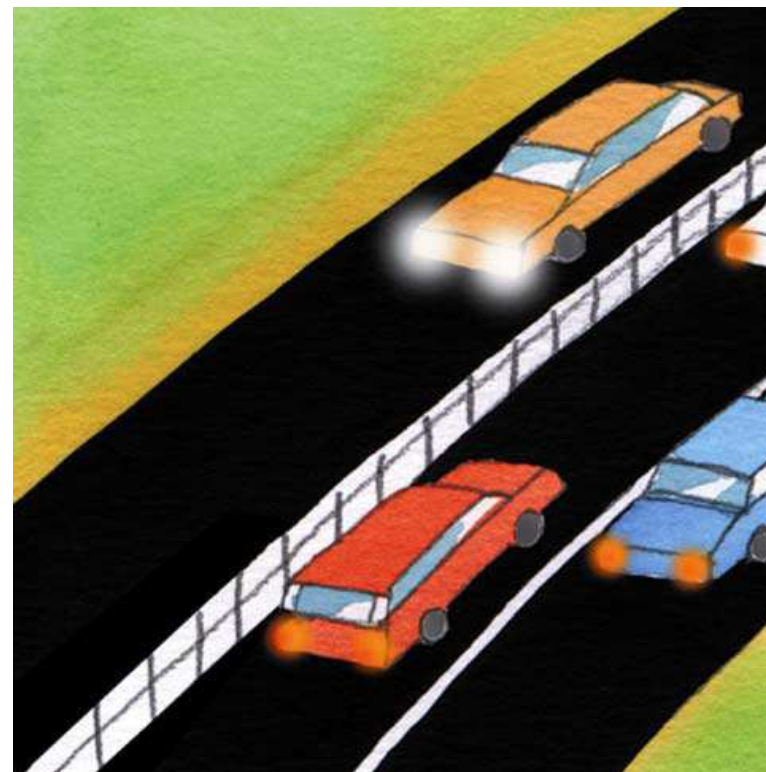


## “Rule of Science”

“The biomechanical tolerance of the human is the limiting factor for the road transport system”



CENTRE GUARD RAILS ( 13m roads )



**SAFE ROAD AREAS:**  
**Design for people leaving the road**



## Results of improved side areas

- Euro -RAP shows a 50% reduction of serious and fatal injuries for 4-star side areas than 2-star areas
- Treatment with barriers is highly cost effective



A safety policy without an infrastructure component is likely to failure!

## Australia

move towards a Safe System approach to road safety represents a significant shift in thinking about road safety. By taking a total view of the combined factors involved in road safety, the Safe System approach aims to design and build a transport system that will protect responsible road users and reduce the number of deaths and serious injuries.

The Safe System approach recognises that even with a focus on prevention, road crashes will occur – therefore, the road system must be designed to be more forgiving of human error and attempt to manage crash forces to survivable levels, while reducing the contribution of unsafe road user behaviour to road crashes.

A Safe System is one where the likelihood of a road crash is reduced, and where any crash that does occur minimises death and serious injury. The Safe System approach identifies the shared responsibility of road system and vehicle designers, providers and users in achieving this outcome. Achieving a Safe System of road travel is based on an understanding that the human body is vulnerable and unlikely to survive an uncushioned impact at a speed of more than 30km/h. Even relatively low speeds can kill or seriously injure unless the vehicle and the road and roadside environment take account of the physical vulnerability of all road users.

The Safe System approach encourages a better understanding of the interaction between the key elements of the road system: road users, vehicles, roads and roadsides, and travel speeds. Exploring these interactions maximises the potential advantage of initiatives in reducing deaths and injuries from linking different road safety activities. Under the Safe System approach, road users have a responsibility to comply with the rules to ensure that they act within the limits of the system's design.

the safe system approach includes: designing and maintaining roads and roadsides to reduce risk to as – low as reasonably practical setting speed limits according to the safety of the road and roadside – advising, educating and encouraging road users to comply with road – rules, be unimpaired and alert, and drive according to the prevailing conditions encouraging consumers to purchase safer vehicles with primary – safety features that reduce the likelihood of a crash, such as electronic stability control, and secondary safety features that reduce injury severity in a crash, such as side curtain airbags. The success of the Safe System approach is dependent on road users acting within the limits of the system's design. Hence the importance given to ensuring the community becomes more aware of the risks associated with road travel, and that people are able to make better informed decisions on issues such as vehicle choice, speed and behaviour. Additionally, through enforcement initiatives, the Safe System approach will protect the wider community from the actions of a minority of road users who repeatedly put the community at risk with anti-social behaviour.

