft' (energy absorbing) on the front of the train to decelerate the impacting person. Changing the frame of reference clearly shows that in such crash scenarios involving objects of vastly different masses, the energy that must be managed is not that of the heavy vehicle, but the energy imparted to the lighter vehicle, which is a much easier problem to deal with.

Hence, if a pedestrian was struck by a train travelling at 100km/h, which had a large airbag fitted to its front (resulting in 4m crush of the airbag, and an average 10g acceleration on the pedestrian), the impact would be quite survivable with the pedestrian likely to be uninjured!

Similarly, considering a car-train crash at a level crossing [Figure 2], for example, by adding an appropriate interface, such as an airbag on the train between the impacting vehicles, a train impact speed of 80km/h train, for an average 10g acceleration level, requires air bag 'crush' (displacement) of 2.5 metres [9, 10].

The vital factor to note from these calculations and previously cited research is that it is not the mass difference that is important but the interface between the impacting vehicles that determines the injury risk. We are not trying to stop the train but rather we are trying to accelerate the car (or pedestrian) up to the speed of the train! This is an entirely more practical and solvable task.

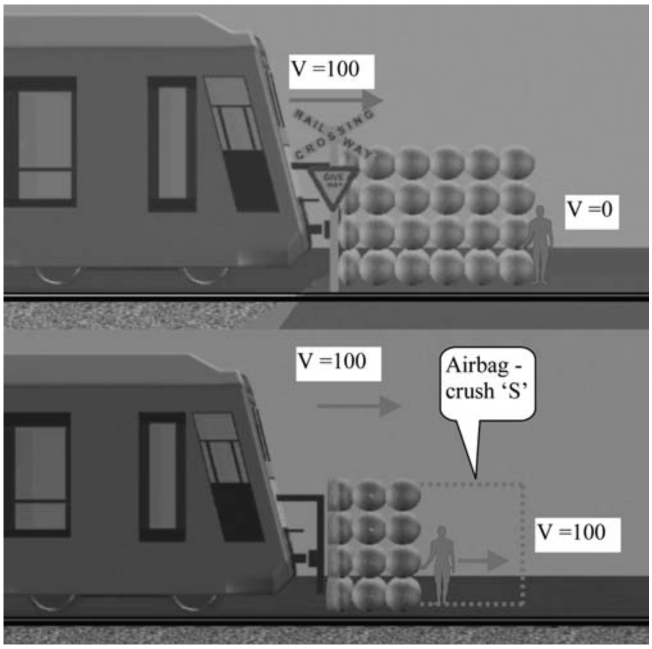

Figure 1. Upper view, at point of impact between pedestrian and train with front airbag deployed. After initial impact, airbag has compressed distance 'S', and accelerated the pedestrian up to the speed of the train [100km/h]

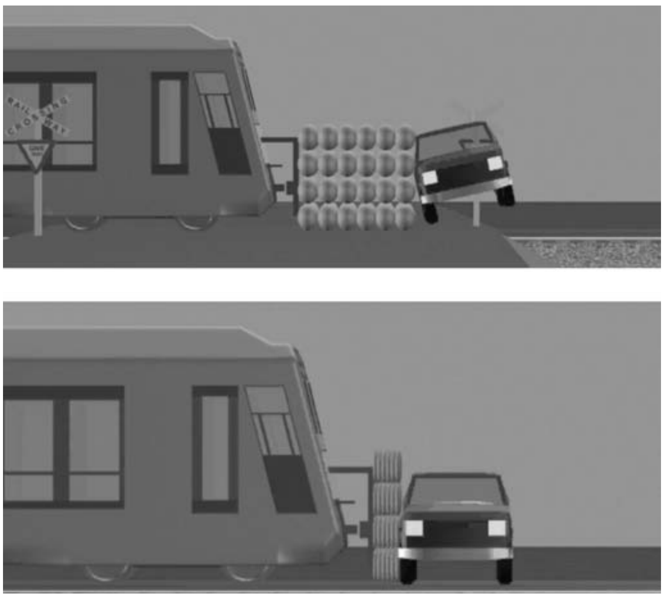

Figure 2: Illustration of improved collision interface compatibility at a level crossing between a vehicle and train with front airbag deployed

