Road Safety Factsheet

July 2018

Safe System Factsheet

In 2016, 1,792 people were killed and 24,101 people were seriously injured in reported road accidents in Great Britain[1].

Around 90% of road crashes involve some element of human error. Although educating road users can reduce the number of road crashes that occur, human error cannot be eradicated. Therefore, road users will still sometimes make mistakes that can lead to collisions. One way in which the number of road users killed or seriously injured can be reduced is by adopting a Safe System approach, so that crashes are less likely and when they do occur, it is less likely that the road users involved will be killed or seriously injured.

Traditional road safety approach[2]

Traditionally in road safety, during the 1950s and 1960s, there was an assumption that the primary goal of road safety was to correct human behaviour, rather than acknowledge that the causes of crashes are related to the inherent risks of using the existing road infrastructure. At this time, the analysis of road crashes involved attempting to understand all of the factors involved in a collision in order to suggest ways in which it could have been prevented.

In the 1970s, there were on average 7,000 people killed on Britain's roads every year. However, by 2010, this figure had fallen to under 2,000, despite the increase in the number of vehicles on the road. This has largely been attributed to improvements in vehicle and road design, alongside the education, training and publicity initiatives at both national and local level. Specific interventions such as compulsory seatbelts for all drivers and passengers in cars have greatly improved occupant safety.

Despite this, since 2010, the number of people being killed on the roads each year has remained consistently around 1,900 to 1,700. Many of these fatalities are pedestrians, cyclists and motorcyclists.

In 1997, the Swedish parliament approved Vision Zero, based on an underlying principle that "it can never be ethically acceptable that people are killed or seriously injured when moving within the road transport system". This vision was a forerunner of the Safe Systems approach.

The Safe System approach

Safe System is the generic term for approaches such as 'Vision Zero', 'Sustainable Safety' and 'Towards Zero'. It is based primarily on Vision Zero, recognising that human beings' lives and health should never be compromised by their need to travel. Vision Zero states that any fatal or serious injuries that occur within the road system are unacceptable[2]. This is considered best practice in road safety according to the World Health Organisation (WHO)[3] and the Organisation of Economic Cooperation and Development (OECD)[2].

Unlike the traditional approach to road safety, the Safe System approach recognises that human error is no longer the primary cause of accidents. Rather, a failure of the road system is the cause of many collisions that result in death or serious injury[4]. It also shapes interventions to meet the long-term goal of zero deaths and serious injuries, rather than relying on traditional interventions to set the limits of any long-term targets[5].

The key objective for those managing the roads is that, as road users will continue to make mistakes, when crashes do occur, high severity outcomes such as serious injuries and death do not. Therefore, roads need to be equipped with a 'forgiving' infrastructure, taking into account the vulnerability of human beings[6].

By recognising that road deaths and injuries are not an inevitable part of using the roads, and seeing them as an unacceptable system failure, it counters the risk that transport planners might adopt measures of transport efficiency that tolerate fatalities that are affordably preventable[2].

Road crashes costs usually represent around 1-3% of a country's gross domestic product (GDP), depending on the approach used. The Safe System approach can produce economic savings for a society, as the costs of the prevention of accidents are usually substantially less than the cost of collisions occurring. Therefore, attention must be given to making roads and roadsides, vehicles and speeds more forgiving, as well as continuing to work towards achieving greater levels of road user compliance[6].

Principles of the Safe System approach

The Safe System is based on a number of principles [2, 6]:

- **People make mistakes that lead to road crashes.**
  The Safe System recognises that road users are human beings who will inevitably sometimes make mistakes that can lead to a collision. Human error is human nature and is to be expected. This is because human beings cannot be relied upon to repeatedly perform correctly in all traffic conditions at all times, even if they intend to behave safely on the roads. There are many reasons why road users commit errors and misjudgements. In many cases, these errors originate from interaction between the road user and the complex physical, social and technical environment. Therefore, those designing the roads need to understand these complex interactions and design the road in a way that guides the road user to behave as safely as possible. However, the capabilities and limitations of human beings must also be taken into consideration, meaning the road infrastructure must be designed in a way that is forgiving of mistakes.

- **The human body has a limited physical ability to tolerate crash forces before harm occurs.**
  The human body can only withstand a certain level of kinetic energy before a crash will result in death or serious injury. There is a strong relationship between speed and the energy released when an object suddenly stops the movement. Injuries can be avoided, or reduced, by lowering the speed before impact and softening the composition of the obstacle. For example, a pedestrian hit by a vehicle travelling at 20mph has a 1.5% fatality risk, versus an 8% fatality risk when hit at 30mph[7].

