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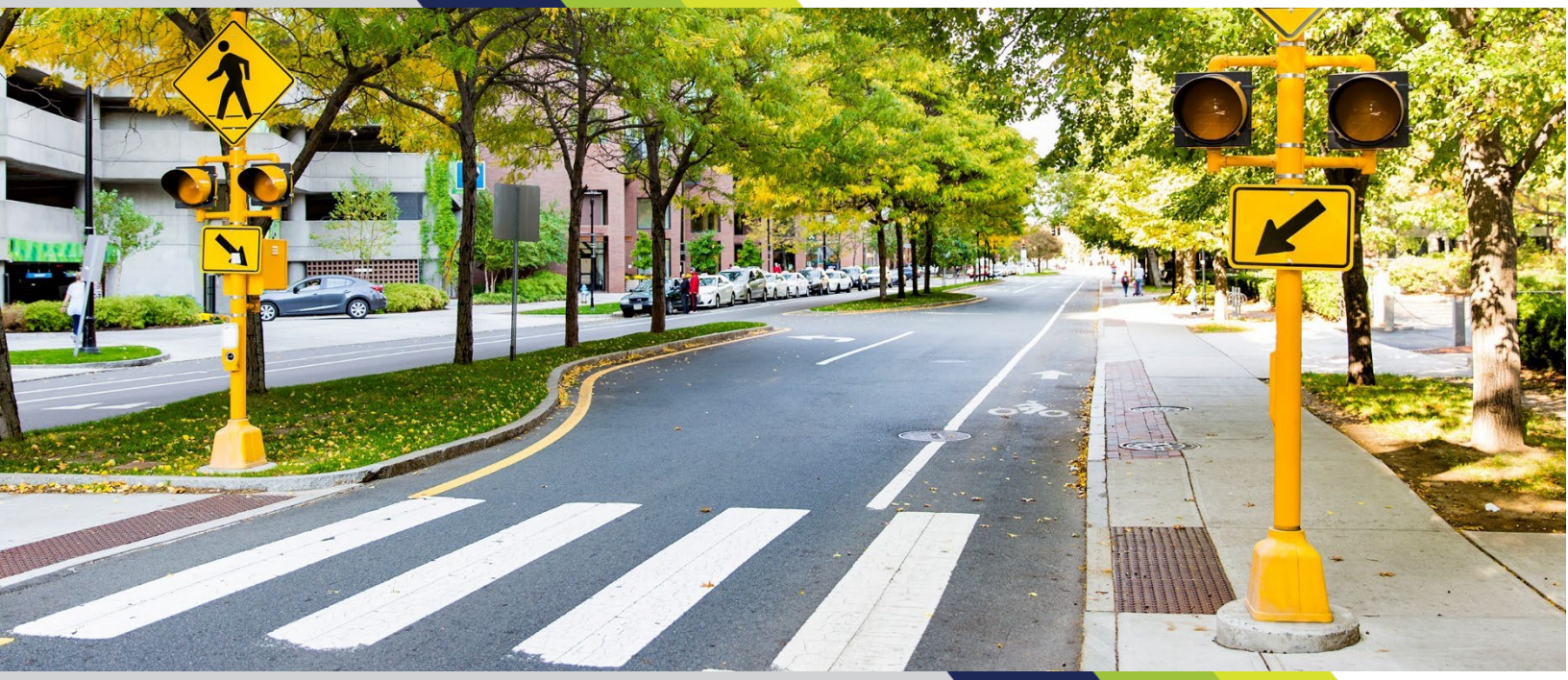

THE ROAD FORWARD

A Safe System Approach to Building a Safer Transportation Network

MOMENTUM

U.S. Department of Transportation, Office of the Secretary
www.transportation.gov/Momentum

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ABOUT THIS TOOLKIT

The U.S. Department of Transportation's (U.S. DOT) Office of International Transportation and Trade developed this document as part of its *Momentum* initiative.

Through *Momentum*, U.S. DOT aims to assist global partners by sharing knowledge and best practices in key areas, including economic development, sustainability, and equity.