Intersection and Visibility Interfaces at Level Crossings

The fatal collision of a fast train and semi trailer carrying a large 'granite boulder' and heavy cast forging at the Trawalla level crossing demonstrated a number of major interface failings. These include:

- Visual interface failure: the crossing geometry - the roadway and track intersected at an angle; the driver's view out of the cab of the prime-mover was severely restricted by the cabin design [large B pillar]; landscape and pole obstructions.
- Poor crossing design providing no visual or other aides to the driver to identify when and where a train was approaching the crossing.
- Train and truck speed interface incompatibility: the high speed of the train coupled with the long duration required for the semi-trailer to clear the crossing, and thus the distance the train was away from the crossing when it need to be first sighted by the driver;
- Impact incompatibility with a high-speed train impacting heavily loaded semi trailer.

This example also illustrates the vital necessity to deal with interface design at both the macro and micro level. The macro level could be considered as the overall interface design between a high speed train and an uncontrolled intersection. At a micro level, unless the Interface Design of the visual environment is properly considered from the truck driver's viewpoint (i.e. by literally sitting in his seat at the crossing, in a prime-mover), the macro level solution will be negated).

The following photographs [Figure 3, Figure 4 & Figure 5] illustrate some of the above interface issues at the level crossing and the Trawalla collision.

Crashes between Cars and Heavy Vehicles

Other interface examples involve underrun crashes with heavy vehicles [8, 11, 12]. Here we see the most adverse interfaces, both with geometric and stiffness incompatibility.

Figure 3: View of the Trawalla level crossing showing a prime mover stopped at the crossing (part of the DVE incident investigation and reconstruction). Note the acute angle of the crossing to the roadway.

An appropriate interface includes the fitment of energy absorbing underrun barriers to the front side and rear of trucks [Figure 6 & Figure 7]

Figure 4: Trawalla level crossing - reconstruction showing a similar semi-trailer and the load involved in the level crossing crash. Note the extreme collision interface incompatibility between the front of the high speed train and the trailer and large 'rock' impacted.

Figure 5: Trawalla level crossing - reconstruction showing the view from the driver's seat and the severely restricted length of track able to be seen. This is an example of very poor visual interface design at the crossing, arising from the level crossing design and the prime-mover cabin design.

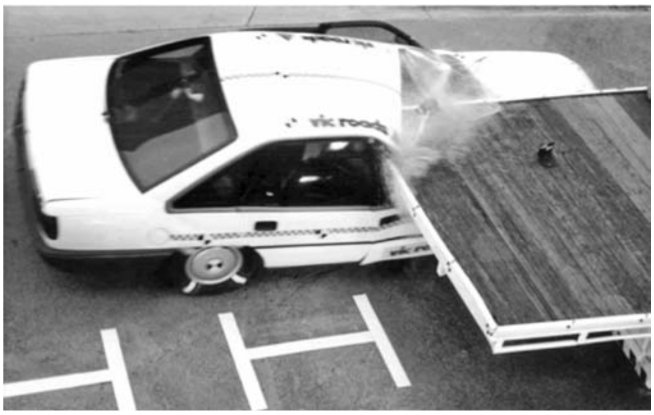

Figure 6: Rear underrun crash test of commodore sedan at 50km/h into rear of tray truck without an underrun barrier)

Figure 7 Detail showing interface height of front of Corolla and the underrun barrier.

The importance of such interface analysis and countermeasure development, including the vital role of testing and evaluation as illustrated in these examples, is that it helps ensure clarity of understanding in terms of crash and injury causation and countermeasure development. For too long in the authors' experience, there have been many examples of clouded and confused thinking both as regards causal factors and the range of options for countermeasure development. Let us be clear on these factors, and then, with clarity, debate what measures can be taken.