- **Road Safety and the reduction of crashes resulting in death or serious injury is a shared responsibility for those who design, build, manage and use roads and vehicles and those who provide post-crash care.**
 Both those who manage the roads and those who use the roads should take up a role in eradicating serious injuries and deaths. It involves policy makers, planners, engineers, vehicle manufacturers, fleet managers, enforcement officers, health agencies and the media. While it is the individual responsibility of every road user to abide by safety related laws and regulations, which can be encouraged by education and enforcement interventions, human beings will make mistakes. In a Safe System, human behaviour is informed and guided by the design, layout and operation of the road network. Road designs that provide feedback to road users or that are self-explaining can help to create an environment that promotes safe road use. In a system where human mistakes are accounted for, a large share of responsibility shifts from the individual to the automotive industry, police, health services, politicians and road safety bodies. All bear joint responsibility for providing a road environment that anticipates potential mistakes and deals with them to avoid serious injury or death.

- **All parts of the system must be strengthened in combination to multiply their effects, so that if one part of the system fails, all road users are still protected.**
  If one part of the system fails, serious injury or even death could occur. In isolation, one error may not lead to dramatic consequences, but it becomes a danger when it becomes a 'chain of events' leading to a collision, where a number of parts of the system fail. To counter this, the Safe System strengthens all of the dimensions of the road system so that the combination of measures cover for each other. If one part of the system fails, road users are protected as the system is 'layered'. For greater effect, the layers of the system should be managed as a whole rather than as separate parts, and should be considered together, rather than one at a time. This is a key difference from the traditional road safety approach in which responses are managed by different agencies.

Pillars of the Safe System approach [2, 6]

According to the Safe System approach, crashes resulting from failures in the road system can be addressed through improvements to the road system. These improvements can include management of infrastructure, improved vehicle design and reduced speeds. There are five essential elements of the Safe System approach, which reflect a holistic view of road safety, as the diagram below shows[8]:
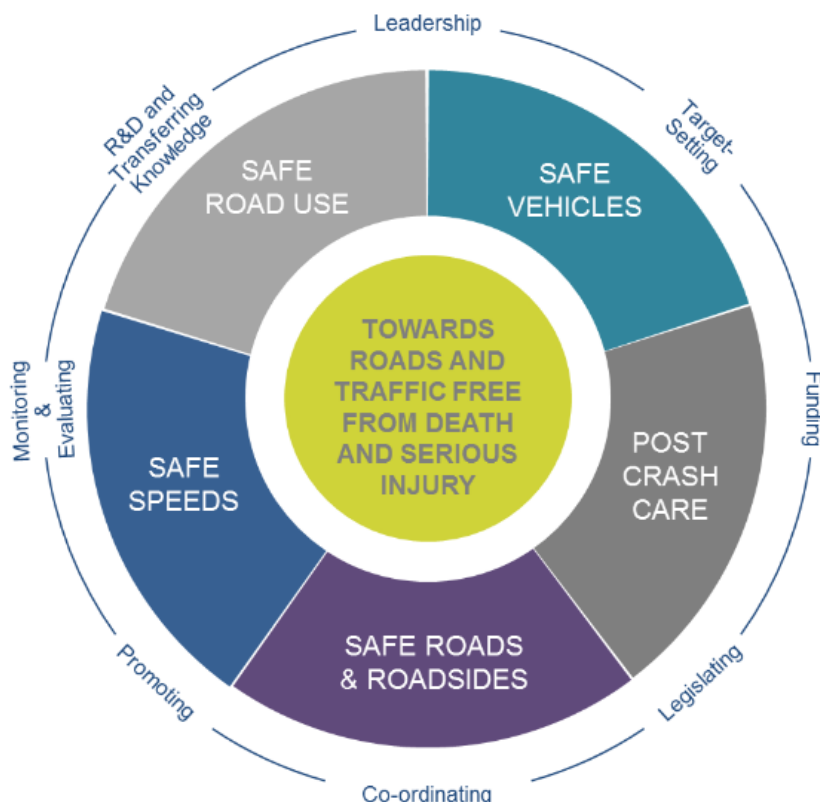
- **Safe roads and roadsides**
  In a Safe System, roads are designed to reduce the risk of crashes occurring and the severity of injury, should a collision occur. One way in which this can be achieved is to segregate different kinds of road users and to segregate traffic moving in different directions or at a different speed. If this is not possible, a speed limit to protect the most vulnerable road users can be implemented.

- **Safe Speeds**
  Speed limits in a Safe System are based on aiding crash avoidance and reducing the speed at which impacts occur, to ensure that the body's limit for physical trauma is not reached. The Safe System aims to establish appropriate speed limits according to the features of the road, the function it serves and the physical tolerance of road users present. The setting of speed limits should also be determined by the protective quality of the road sections and vehicles in use rather than the behaviour of road users. The Safe System also works to enforce existing speed limits and to educate road users to ensure that they comply with speed limits.