The Safe System will deliver reductions in deaths and severity of injuries by co-ordinating the management of all the components of the transport system that impact on safety.

risk associated with run-off-road crashes can be reduced through the removal of roadside hazards and installation of safety barriers

## Muarc

It's not hard to see why this is such a pressing area of research: "The distribution of injuries in Australia – and it's similar in many high-income countries – is that road deaths are about a third of the total injury deaths," he says. "Suicide (intentional injury) is about a third, and the other third is from the home and leisure sector." It is logical, then, that road safety is the most obvious target for preventative efforts. "Road accidents involve high kinetic injury and hence there's a high fatality consequence. Sporting injuries, on the other hand, are

very numerous but less severe – they're not travelling at 100km/h.”

the interface between the road user, the vehicle and the infrastructure.

We'd like a situation where we have an unwritten contract with the driver that if they stay within the road rules – they don't drive fatigued or drunk or over the speed limit– then we could **create a system forgiving enough that if they made a mistake, they won't end up as just another KSI statistic.**  
**And yes, I think we can get to that stage.”**

# The road to Vision Zero

Safe System approach to road safety represents a significant shift in thinking about road safety

Now there is recognition that accidents and injuries result from a combination of factors, road user error being only one of many. This has led to a systems approach, recognising that **combinations of factors come together to cause accidents and injuries.**

The Safe System approach recognises that, even with the best preventive programs in place, road crashes will still occur – and aims to build a road system that offers maximum protection to all users by providing safer road infrastructure, increasing the proportion of safe vehicles on our roads and improving the safe behaviour of road users

**This approach aims to create a much safer road environment in which alert and responsible road users should not lose their lives – or be permanently disabled –**

**. The Safe System values the health and well being of road users and takes human error into account**

It is important that the collection and analysis of crash related data is continually improved to ensure the ongoing development of innovative and effective road safety countermeasures.

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Additionally, through enforcement initiatives, the Safe System approach will protect the wider community from the actions of a minority of road users who repeatedly put the community at risk with anti-social behaviour.

The likelihood of Victorians being killed or seriously injured as a result of involvement in common types of crashes can be reduced through improved road infrastructure. For example,

risk associated with run-off-road crashes can be reduced through the removal of roadside hazards and installation of safety barriers

### **safety Barriers**

Steel guardrails and wire rope safety barriers are highly effective in absorbing the impact of vehicles travelling at high speeds. In particular, **wire rope barriers can reduce fatal and serious injury crashes by up to 90 per cent.** A combination of these barriers will be installed at places where there is a high risk of cars **running off the road and hitting trees** and other roadside objects.

### **The Systems Approach**

At present, we are seeing a shift in thinking about road traffic accidents which is of fundamental importance. It has long been accepted in other activities such as industrial safety, the railways and aviation, that the operator (be he pilot, driver or skipper) is only one part of a dynamic system, with his specific limitations as to performance over time, with the effects of fatigue and alcohol, and predictable error rates. Therefore the other parts of the system, in this case the highway, the vehicle and the traffic management components, must be designed with a recognition of the limitations of road users. This is contrary to the historical view that road users through training, supervision and retribution can cope with the demands of traditional highways without causing accidents

### **2)Vehicles**

**Australasian research indicates that if each motorist upgraded their vehicle to the safest in its class, road trauma would immediately drop by up to one-third.**



John Dawson **from the** International Road Assessment Programme (iRAP) **looks back at some of the key developments that are steering us on a course to a safer roads infrastructure. Despite the obvious success, as he notes, some big challenges remain**



My new boss said to me, "When you can, have a

look at this site – the records say eight people have been killed or seriously injured in the last period." It was my first week as a young engineering graduate in the front-line office responsible for London's major roads. It was my first practical encounter with the scale of the slaughter on roads – a slaughter so routine and predictable that most safety engineers in most countries rely on a simple three-year bodycount to decide whether or not a location should be a priority for treatment.

In the past decade alone, over half a million people have been killed in Europe and 10 times that number seriously hurt. In the 21st century, the laws that govern safety on the roads are like a parallel universe frozen in time running alongside those that operate in every other field. In the roads universe, routine and predictable mass slaughter is accepted. In the parallel universe, failure to warn that a coffee is hot can lead to sanctions. In the roads universe, it is normal to blame the victim for predictable human mistakes. In the parallel universe, even remote company directors can be judged as 'the guiding hand' and sent to jail if the company framework that protects people against human errors is flawed.

**Right:** *Important measures such as drink-driving enforcement can lead to reductions in road deaths*

When I was given that first accident site to look at more than 25 years ago, leading countries were still learning that road deaths could still be cut despite continuing traffic growth. The important measures were identified, such as compulsory seatbelt wearing or drink-drive enforcement – and promoted hard. There were careful experiments into the safety of road designs and action on the outcomes. The road safety research program was well funded and supported. The Ministers who introduced the policies became well known and respected as the reducing national death toll became clear. During this period, most of the vaccines to prevent road deaths were defined – action on seatbelts, helmets, drink, speed, a points system for driving offenses, and safer road infrastructure.