Vehicle Rollover

The following examples illustrate a solution to the problem of vehicle roof crush arising in rollover crashes and increasing the injury risk to vehicle occupants. The "SWAN" Rollover Protection Structure (ROPS) design was developed for BHP-Billiton and other resource companies to provide a structural system to prevent or minimise structural deformation or collapse of the vehicle roof and cabin structure, and reduce injury risk to the driver and other occupants [13]. It is an external structure which provides both a geometric and structural [strength] interface with the road surface that shields the cabin from direct loading in a rollover [Figure 8, Figure 9 & Figure 10].

Figure 8: (Above and Below left)The 'SWAN" ROPS fitted to utility type vehicles to provide occupant compartment protection a rollover

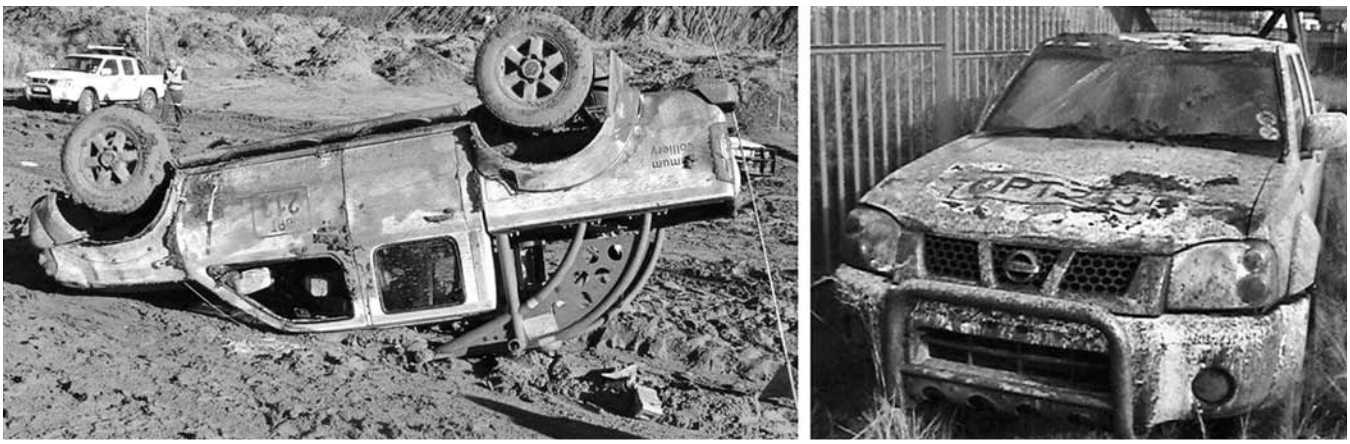

Figure 9: (Above Middle & Bottom) Third rollover of a vehicle equipped with Swan ROPS resulting in maintenance of occupant survival space and only minor injuries.

Figure 10: Side-by-side comparison of testing conducted at 60km/h on OEM vehicle with ROPS (left) and without ROPS (right)

Pedestrian Involved Crashes

The authors have investigated many vehicle-pedestrian impacts, both in city and suburban areas, and some other interstate regions, around Australia. The issue of pedestrian safety involves numerous interfaces, from behavioural, road design, traffic flow, and vehicle design. We will focus on a few areas out of many [14].

Vehicle-Pedestrian Impact Interface

In a well-publicised pedestrian incident, Richmond AFL footballer Graham Polak was struck on the head and seriously injured by a tram on the night of 28 June 2008. This unfortunate incident once again reminds us how little is done (yet how much could be done) with the interface design of the front of our trams and buses to reduce severe and fatal injury risk to pedestrians.

Trams, trains and buses have stiff, hard front structures which can and do inflict serious head and other injuries even at low speeds [15]. Energy absorbing surfaces, i.e. Interface Design, could be practically added to the front of trams and buses to makes these structures "crashworthy" for pedestrians [Figure 11] but for some unknown reason this is not happening. Such recommendations were made in a Monash University Accident Research Centre Report for VicRoads in 1993 [11]. Public transport authorities need to apply attention to the opportunities to implement known, practical safety solutions to reduce the horrible consequences of brain injury.