- **Safe vehicles**
  Vehicles are designed and regulated to minimise the occurrence and consequences of collisions. Making vehicles safer can involve installing 'active' safety measures, which can prevent collisions occurring, such as autonomous emergency braking or 'passive' safety measures, which protect occupants if a collision does occur, such as seatbelts and airbags. It is also vital to ensure that vehicles are roadworthy, that is, regulated to the highest standards.

  Increasingly, roads and vehicles will be managed within an intelligent transport system relying on ever more autonomous vehicles and smart infrastructure. As safety becomes hardwired into vehicle technology and road design, there is potential to further reduce road casualties and deaths.

- **Safe road use**
  As Safe Systems involve both those who manage and design the roads and those who use them to be responsible for eradicating serious injuries and fatalities on the roads, all road users are expected to use the roads safely and comply with the rules. Safe road users are competent at the basics of safe road use, including paying full attention to the road, adapting to the conditions of the road, travelling at lower speeds, not drinking alcohol or taking drugs and driving, not driving when tired and not close following the vehicle in front, nor using a hand held mobile phone.

  Measures to encourage safe road use could include working together to reduce traffic, by inspiring people to use active modes of transport such as walking and cycling or use public transport rather than their own vehicle. Education interventions are also important, to ensure that road users are risk aware and act appropriately to keep themselves safe on the road. Technology within vehicles, such as feedback from the speedometer and seatbelt reminders can also educate road users about safe road use[9].

- **Post-crash response**
  The Department for Transport state that it is vital to work with the emergency services and the National Health Service (NHS) to ensure that road collisions are effectively responded to and investigated. Health outcomes for victims of collisions rely on the ability of the emergency medical care system to quickly locate and provide emergency first responder care to stabilise the victim and transport them to hospital for the appropriate care and treatment[10].

However, it must be noted that there is a limit to the extent that infrastructure and vehicle design can accommodate crashes resulting from extreme road user behaviour, such as excessive speeding and drink driving. Therefore, other countermeasures will be essential to influence road user behaviour[11].

Safe System approach in practice

There are a number of countries, regions and organisations who have already adopted some or all of the principles of the Safe System. Some examples include Sweden and 'Vision Zero' and Transport for London's road safety strategy.

Sweden [6]

Sweden launched Vision Zero in 1994, based on strategy already in use in the air and rail transport industries, drawing upon the principles of the Safe System approach. It became law in 1997, as part of the Road Safety Traffic Bill, setting the target of no deaths or serious injuries on Sweden's roads. This is based on the principle that if a human makes an error on the roads, the road system should not fail.

The Swedish Transport Administration has a highly developed approach to treating both its urban and rural road networks. Their approach involves a combination of infrastructure and speed limit setting that recognises the performance limits of humans and vehicle fleets. Sweden's strategy for addressing rural road safety involves raising the quality of infrastructure along major rural corridors and routes to Vision Zero standards by investing where speed limits exceed 80km/h and no physical separation exists between vehicles travelling in the opposite direction. Therefore, continuous mid and side barriers are being provided, rather than relying on painted lines. A similar approach is used for urban and semi-urban roads. For high speed roads, such as 90/100km/h motorways, continuous mid and side barriers have been added and hazard free 'clear zones' near intersections. Complete segregation for vulnerable road users is also being implemented in 60km/h zones to meet Vision Zero principles.

One study examined the circumstances of 215 fatal crashes, in which 284 people were killed, in Sweden in 2004. In 63% of these crashes, it was judged that the road or vehicle did not meet the safety standards that would have existed if the Safe System approach has been fully implemented. The Safe System could, therefore, have prevented these fatalities, even without addressing road user behaviour[12].

London[13]

Some organisations are also introducing the principles of the Safe System in their strategies. Transport for London's (TfL) 'Safe Streets for London' plan is based on the pillars of the Safe Systems approach. It seeks to encourage a common approach to road safety among the organisations involved in the management of the road transport system in London. As this vision will take time to achieve, a target has been set to receive a 40% reduction in killed or seriously injured casualties by 2020, from a baseline of the 2005-9 average.

In June 2017, Mayor of London, Sadiq Khan, stated that "minimising road danger is fundamental to the creation of streets where everyone feels safe walking, cycling and using public transport. All deaths and serious injuries from road collisions are to be eliminated by 2041."

Therefore, London will focus on developing safe roads, safe vehicles and safe road use in a number of ways:

- **Safe roads**- London will aim for roads that are safe and feel safe, as this is vital to encouraging active travel. This will be achieved by identifying and treating high-risk locations on the road network with effective engineering solutions and applying technology and engineering measures to maximise compliance with the speed limit.