To learn more about U.S. DOT's *Momentum* resources, please visit:

www.transportation.gov/momentum

This toolkit provides a suite of strategies and approaches to reduce both the occurrences and consequences of crashes for both motorists and non-vehicle users. It aims to help government agency decision-makers:

- ✓ Better understand what the Safe System Approach to safety is and how it can contribute to achieving overall safety goals.
- ✓ Learn how to put safe system strategies into action.
- ✓ Learn how to create a comprehensive road safety plan.
- ✓ Better understand strategies that agencies can adopt (in collaboration with others) to support safety initiatives across the transportation network.

This toolkit uses the term "government agency" broadly to refer to a public entity that focuses on transportation or is involved in transportation decision-making at any level. Examples might include Federal transportation departments or sub-departments, ministries or sub-ministries, local or regional government entities, or port authorities.

This toolkit provides a starting point for obtaining information. Please contact U.S. DOT's Momentum initiative to explore specific topics in more depth.

Who are the most vulnerable road users (VRUs)?

In Brazil, about 44,000 people die from crashes every year, more than half of them are pedestrians, bicyclists, and motorcyclists. That is just one example of how these users are at a disproportionate risk across the world. Pedestrians and bicyclists are especially vulnerable because they are the most exposed to injury and death in the case of a crash and present the least risk to other road users. Protecting these vulnerable users is the responsibility of the whole system and should be addressed in a multi-tier approach: from behavioral changes to design and roadway interventions.

Powered Two-Wheelers (PTWs): The safety of motorcyclists is a concern in countries where PTWs represent a large share of the vehicle fleet. According to Association of Transportation Safety Information Professionals (ATSIP), the number of PTW users killed on roadways increased by 7 percent between 2010 and 2019. The highest increases during this time were in Latin America with Chile (+89 percent), Argentina (+70 percent) and Colombia (+66 percent).

Sources: WHO 2015, DATASUS 2017

WHY SHOULD GOVERNMENT AGENCIES ADDRESS ROAD SAFETY CONCERNS?

Road deaths are preventable, and a tragic drain on a country's people. There are many reasons governments should address road safety concerns, including:

- **Young people are the most vulnerable to road traffic injuries.** According to the WHO, crashes are the leading cause of death for people ages 5-29. This is especially true for young males under 25, which experience 73 percent of all road traffic deaths.[1]
- **Developing economies have higher rates of road injuries.** 93 percent of world fatalities come from low- and middle-income countries[2].
- **Recovering from crash-related injuries is expensive.** Treatment costs for the injured and the loss of productivity from those killed or disabled can put a heavy economic burden on victims and their families. Also, road crashes and the resulting fatalities and injuries cost countries 3 percent of their annual gross domestic product. [3]

A comprehensive and collaborative approach to road safety should account for the needs of all road users and provide special attention and protection to those most vulnerable. Road users include bicyclists, pedestrians, motorcyclists, and motor vehicle drivers and passengers, including on-road public transportation vehicles (e.g., buses).

Around the world, approximately 1.3 million people die each year in road traffic crashes. Between 20 and 50 million people receive non-fatal injuries. About half of these traffic fatalities and injuries are incurred by the road's most vulnerable users. The term "vulnerable road users" generally refers to people who walk, bike, roll, or use modes of travel that do not include cars, public transport, or licensed commercial vehicles (where users of those modes are protected from impact by an enclosure). Vulnerable road users include pedestrians, motorcyclists, and bicyclists.

Source: Global Plan - Decade of Action for Road Safety 2021-2030 (who.int)

[1] Road Traffic Injuries, World Health Organization, June 2022
[2] Ibid.
[3] Road Traffic Injuries, World Health Organization, June 2022

Government agencies can implement tools and strategies that leverage a Safe System Approach to reduce these negative outcomes, with the goal of achieving zero fatalities and serious injuries.

Growing economies are experiencing considerable transportation system growth, usage, and increasing motorized vehicle volumes. Incorporating a Safe System Approach while these systems develop can help shape user experience, multimodal access, and road safety outcomes. Designing streets with safety in mind and expanding access to public transit can help developing transportation systems reduce fatalities and serious injuries, especially for vulnerable road users.

Implementing a Safe System Approach in the U.S.

Road safety in the United States has drastically improved in the last 100 years. However, the rate of fatalities due to road crashes plateaued in the 1990s and has not decreased significantly since. Traditionally, roads were designed to move people quickly, which reduced safety. Implementing the Safe System Approach is a crucial shift in U.S. road safety priorities for safeguarding the lives of the most vulnerable on the road.