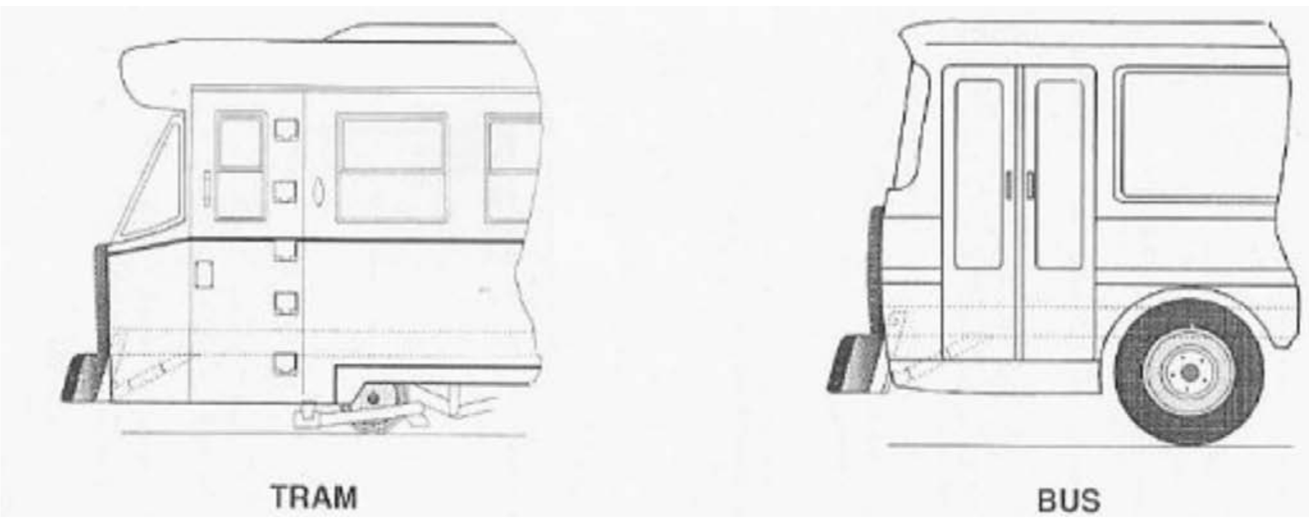

Figure 11: Figure showing the addition of simple but effective energy absorbing structures added to the front of a tram and a bus to reduce pedestrian severe injury risk [10]

Other well-known examples of hazardous interfaces for pedestrians include steel bull bars on the front of cars and trucks [Figure 12]

Figure 12: View of a vehicle that impacted a pedestrian [fatality]. Note stiff bull bar structure

Other examples of increasingly hazardous interfaces arise between bicycles and pedestrians on shared pathways. A MADYMO model [16] of a serious injury collision between a pedestrian and bicyclist on a shared pathway in Sydney is shown below [Figure 13].

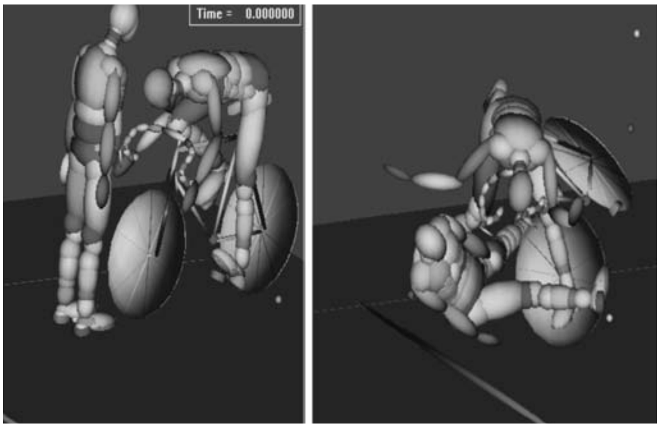

Figure 13: MADYMO computer model of cyclist-pedestrian impact [see Short et al, 2006]

With the increasing push for more cycling, much attention needs to be paid to the interface design for bicyclists, pedestrians, and vehicles. Even now ideas such as so-called ‘shared pathways’ are gaining increased attention in our transport plans. From an Interface Design viewpoint, the concept of “shared pathways” is fraught with high injury risk potential. In road safety we must always be vigilant against being blinded by politically correct sounding words such as “shared”, which can shield such schemes from deserved critical safety scrutiny. In terms of attempting a “quantum leap” for improved pedestrian safety, the 2004 MUARC study [17] attempts to systematically integrate all the factors which relate to pedestrian injury risk and prevention. This is based on the Vision Zero paradigm for road safety.