**Left:** *Simple infrastructure improvements, such as wire-rope fencing, can turn previously unsafe roads into much safer roads for travelers*

### **Poor performers**

By the late 1990s, three major trends became clear. The first was that the developed countries that had been poor performers in road safety at last began to use the well-established vaccines. The political leadership in France, for example, was finally persuaded that appalling French death rates could be tackled by the basic action on enforcement and drink that

nearby countries had taken two decades earlier. Just a speech and the perception that the law would be taken more seriously led to a sharp, immediate drop in French road deaths. Similar successful action in Spain, Italy and the new EC countries followed. The first pan-European target for a 50% reduction in road deaths provided competitive pressure on nation states. Worldwide these simple targets helped country after country get organized to tackle road deaths despite the



and local government involved.

**Developing world** trend in the developing drowned the advances developed countries. in the global economy, China and India, meant growing motorization. A century after the world, this growing now led to the same rapidly rising road



number of national agencies

The second world in The growth driven by rapidly half developing prosperity pattern of deaths in

developing countries. Over 90% of road deaths are now in developing countries. The World Health Organization says the global toll is already on a par with TB and Malaria with more than a million road deaths a year.

**Left:** *Lord Robertson of Port Ellen, Chairman of the Commission for Global Road Safety, urged world leaders to make a strong commitment to tackling road deaths when ministers met at the 2009 Moscow Conference on global road safety*

Road safety programs do not get a fraction of the billions spent on health. The question is whether the world will sit and watch slaughter on an epic scale. Without use of the road safety vaccines, tens of millions will die and hundreds of millions will be crippled in the two decades ahead unless we get organized now. Thanks to statesmen such as Lord Robertson (the former NATO Secretary General) and two Nobel Peace Prize winners – Archbishop Desmond Tutu and President Oscar Arias of Costa Rica – some big voices are speaking out. The world’s Transport Ministers have just met in Russia at the Global Ministerial Conference on Road Safety to thrash out practical actions such as funding for road safety programs from development banks.

**Right:** *Specially equipped vehicles video the road network, in this case in Serbia*



### **The end of 'business as usual'**

The third major trend of the late 1990s was the rejection of 'business as usual' by the top performing nations. Road safety research has now reached the point at which we know how to stop routine, predictable death on the roads. One or two countries have reached the point where every road death is subject to an inquiry

so the lessons learned can stop that type of death happening again. We can define the principle parameters of a safe road system in which nobody is expected to die just as surely as we can define a safe railway, safe factory or safe air travel system. The challenge being tackled in the leading countries is to train, educate and work through the new laws and institutions needed. For example, a separation between those responsible for setting acceptable safety levels on the road network and those responsible for financing and operating roads.

**Left:** *After the video data is collected, raters undertake desktop inspections of road infrastructure elements by conducting a virtual drive-through of the network*

## Vision Zero

**The basic principle of the safe system is simply that the human body cannot survive a sudden uncushioned impact of more than around 40km/h (25mph). Road users, vehicle manufacturers and road authorities must act on their responsibilities to stop that from happening. As individual road users we have to take our responsibility – wear a seatbelt, be sober, obey speed limits and the rules of the road. We should expect severe sanctions if we willfully flout laws and put others at risk – but our frequent human mistakes must not result in a death sentence.**

Vehicles on the road have to be forgiving with systems to trap errors, such as intelligent seatbelt reminders and ESC, and airbags and crumple zones to protect occupants and pedestrians and cyclists when things go wrong. And the road infrastructure must not invite errors and must be as forgiving as the vehicle. In short, we need five-star drivers in five-star cars on five-star roads: to me, vision zero means finding the flight path to deliver it.

With huge amounts of money and ingenuity, **F1 motorsport has shown at the extreme how the safe system works.** When I started my working life, a third of the drivers lining up on the F1 grid would end up dead within a handful of years. Today, any death would be shocking and drivers routinely walk away from collisions at up to 300km/h (186mph). The drivers obey rules and face fierce sanctions if they break them (not least

the speed limits near pedestrians in the pit lanes): **the car and track work together as a safe system to dissipate the energies involved in long slow crashes.** On public roads, the safety challenge is to make roads safe and manage the energies at speeds of 90km/h (56mph) and below.

### **A state of mind**

Adopting Vision Zero for me means entering a state of mind in which it is unethical when we know better to offer a system in which people will routinely die or be crippled from sudden high energy crashes. The vision helps set the challenge to pull through the new designs, new institutions and new laws that are needed.

