

Road safety factsheet: Safe system factsheet

January 2024

In 2022, 1,711 people were killed and 28,031 people were seriously injured in reported road collisions in Great Britain¹.

Around 90 per cent of road collisions involve some element of human error. Although educating road users can reduce the number of road collisions 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 collisions 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 approach²

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 collisions are related to the inherent risks of using the existing road infrastructure. At this time, the analysis of road collisions 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 1,700 to 1,900. 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.

¹ DfT (2023) 'Reported road casualties in Great Britain: Numbers and rates; table RAS0201'

[https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain:](https://www.gov.uk/government/statistical-data-sets/reported-road-accidents-vehicles-and-casualties-tables-for-great-britain)

Accessed January 2024

² ITF (2016), Zero Road Deaths and Serious Injuries: Leading a Paradigm Shift to a Safe System, OECD Publishing, Paris,

<https://doi.org/10.1787/9789282108055-en>: Accessed January 2024

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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 unacceptable². 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 crashes. Rather, a failure of the road system is the cause of many collisions that result in death or serious injury⁴. 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 targets⁵.

The key objective for those managing the roads is that, as road users will continue to make mistakes, when collisions 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 beings⁶.

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 preventable².

Road collisions costs usually represent around one to three per cent 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 crashes 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 compliance⁶.

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 collisions.** 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

³ World Health Organisation (2021) 'Global Plan for the Decade of Action for Road Safety: 2021-2030'

<https://www.who.int/publications/m/item/global-plan-for-the-decade-of-action-for-road-safety-2021-2030>: Accessed January 2024

⁴ Salmon et al (2012) 'Managing error on the open road: The contribution of human error models', *Safety Science*, 48: 1225-1235

⁵ Organisation for Economic Co-operation and Development (2008) 'Towards Zero: Ambitious road safety targets and the safe system approach' <https://www.itf-oecd.org/towards-zero>: Accessed January 2024

⁶ Austroads (2016) 'Research Report AP-R509-16: Safe System Assessment Framework'

<https://www.onlinepublications.austroads.com.au/items/AP-R509-16>: Accessed January 2024

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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 collision forces before harm occurs.** The human body can only withstand a certain level of kinetic energy before a collision 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 per cent fatality risk, versus an eight per cent fatality risk when hit at 30mph⁷.
- **Road safety and the reduction of collisions 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-collision 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.

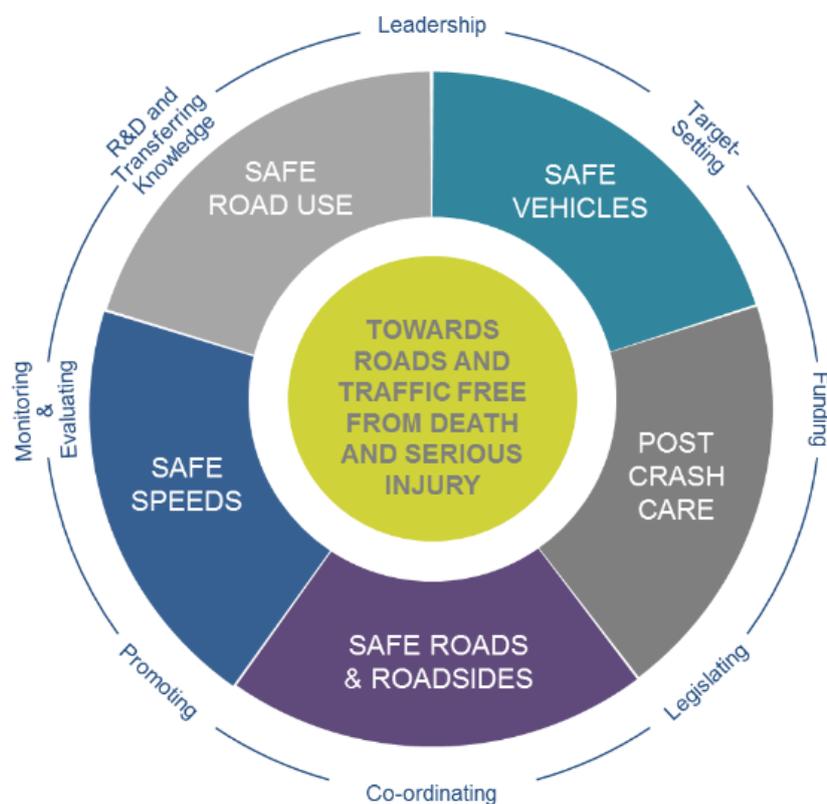
Pillars of the safe system approach ^{2,6}

According to the safe system approach, collisions resulting from failures in the road system can be addressed through improvements to the road system. These improvements can include management of infrastructure,

⁷ Rosén, E. et al. (2011) 'Literature review of pedestrian fatality risk as a function of car impact speed', *Accident Analysis and Prevention*, 43: 25-33.

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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 shows⁸:



- **Safe roads and roadsides.** In a safe system, roads are designed to reduce the risk of collisions 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 different speeds. 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 collision 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.

⁸ Parliamentary Advisory Council for Transport Safety (PACTS) (Not dated) 'Safe System' <http://www.pacts.org.uk/safe-system/>: Accessed January 2024

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- **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 the safe system requires 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 handheld 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 use⁹.