Figure 14 is a diagram from the 2004 MUARC report in which a vehicle’s kinetic energy is the injury risk source, and in a systematic way considers how the pedestrian can be protected both from crash risk and injury risk.

Of particular interest in this paper is that such a fundamental analysis of pedestrian collisions and injury risk can be used to

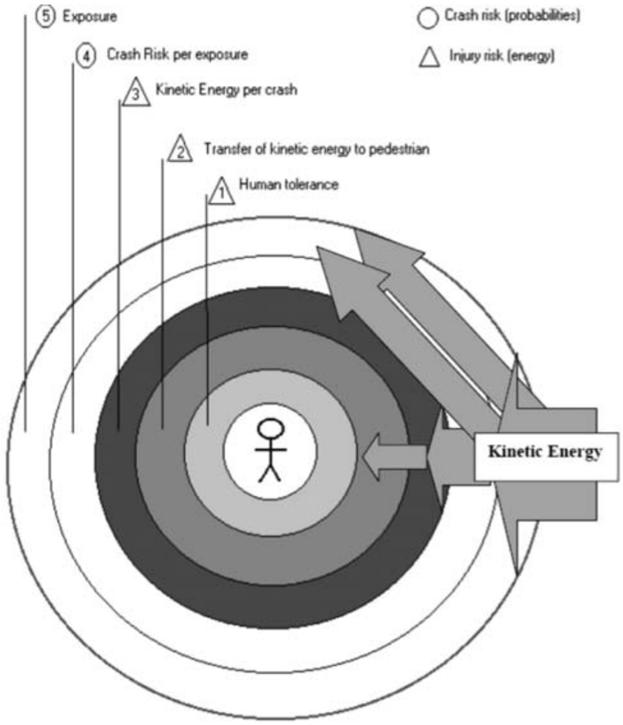

Figure 14: Conceptual model for fundamental analysis of pedestrian injury risk considering “Kinetic Energy and the five layers of protection’ using the MUARC developed “Visionary Research Model’ [17]

identify and consider appropriate Interface Design options at each stage. For example, “Exposure” can involve removing the interface (overpasses, tunnels, reduced travel needs etc.); in “Human Tolerance” the interface may include design modification to the vehicle front, or reduced speed, or other measures.

Motorcycle Safety – Impacts with Guard Rails

Current roadside guardrail systems, such as W-beams, wire ropes, provide a hazardous interface between a motorcyclist and the barrier. These interfaces may have been designed and tested to cater for occupants encapsulated in a vehicle body, but they are not designed to safely interface with unprotected or vulnerable road users.

Current W-beam assemblies typically consist of thin metal sheeting with a “W” shaped cross section that is mounted to metal or wooden posts (see Figure 15). The risk associated with motorcycle impacts to W-beam barriers lies in the presence of the exposed posts and sharp metal edges. The exposed posts concentrate the impact forces on the rider and can easily trap body parts instead of allowing the smooth metal sheeting to ride-down the impact over a distance as would occur with an automobile. Further, sharp edges or connected roadway signs, e.g. chevrons, can sever human body parts. Protruding bolts, reflectors and other projecting components can cause further exacerbated injury. The metal sheeting has relatively (for a motorcyclist) little elastic deformation and thus does not provide a soft or padded [energy absorbing] impact for a motorcyclist.

Current wire rope barriers, although they can vary in design, are typically comprised of three or four lengths of woven wire “rope” which are fed though grounded posts and are anchored into the ground at the ends (see Figure 16). Similar to W-beam barriers, the risk associated with motorcycle impacts to wire rope barriers lies in the presence of the exposed posts and relative sharp edges along with a potential risk of a “cheese grater” type scenario. The exposed posts and highly tensioned cables concentrate the impact forces on the rider and can easily trap body parts instead of allowing them to ride-down the impact via a “catching” mechanism as would occur with an automobile (see Figure 16).