In 2022, the U.S. released its National Roadway Safety Strategy (NRSS) – a comprehensive road safety strategy rooted in the Safe System Approach. The NRSS will help the U.S. Department of Transportation work towards the target of reducing 66 percent of motor vehicle-related fatalities by 2040, an intermediate milestone towards the goal of zero roadway deaths. The U.S. is working to make roads safer and is learning from international counterparts that have paved the way in improving road safety outcomes. There are early signs of improvement that the strategy is effective in the U.S.

Source: National Roadway Safety Strategy

Increased road safety can help make transportation systems more productive. Allowing for safe non-vehicle travel and increasing viable travel options can help reduce system congestion, increasing local access, reducing emissions, costs, etc. A Safe System Approach can help create cycles of investment to improve travel options beyond solely individual vehicle travel but also support improvement to multimodal transportation including transit, and other sustainable cost-effective travel.

In August 2020, the United Nations (UN) General Assembly adopted Resolution 74/299[4], "Improving global road safety," proclaiming the Decade of Action for Road Safety 2021-2030. This resolution set the goal of preventing at least 50 percent of road traffic deaths and injuries by 2030. In cooperation with other partners in the UN Road Safety Collaboration, the World Health Organization (WHO) and the UN regional commissions have developed a Global Plan for the Decade of Action for Road Safety (2021-2030)[5], which was released in October 2021. The Global Plan includes accelerated action to make walking, cycling, and using public transport safer; to ensure safe roads, vehicles, and behaviors; and to guarantee timely and effective emergency care. These

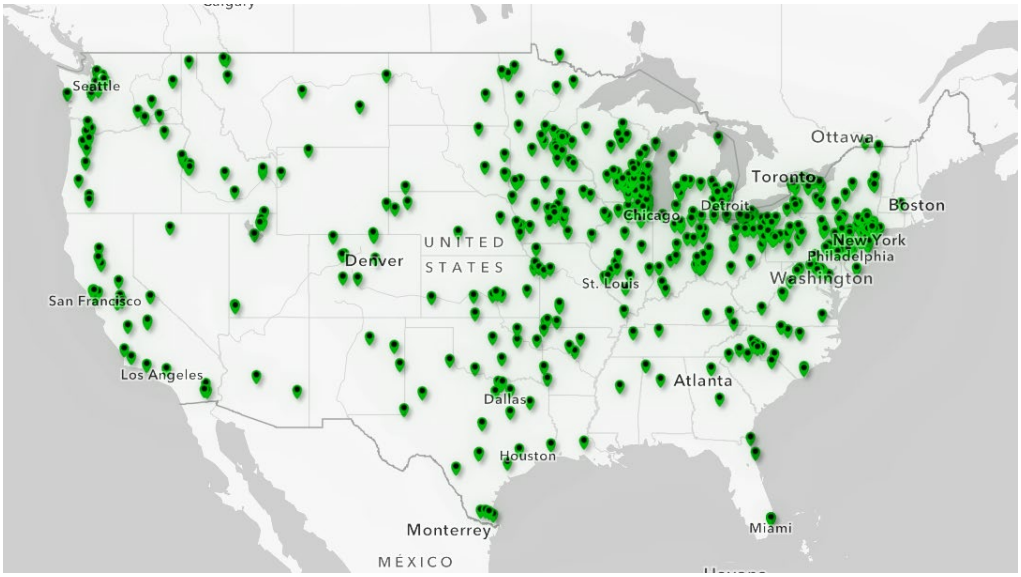
[4] Resolution 74/299: Improving global road safety, United Nations, September 2020
[5] Decade of Action for Road Safety 2021-2030, World Health Organization

global initiatives hope to inspire governments, public agencies, and their partners to act boldly towards achieving safer roads by using the tools and knowledge gained from the 2011-2020 Decade of Action.