Later during my first graduate job on London's roads, I didn't offer designs for traffic signals on busy high-speed roads. I knew the result would be that every month someone would be killed or seriously injured as a result. The capacity and economic tools I was given to use said the deaths were okay, just as long as they were offset by journey time savings. These tools are still religiously used worldwide with their implicit logic that there is a rate of exchange between death and injury and the mobility we all enjoy. I worked at it and found I could create roundabout designs that achieved a better economic return.

At that time, I didn't know why well-designed roundabouts were magic – that they worked by slowing vehicles and keeping sudden uncushioned forces below 40km/h (25mph) and turning them to eliminate brutal side-impacts. I just knew that every time a roundabout was constructed the deaths and serious injuries disappeared. And there are countless similar stories from Brazil to Bordeaux of how they save lives.

**The new 'two plus one' roads developed in Sweden and quickly implemented in other countries are proving to be the safest type of road ever built.** They were crafted in Sweden from the state of mind demanded by Vision Zero asking how can we stop the unacceptable forces.

### **EuroNCAP**

One of the big achievements of the 1990s was the New Car Assessment Programme (NCAP). In the early **1990s, the research laboratories showed that there was a new magic bullet to fire. If the standards of car crash performance could be substantially raised, thousands of European deaths could be saved every year.** The problem was that legislation took so long and – even then – the political compromises were bound to lead to a 'lowest common denominator' safety standard far lower than could be achieved. New regulations would quickly become a fossil restricting continuous improvement. A consumer-led program, however, would allow cars to be bought from the showroom, crash-tested, and the results published in the form of star ratings. It would take months instead of decades to create this new market in safety.



**Right:** Euro NCAP provides motoring consumers – both drivers and the automotive

*industry – with a realistic and independent assessment of the safety performance of some of the most popular cars sold in Europe*

Today, no manufacturer wants to offer less than a four-star car and five stars is common. Manufacturers advertise their NCAP achievements. NCAP transformed the safety of vehicles and released the ingenuity of vehicle engineers.

### **EuroRAP and the roads**

Lessons were learned in the battle to get NCAP accepted on how unnecessary confrontation could be avoided. When the European Road Assessment Programme (EuroRAP) was established nearly seven years ago, progressive road authorities were invited to become members to assure good technical advice.

**Left:** *iRAP Star Ratings are based on road inspection data and provide a simple and objective measure of the level of safety which is 'built-in' to the road for car occupants, motorcyclists, bicyclists and pedestrians*

The result is that EuroRAP has rapidly grown to be active in 30 European countries and iRAP has been established and is rolling RAP out quickly across North America, Asia, Australasia, Latin America and Africa. Partnerships have been put in place with international institutions such as the European Commission and World Bank, as well as with top performing national governments in both developed and developing countries. With 2-5% of GDP being lost to road crashes, the case for large programs to upgrade the safety of networks with affordable programs of high-return safety schemes is being made. Some are now entering national investment programs. The early results show that even the first modest programs can reduce national death rates quickly by around 10-20%, year in year out. Countries such as Ireland have already demonstrated what can be done.

Until EuroRAP, roads were assumed to be safe if they were built to the proprietary national standards of the time, but this model now longer works. The death rate on the worst roads in a country is typically way over ten times that of the best. Now the safety of a road can be measured to a set of consistent international protocols. The rate at which unsafe roads are being eliminated can be tracked year by year. **Main trade routes**



with less than four-star safety rating will become as unacceptable as new cars with less than four-star safety rating. Busy high-risk roads anywhere on the network become a priority for treatment.

Most routine and predictable deaths take place on busy one- or two-star single-carriageway roads full of design flaws and missing safety features. Realistically, most of these roads will never be rebuilt – but their safety can be upgraded. The early target of RAP programs is the dysfunctional roads on which deaths are concentrated – main regional routes in developed countries and main national roads in low- and middle-income countries. Unbelievably, the measures that RAP is identifying are not only affordable but have some of the highest economic paybacks in the economy – crippling a young breadwinner means providing care for a lifetime at huge cost while affordable curbing, safe crossings, safety fencing and roundabouts save lives for decades. Often just road paint can save lives.

**Right:** *Since 2000, more than 1,000km of road in Sweden have been converted from wide ordinary road into 2+1-road, all with barriers*

The problem I was given decades ago in the London office turned out to be a simple blackspot problem. One look at the site and even a raw graduate could see that the pedestrian crossing was so badly laid that pedestrians thought they were safe and drivers couldn't tell there was a crossing at all. **Today's challenge is not to treat just the tip of the iceberg. If we wait for people to die in clusters at blackspots before we eliminate the risks, then we institutionalize mass slaughter for another century.** Vision Zero frees us and shows how to tackle one of humanities' greatest challenges.