The ideal interface design [Figure 17] for a motorcyclist and barrier includes:

- A smooth interface for an impacting rider which allows maximum deflection to increase crash pulse durations [and hence reduced crash severity].
- High level of deformation crush distance to further reduce the risk of severe head and chest injury;
- Totally shields the rider from interface with the steel sections of the guardrail.

Figure 15: Example of typical W-beam guardrail (manufactured by Armco)

Figure 16: Motorcycle interaction with a typical wire rope barrier. Other interactions involve the motorcyclist sliding or vaulting into the barrier

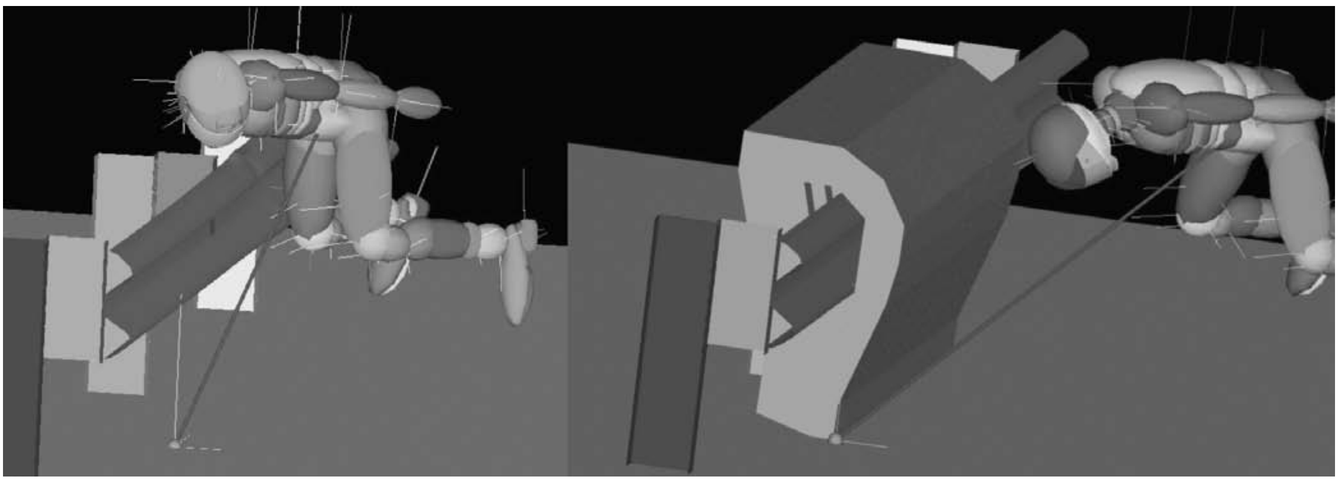

Figure 17: Computer model of a displaced rider impacting a ‘W’ beam guardrail segment [very hazardous interface], and one fitted with a well design energy absorbing system [low injury risk impact interface].

Bus Rollover Crashes

The final example of interface design relates to bus rollover crashes. The bus structure in rollovers typically adequately caters for compliance with the requirements of ADR59, and occupant restraint by the use of 3-point seatbelts. However a glaring Interface Design deficiency resulting in serious injury and death is the lack of security side glazing, permitting partial ejection of occupants with consequent catastrophic injuries (crushing, amputations, etc.). As stated in [18], a needed improvement for bus [and truck safety] is the retention of windscreen and other glazing:

The majority of large trucks and buses have windscreens and side glass that pops out or shatters upon impact in a rollover collision. The result is a large, wide-open portal from which occupants can easily be ejected. If the windscreen and other glazing is retained by being plastic or laminated, ejections will be reduced.

We strongly recommend that the requirements for bus side-glazing design are modified by the inclusion of an internal plastic laminate or any other effective method. This is to ensure that the interface between the occupant and bus sliding on its side after a rollover remains the inside of the bus and not the highly hazardous road surface due to failure of the occupant containment barrier.