Hoboken, New Jersey's Pursuit of Safer Streets

Hoboken, New Jersey is pursuing a Vision Zero strategy to increase the safety and accessibility of their roadway system. In 2024, Hoboken reached an incredible milestone: seven consecutive years without a traffic-related death. Through the systematic implementation of Vision Zero safety improvements, Hoboken has become one of the few urban cities in the United States to achieve this feat. Hoboken has implemented high-impact measures such as increasing sightlines by limiting parking near crosswalks to increase safety. The city has built robust political will and public buy-in by building a coalition to support the strategy with decisionmakers, community leaders, and advocacy organizations. The city also has a website where residents can pledge to be a part of the initiative, find resources, and track city programs that support Vision Zero.

Sources: A New Approach to Traffic Safety in Hoboken and City of Hoboken reaches new Vision Zero milestone: seven consecutive years without a traffic death (hobokennj.gov)



Zero is possible. Small Cities (5,000 – 50,000 people) in the U.S. with zero fatality rate. Source: Our Nation's Roadway Safety Crisis (arcgis.com)

This toolkit is an invitation to aim for zero fatalities by using the Safe System Approach to change the way we think about road safety. This toolkit outlines the elements of the Safe System Approach and how they can be applied to improve road safety.

For more information:

- World Health Organization Road Traffic Injuries Safety
- World Health Organization Developing Global Target for Road Safety
- United Nations Resolution 74/299
- World Health Organization Decade of Action for Road Safety 2021-2030
- World Health Organization Decade of Action for Road Safety 2011-2020

WHAT IS A SAFE SYSTEM APPROACH?

Adopting a comprehensive Safe System Approach for road safety can help governments reduce traffic fatalities and serious injuries and mitigate the overall risks to users of transportation systems.

The Safe System Approach is a holistic, solution-oriented, proactive approach to road safety that centers on human vulnerabilities. It considers the reality that humans are prone to mistakes, and that road mistakes can too easily lead to serious injuries and even fatalities. Humans are prone to error both in transportation system design and in behaviors by drivers and other road users. For governments to mitigate risks, transportation systems must build in redundancies to allow for errors that do not result in major system failures. This approach relies on data collection and analysis to prevent issues before they occur. When crashes do occur, roadway engineering must also consider how to limit serious harm to the human body to acceptable levels.

The Origin and Expansion of the Safe System Approach

The Safe System Approach originated with Sweden's Vision Zero and the Netherlands' Sustainable Safety programs. As a result of implementing its Vision Zero program, Sweden experienced a 50 percent decrease in road traffic fatalities between 1994 and 2015. The Safe System Approach has since been implemented in Australia, Europe, South America, and New Zealand. In 2018, the World Resources Institute conducted an analysis of road safety outcomes across 53 countries from 1994 to 2015, comparing countries that had and had not implemented Safe System Approach. This research found that countries that implemented the approach had the lowest rates of roadway fatalities per 100,000 inhabitants, with the most impressive progress in road safety outcomes found in the countries that pioneered the Safe System Approach: Sweden and the Netherlands.

Source: Sustainable & Safe: A Vision and Guidance for Zero Road Deaths

The Safe System Approach aims to protect all road users, including pedestrians, bicyclists, assisted mobility devices, mass transit, motor vehicle passengers, and those travelling by other means of transportation. It achieves this by building and reinforcing multiple layers of protection to prevent crashes and minimize injuries when they do occur. The Safe System Approach builds on six fundamental principles:

- **Death and serious injury are unacceptable.** This approach prioritizes eliminating all crashes that lead to death or serious injury.
- **Humans make mistakes.** People will ultimately make decisions and mistakes that can lead to crashes. The transportation system can be designed to help accommodate for levels of

Source: USDOT

human mistakes to help prevent death or serious injury when crashes do occur.