- **Safe vehicles**- London aims to have vehicles that are safe for both their occupants and other road users, meaning that changes could be required to designs, regulation and the use of vehicles. This will be achieved by lobbying for improvements to vehicle technology and improving the offering of the Fleet Operators Recognition Scheme to increase its uptake. Transport for London has policies in place within its tendering procedures which restrict unsuitable lorries from using the city's streets and plans to adopt a 'direct vision standard' for lorry cabs to improve pedestrian and cyclist safety.

- **Safe road use**- London will encourage safe road use by investing in Road Danger Reduction campaigns (launched May 2018) focusing on reducing road user behaviours, such as speed, that introduce risk and developing tailored training resources to improve the road safety of children, young people and vulnerable road users.

In 2018, Transport for London also launched a Vision Zero action plan[14]. The action plan identified a number of interim targets, including achieving a 65% reduction in deaths and serious injuries by 2022 based on the 2010-2014 baseline figure, a 70% reduction by 2030 and zero fatalities on London's roads by 2041. There are five ways in which this will be achieved:

- Lower speed limits on Transport for London's road network: it has been proposed that 20mph should be the new general speed limit on all Transport for London roads within the congestion charging zone by 2020.
- Safety improvements to junctions: improvements will be made to 73 of the junctions with the poorest safety records to reduce risk to pedestrians and cyclists.
- Improved safety standards for the design of HGV's: the Direct Vision Standard will be introduced in 2020 to improve vehicle safety and increase visibility of vulnerable road users. Only those vehicles that achieve a three-star rating or above will be able to operate in London from 2024.
- Bus safety standard: will be written into all new bus operator contracts from the end of 2018 and will identify the latest safety technologies and features to reduce casualties on the bus network. The aim being that no one will be killed on or by a bus by 2030.
- Improvements to streets for active travel: £2.2 billion will be invested in streets across London to make them safer for cycling and walking.

Safer Roads Fund[15]

The Department for Transport introduced the Safer Roads Fund (SRF) to support road safety in England. It targets the 50 most dangerous stretches of roads in England, as identified through the Road Safety Foundation mapping programme. The Road Safety Foundation support local authorities in designing schemes via the International Roads Assessment Programme and coaching from engineers.

The Department for Transport hope that the Safer Roads Fund will not just be a grant giving process that enables local authorities to do more to their selected roads than would otherwise be the case. It is hoped that it will also enable local authorities to work differently by embracing the Safe System approach in building their business case and to encourage collaboration between local authority departments to achieve more effective road safety interventions.

Road Safety Management Capacity Review[16]

Road Safety factsheet: Safe System

In 2018, the Department for Transport commissioned and published a Road Safety Management Capacity Review, which recognises that a Safe System approach should be implemented on Britain's roads.

The review explored the extent that the Safe System approach was being adhered to and found that a variety of Safe System interventions are practiced daily by road engineers in Britain, such as roundabouts and speed management. However, many parts of the network allows speeds that are in excess of the protective quality of roads and roadsides. This means that some key road engineering standards will now need to be updated, speed management will need to take into account the protective quality of roads and roadsides, road function and use, and the protection afforded by vehicles travelling on the network to align with the principles of the Safe System.

The review also found that posted speed limits allow speeds that are in excess of the design limits of roads, particularly on single carriageway rural roads, where inappropriate but allowable speed is often cited as a contributory factor in collisions. However, in urban areas, 20mph limits are increasingly being implemented in areas with high pedestrian and cyclist volumes. Despite this, compliance with speed limits is still poor, although it is expected that new vehicle technology such as intelligent speed adaptation and better enforcement could improve compliance. The review recognised that the Department for Transport should acknowledge the central role of speed as a design parameter of the Safe System approach and review national speed limits on roads in Britain as soon as possible.

In terms of safer vehicles, current vehicle policy work emphasises future connected and autonomous vehicles. However, a Safe System approach recognises that current and upcoming life-saving driver assistance technologies should be focussed upon. Therefore, the Department for Transport should promote technologies such as intelligent speed adaptation and autonomous emergency braking.

The Royal Society for the Prevention of Accidents

Conclusion

We all use the road in some way in our everyday lives. Unfortunately, this comes at a price, which includes people being killed and seriously injured. However, as the Safe System suggests, these road deaths and injuries are not inevitable.

RoSPA supports the Safe System approach and recognises the importance of embedding the principles of the system in British road safety.

RoSPA hopes that this will help to progressively eliminate all possible sources of risk by focussing on safe roads and junctions, safe road user, safe speeds and safe vehicles. However, it must be noted that there is a limit to the extent that infrastructure and vehicle design can accommodate crashes resulting from extreme road user behaviour, such as travelling at excessive speeds and taking drugs or alcohol before driving.

Therefore, it is essential that other countermeasures continue to be used to influence road user behaviour.

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