Conclusions

The authors in this paper argue that further significant advances in road safety will arise from the understanding and purposeful incorporation of Interface Design in road safety programs. In Interface Design, we explicitly recognise that failures in our road safety system occur because of breakdowns in system safety at various interfaces. By paying due attention to interface design we open up our thinking to an increased range of countermeasures possibilities, and provide opportunities for improving road safety and reducing risk.

By the proper consideration of the interfaces at all levels of our road transport system from behavioural, road design and vehicle design, significant safety benefits can be achieved. This is true whether the interfaces are considered on a macro level, as with the example of level crossing design and impacts, or on a micro level as is given in the paper with the example of head impact with a stiff object. Importantly however, Interface Design must be considered at all levels to ensure that overall system safety is achieved.

References

1. Tingvall, C., The Swedish 'Vision Zero' and how Parliamentary approval was obtained'. Paper presented to Road Safety Research – Policing- Education Conference. 1-17 November, 1998, Wellington, New Zealand.
2. Grzebieta R. & Rechnitzer G., Vision Zero – The Need for Crashworthy Systems, Proceedings 24th Australasian Transport Research Forum "Zero Road Toll - A dream or a realistic Vision; Hobart, Tasmania, 17-20 April 2001.
3. Safe Systems Approach, see Victoria's Arrive Alive: http://www.arrivealive.vic.gov.au/about/towards_a_safe_system/towards_a_safe_system.html
4. Rechnitzer G, & Grzebieta R. Crashworthy Systems: A paradigm shift in road safety design, Transport Engineering in Australia, V5 No.2, 1999.pp74-82.
5. Grzebieta R.H. & Rechnitzer G., Crashworthy Systems – a paradigm shift in road design (part II), Transport Engineering in Australia, V7, Nos 1&2, 2001, Institution of Engineers Australia.
6. Tingvall C, Krafft M, Kullgren A. & Lie A., The Development Of Passive Safety Of Cars – A Matter of Interfaces; Proc. 10th International Pacific Conference On Automotive Engineering (IPC-10), May 1999, Melbourne Australia.
7. Grzebieta R., Rechnitzer G., Tingvall C., Judd R. & Powell C., Vehicle compatibility - get the geometry and interfaces right first; Proceedings 1999 Road Safety Research, Policing and Education 2000 Conference, Sheraton Brisbane, Queensland, 26-28 November 2000.
8. Rechnitzer G. The Improvement Of Heavy Vehicle Design To Reduce Injury Risk In Crashes With Other Road Users, PhD Thesis, Monash University, June 2003.
9. Rechnitzer G, Applying First Principles For The Design Of Crashworthy Systems For Road Safety, Proceedings Road Safety Research, Policing and Education 2000 Conference, Sheraton Brisbane, QLD, November 26th –28th 2000.
10. Rechnitzer G., Innovative Measures to Reduce Crash Occurrence and Severe Injury Risk at Passive Railroad Crossings, Proceeding of the Seventh International Symposium On Railroad-Highway Grade Crossing Research And Safety - Getting Active At Passive Crossings, 20-21 February 2002, Monash University (Clayton), Melbourne, Australia.
11. Rechnitzer G, Truck Involved Crash Study: Fatal and injury crashes of cars and other road users with the front and side of heavy vehicles, Monash University Accident Research Centre, Melbourne, Report 35. 1993. [http://www.monash.edu.au/muarc/reports/muarc035.html]
12. Rechnitzer G., Seyer K. & Powell G., Performance Criteria, Design And Crash Testing Of Effective Rear Underride Guards, Proceedings of the 17th International Technical Conference On The Enhanced Safety Of Vehicles, Amsterdam 2001, 4-7 June 2001.
13. Richardson S, Rechnitzer G, Orton T, Shifman M & Crocker S, Development of Roll Over Protective Structures for Mining Light Vehicles, SAE World Congress and Exhibition April 2009, Detroit USA, SAE paper 2009-01-0831.
14. Rechnitzer G, Orton T, Shifman M & Richardson S, Pedestrian Safety – A Challenging Task, 2nd Local Road Safety & Traffic Engineering Conference 26-27 August 2008, Gold Coast International Hotel, Gold Coast, Queensland.