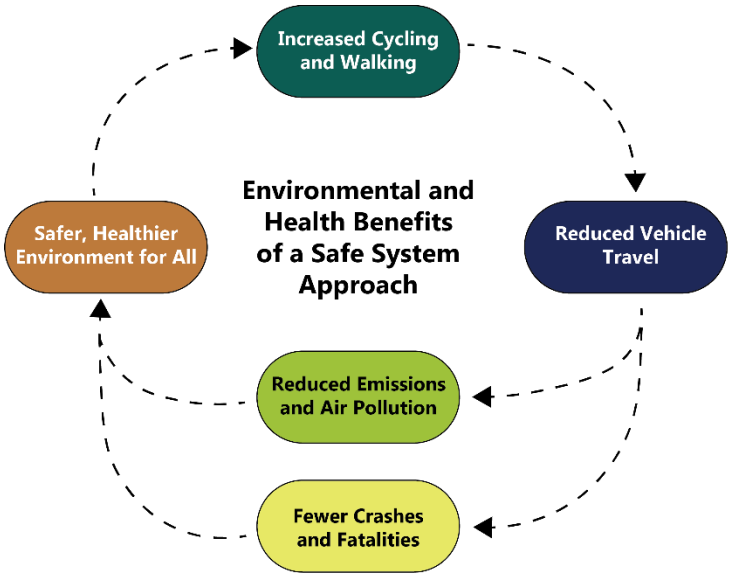
- **Humans are vulnerable.** People have limits for tolerating crash forces before death and serious injury occurs; therefore, it is critical to design and operate a transportation system that is human-centric and accommodates human vulnerabilities.
- **Responsibility is shared.** All stakeholders, including governments at all levels, industry, non-governmental organizations and advocates, and the public, are vital to preventing fatalities and serious injury on the road.
- **Safety is proactive**. Safety concerns should be proactively identified and addressed in transportation systems, not only as a response to crashes.
- **Redundancy is crucial.** Reducing risks requires that all aspects of the transportation system be strengthened. If one fails, another aspect can still protect people.

The U.S. Department of Transportation's Safe System Approach outlines five key objectives in the National Roadway Safety Strategy:

- **Safer People**: Emphasizing the safety of road users of all modes and mobility levels through engineering, education, and outreach strategies.
- **Safer Vehicles:** Ensuring access to and the optimization of vehicle systems and features to help prevent crashes.
- **Safer Speeds:** Utilizing a combination of outreach, education, roadway design, signage, and enforcement to reduce speed-related crashes.
- **Safer Roads**: Designing roadways and accompanying infrastructure to encourage safe behaviors, mitigate mistakes, and facilitate ease of travel for all road users.
- **Post-Crash Care:** Improving crash survivability by designing, planning, and implementing crash care response.

Road safety efforts can provide environmental and health benefits in addition to reducing traffic fatalities. A Safe System Approach to road safety highlights nonmotorized forms of travel and makes it safer – and more desirable – to walk and bike. Increased walking and bicycling can lead to health benefits such as:

- More physically active lifestyles
- Lower healthcare costs
- Increased connections to their community
- Increased social connections with other bicyclists and pedestrians.



Source: World Resrouces Insititute Sustainable and Safe Report

The positive environmental impacts of promoting walking and biking can include:

- Reduced dependence on motor vehicles through land use planning, multimodal options, road design, and infrastructure
- Reduced traffic congestion and associated local air pollution
- Reduced sound pollution
- Reduced motor vehicle emissions
- Improved local air quality for residents

Fewer crashes and fatalities through fewer motor vehicles miles traveled contribute to a positive feedback loop of associated benefits and improved quality of life for all travelers.

Case Study: A Safe System Approach in Practice in Bogotá, Colombia

In 2016, Bogotá, Colombia, revisited its Road Safety Plan and identified a need for a more robust approach to reducing traffic crashes. The District Department of Mobility identified that 500 to 600 fatalities were occurring annually on the city's roadways. In 2017, Bogotá officially adopted a Vision Zero plan with a Safe System focus. The plan includes roadway designs and reconfigurations, communication and outreach campaigns, public engagement, leadership buy-in, and enforcement of traffic laws by the city's police department.

Source: The City Fix

The city's Vision Zero plan reduced speed limits to 50km/h for major roads and 30km/h in school areas. The new speed limits were implemented in a phased approach, beginning with arterial roadways in 2018 and 2019 and the remaining main roads in the city in 2020. The city also developed safe designs for vulnerable road users – in this case, motorcyclists, pedestrians, and bicyclists – around commercial areas, including road reconfigurations to manage speeds and provide shelter for pedestrians and bicyclists. Between October 2018 and March 2019, the city recorded an 11 percent reduction in fatalities as compared to 2015-2017, which translates to an estimated 37 lives saved in Bogotá.[6]

Source: Bogota's Vision Zero Plan

[6] The Safe System Approach in Action: The Speed-Management Programme in Bogotá, Colombia, International Transport Forum