- **Post-collision 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 treatment¹⁰.
However, it must be noted that there is a limit to the extent that infrastructure and vehicle design can accommodate collisions resulting from extreme road user behaviour, such as excessive speeding and drink driving. Therefore, other countermeasures will be essential to influence road user behaviour¹¹.

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.

⁹ Brake (undated) 'The safe system and road safety approach to road safety' <https://www.brake.org.uk/get-involved/take-action/mybrake/knowledge-centre/safe-system>: Accessed January 2024

¹⁰ DfT (2015) 'Working Together to Build a Safer Road System: British Road Safety Statement' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/487949/british_road_safety_statement_web.pdf: Accessed January 2024

¹¹ Wundersitz, L. and Baldock, M. (2012) 'The relative contribution of system failures and extreme behaviour in South Australian crashes: Preliminary findings', *Australasian Road Safety Research, Policing and Education Conference 2012*.

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Sweden⁶

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 collisions, in which 284 people were killed, in Sweden in 2004. In 63 per cent of these collisions, 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 behaviour¹².

London

In 2013, Transport for London's (TfL) implemented a 'Safe Streets for London' which was based on the pillars of the Safe Systems approach¹³. It sought to encourage a common approach to road safety among the organisations involved in the management of the road transport system in London and a target has been set to achieve a 40 per cent reduction in killed or seriously injured casualties by 2020, from a baseline of the 2005-9 average.

In 2018, Transport for London launched a Vision Zero action plan¹⁴. The action plan identified a number of interim targets, including achieving a 65 per cent reduction in deaths and serious injuries by 2022 based on the 2010-2014 baseline figure, a 70 per cent reduction by 2030 and zero fatalities on London's roads by 2041. There were five ways in which they looked to achieve this:

¹² Stigson et al. (2008) 'Use of fatal real-life crashes to analyze a safe road transport system model, including the road user, the vehicle, and the road', *Traffic Injury Prevention*, 9 :463-471.

¹³ Transport for London (2013) 'Safe Streets Plan for London: Working together, towards roads free from death and serious injury' <http://content.tfl.gov.uk/safe-streets-for-london.pdf> Date Accessed: 13/04/2018.

¹⁴ Transport for London (2018) Vision Zero for London, <https://tfl.gov.uk/corporate/safety-and-security/road-safety/vision-zero-for-london>: Accessed January 2024

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- Lower speed limits on Transport for London's Road network¹⁵. Phase 1 was to introduce a 20mph speed limit in central London, this was completed in March 2020. Currently 215km of TfL's roads are subject to a 20mph speed limit. Phase 2 aims to lower the speed limit by 10mph on 140km of TfL's roads by 2024.
- Safety improvements to junctions¹⁶: the Safer junctions programme has improved 43 dangerous junctions in London, helping reduce collisions by 23 per cent.
- Improved safety standards for the design of HGV's: the Direct Vision Standard was introduced 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: The bus safety standard introduced in 2019 required buses to be equipped with the latest safety technologies and features to reduce casualties on the bus network. As of September 2021, 18 percent of London's bus fleet had been retrofitted with safety technologies. The aim being that no one will be killed on or by a bus by 2030.

By 2022, London had achieved a 38 percent reduction in people killed or seriously injured on its roads, compared to the 2005-09 baseline¹⁷.

Safer Roads Fund¹⁸

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 only enable local authorities to do more to their selected roads than would otherwise be the case but also that it will 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 review¹⁹

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.

¹⁵Transport for London (undated) Vision Zero for London, Safe speeds <https://tfl.gov.uk/corporate/safety-and-security/road-safety/safe-speeds#:~:text=Progress%20and%20Plans,by%20May%202024%20%2D%20on%20track> Accessed February 2024

¹⁶ Transport for London (2022) Vision Zero action plan progress report, <https://content.tfl.gov.uk/vision-zero-action-plan-progress-report-2021.pdf> Accessed February 2024

¹⁷ Transport for London (2023) Casualties in Greater London during 2022 – Data release, <https://content.tfl.gov.uk/casualties-in-greater-london-2022.pdf>: Accessed January 2024

¹⁸ Kantar Public (2018) 'Process Evaluation of the Safer Roads Fund: Phase 1 Report' https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/715797/process-evaluation-of-the-safer-roads-fund-phase-1.pdf: Accessed January 2024.

¹⁹ Systra for the Department for Transport (2018) 'Road Safety Management Capacity Review', URL: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/717062/road-safety-management-capacity-review.pdf: Accessed January 2024

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The review explored the extent to which 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 improved roundabouts and speed management. However, many parts of the network allow 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 assistance 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.

General and pedestrian safety regulations (GSR)²⁰

In 2022, the EU introduced a suite of 15 integrated measures that included a range of technologies to assist drivers in complying with the rules of the road, as well as providing protection for those inside and outside of the vehicle in the event of a crash. The UK currently has not adopted this regulation. PACTS has estimated that if these regulations were adopted it would save 1,762 deaths and 15,612 serious injuries over a 16-year period.

Conclusion

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 users, 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 collisions 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.

²⁰ PACTS (2023) Still unvaccinated: GSR one year on, PACTS briefing July 2023, <https://www.pacts.org.uk/wp-content/uploads/PACTS-briefing-Still-unvaccinated-GSR-one-year-on-2023.pdf> Accessed February 2024