15. Grzebieta R. & Rechnitzer G., Tram Interface crashworthiness, ICrash 2000 International Crashworthiness Conference 6-8 September 2000, London.
16. Short A., Grzebieta R.H., Rechnitzer G., and Arndt N., Bicyclist with Pedestrian Impacts, Proceedings 5th Int. Crashworthiness Conf. ICRASH2006, Bolton Institute U.K., Athens, Greece, July 2006.
17. Corben B, Senserrick T, Cameron M & Rechnitzer G; Development Of The Visionary Research Model - Application To The Car/Pedestrian Conflict. Monash University Accident Research Centre Report No. 229, December 2004.
18. Anderson, J., et al., "Influence of Passengers During Coach Rollover," Cranfield Impact Centre Ltd., ESV Proceedings, Nagoya, Japan, Paper No. 216, 2003.

Making a Safer Systems Approach to Road Safety Work

"Damned if we don't" – Exciting Times, 2009 and Beyond

By Paul Hillier, ARRB Group

This article comments on two seminars on road safety held in Sydney shortly before Christmas, before putting forward for broad discussion some of the key messages from a number of recent road safety related documents and journals.

Introduction

In the lead up to Christmas I attended two events hosted by the Sydney Chapter of ACRS. The first was an insightful presentation by Jeanne Breen from the UK providing a commentary on progress with Vision Zero in Sweden, as well as road safety capability review techniques being used by the World Bank in rapidly developing and mechanising countries. A healthy and interesting debate ensued regarding some of the contemporaneous issues in Australia and how best we might overcome them.

This session was complemented a few weeks later by presentations from Dr Soames Job of RTA and Professor Raphael Grzebieta of University of NSW. Information was imparted regarding recent achievements in reducing the road toll and in securing positive road safety outcomes. The presenters provided their personal insights into the opportunities and challenges ahead in making further gains. Again, the need to keep moving forwards, through the implementation of a Safer Systems approach, came across as a common message.

This will require coordination and interaction on a multi-disciplinary and multi-agency basis - a considerable challenge of course, but the presenters hoped that major break-throughs would be made in 2009 and beyond. These are exciting times for road safety professionals, with a realistic chance to aspire to, and achieve, much more than consolidation of past gains.

The recent Towards Zero: Ambitious Road Safety Targets and the Safe System Approach, published by the OECD's International Transport Forum provides positive and practical guidance on the implementation of a Safe Systems approach and meeting ambitious, stretch targets, such that as a profession we have moved from an historical 'no win' position of often being "damned if we did something, damned if we didn't" to a position where we have requisite levels of knowledge, skills, tools and experience at hand that will rightly leave us 'damned if we don't' act together to implement Safe Systems.

Shortly ahead of completing this article, I received the inaugural issue of Vision Zero International technical journal, which provides an amazing Aladdin's cave of information regarding latest actual, and likely and possible future, developments in vehicle technology and in-vehicle safety systems. The potential of these technologies to spearhead future reductions in the road toll is obvious and vast. However, an over-reliance on the features, such that progress in other areas slowed or was curtailed, would be unfortunate and ultimately misguided. The potential for a raft of measures to co-exist and complement each other must surely be even greater.

How do you Assess an Organisation's Capability in Road Safety ?

The presentation given by Jeanne Breen, an internationally renowned Road Safety Consultant, based in the UK, provided her personal thoughts as a review team member on a high-level review of road safety management in Sweden in 2007. It was shown how an established World Bank assessment framework was used in the undertaking of the review. The main finding was that Sweden's road safety management capability and associated systems were at a highly advanced phase of development when benchmarked internationally.

However, it was also recognised that even the Swedes require a degree of institutional strengthening to support the crusade towards Vision Zero, not least the strengthening of the lead agency role, the setting of further interim targets, and further key stakeholder co-ordination and co-working to keep momentum going.