Case Study: Vision Zero for Youth in Mexico City

Source: ITDP

In Mexico, road crashes are one of the leading causes of death for children and young adults.[7] In 2017, Mexico City's transportation agency, the Institute for Transportation and Development Policy (ITDP), piloted a Vision Zero for Youth initiative at a public middle school in the Cuachtemoc neighborhood. The project prioritized stakeholder engagement by working with parents, teachers, students, and authorities to build support for road safety actions. ITDP leveraged its community connections to create a micro-Safe System (the school zone). By using a bottom-up stakeholder involvement strategy, ITDP was able to build political will and get feedback to create a safe system approach that works for the community. The key takeaways from the pilot program included widening sidewalks, reducing pedestrian crossing distances, installing speed bumps, and adding bollards to delineate and protect pedestrian spaces. ITDP also enforced a new 20 km/h speed limit around the school zone. The pilot program improved pedestrian safety in the school zone and created a successful micro-Safe System. The Vision Zero for Youth initiative was successful due to the coordinated efforts by the lead agency and its collaborations with community stakeholders and private sector organizations. Community members had free and easy access to local traffic data to monitor and assess the city's implementation progress and outcomes. The success of the program supports implementation of this approach at a national level in Mexico.

Source: Institute for Transportation and Development Policy (ITDP) Vision Zero for Youth Initiative

[7] The Safe System Approach in Action: Vision Zero for Youth in Mexico City, International Transport Forum

How can data-driven decision-making support a Safe System Approach?

High-quality safety data is fundamental for an effective implementation of the Safe System Approach. A data-driven approach allows agencies to make planning decisions that are more likely to be successful. It is crucial to have clear information how current systems are functioning and where road safety challenges exist. Road safety data should also accurately reflect user experiences in different parts of the transportation system. The Safe System Approach relies on a data-driven decision-making strategy, one where agencies collect and analyze data to guide strategic decisions that align with organizational goals and initiatives. The key aspects to supporting data-driven decisions are standardizing data collection, maintaining proper data storage, and conducting analyses that help answer key road safety questions.

Agencies will need to have good data systems in place to support initiatives and programs. Fatality and serious injury data is the most fundamental data used in the Safe System Approach. Traffic fatality data is often reliant on first responder (e.g., emergency medical services, fire safety responders, law enforcement) reports that sometimes do not provide the entire context for crash and injury data. Hospitals can often fill in the blanks left by police reports and provide more data on pedestrian and bicyclist crashes that are not always well documented by law enforcement. Supplementing crash data with health data helps develop the picture of how and why crashes happen. Roadway data defines what kind of road or highway the crash happens on. Vehicle data helps identify what types of vehicles were involved in the crash. Using an inter-agency approach to collecting data will help build a more comprehensive road safety analysis.

Non-traditional data types, such as socioeconomic and health data, can be especially important to consider. Non-traditional data refers to data types for which there are often few commonly accepted, industry-standard collection and processing procedures. Socioeconomic data can identify where vulnerable road users such as pedestrians, cyclists and motorcyclists are generally more common. It can also point to where there is higher exposure to roadway injuries and severity of crashes due to less efficient care or emergency response times. Roadway safety data can be collected from partnering with other agencies and hospitals in your country to create a more holistic, safety-oriented planning process.

Below is a table of common roadway safety types and details about the information collected for each.

Data Type	Information Collected
Roadway Data	Type of road or highway and intersections, characteristics such as geometric design and roadside risk, observed vehicle speeds, posted speed limits, right of way, visibility issues.
Traffic Data	Type of vehicles, traffic volumes for each mode of transportation, including pedestrians and bicyclists.
Crash Data	Crash type, location and date of crash, weather and surface conditions, fatality, or injury data, and cause(s) of the crash.
Socioeconomic Data	Race, age, gender, housing status, and employment status.
Health Data	Type of injury, seriousness, long-term disability, personal impact of injury (e.g., ability to work).

The Essential Elements of a Comprehensive Road Safety Plan

Increased and continued motorization of transportation has led to a large-scale, global road safety problem. Transportation agencies must exhibit leadership in spurring immediate and effective intervention to prioritize road safety. Creating a framework for continuously improving road safety must start with an intentional foundation. Governments looking to develop or expand their comprehensive safety approach can begin with the following essential elements:

- **A Commitment to Reducing Roadway Facilities and Serious Injuries:** A high-ranking official and/or governing body designates goals or missions for road safety improvements that are inspiring, measurable, impactful, and include a reasonable timetable.
- **A Lead Agency or Task Force:** Establish champions and project managers to ensure timely communication, project delivery, and collaboration among the implementing partners.
- **Analysis of Existing Road Safety Conditions and Trends:** Evaluate the existing road safety conditions to determine high priorities areas of improvement. Including an analysis of crash locations and severity, contributing factors, and crash types by relevant road users (motorists, people walking, transit users, etc.). Analysis of systemic and specific safety needs can also be performed, as needed (e.g., high-risk road features, specific safety needs of relevant road users, public health approaches, analysis of the built environment, demographic, and structural issues, etc.).
- **Engagement and Collaboration:** Generate an intentional and equitable strategy to ensure relevant stakeholders, community representatives, private sector, and advocacy organizations are included in the plan development implementation and that their feedback is received, analyzed, and incorporated into the plan.
- **Project selections and strategy:** Identify a comprehensive set of projects and strategies, shaped by analysis of existing conditions, the best available evidence, and noteworthy practices, as well as stakeholder input and equity considerations, that will address the safety problems described in the plan. Prioritize the projects and strategies to address the locations with the most significant safety challenges.
- **A Strategy to Monitor and Evaluate Progress**: Method to measure progress over time after an Action Plan is developed or updated, including outcome data. Means to ensure ongoing transparency is established with residents and other relevant stakeholders. Should include annual public and accessible reporting on progress toward reducing roadway fatalities and serious injuries.

It is critical to have a safety champion or lead agency to lead the development of safety plans and the implementation of safety countermeasures. A central agency to monitor will help keep partners engaged, updated, and ensure that the process keeps moving forward. A lead agency can also align with partners to distribute responsibilities and duties, including data management and collection. The lead body can access the data landscape and identify gaps in reporting, standardization needs, and partners to complete better overall reporting. To move forward there needs to be capacity and resources available toward safety improvements, this is a key step in achieving any kind of improvements.

Argentina Case Study: Establishing a Lead Agency

In April 2008, Argentina established the Argentine National Road Safety Agency (ANSV) to address rising political and social unrest due to the country's road safety challenges. A 2008 report highlighted that road fatalities were steadily increasing and that most fatalities occurred on high-volume and high-speed national routes. Soon after the establishment of the ANSV, Argentina sought technical support from the World Bank to advance strategy implementation and reduce the severity of road crashes in Argentina. The Argentina Road Safety Project empowered and resourced the ANSV and confirmed the agency's "ownership" of the nation's road safety and its management of targeted partnerships. As part of this effort, the ANSV created a national registry system for driver's licenses, traffic records, and infractions. This helped to form a beneficial relationship between local and national government agencies. The ANSV used these new relationships to establish partnerships with grassroots organizations and parts of the health sector.

The ANSV's Road Safety Project has three components to advance road safety outcomes: institutional capacity building, program development (e.g., demonstration corridors and incentive funds), and road safety monitoring and evaluation.

- **Capacity Building**
    - Establishing a national driver's license registry system and a national traffic records and infractions registry system.
    - Designing and carrying out communications and educations campaigns.
    - Building skills and resources to improve emergency responses, traffic control, and enforcement services.
    - Developing effective and efficient project management capacities.
- **Program Development**
    - Identifying high-risk corridors to undergo safety demonstrations.
    - Creating a finance resource to fund small-scale safety countermeasures, such as small-scale safety measures such as signs, speed bumps, and roundabouts.
- **Monitoring and Evaluation**
    - Utilizing road monitoring systems, road crash data collection and reporting systems, and other road safety information systems.
    - Ensuring the National Road Safety Observatory maintains a publicly accessible database of information on traffic crashes, fatalities, and safety features.

Argentina saw significant improvements in road safety outcomes with the establishment of the ANSV. Between 2008 and 2010, fatalities from road crashes decreased by almost 12 percent. As the lead agency, the ANSV contributed to saving an estimated 2,034 lives between 2008 and 2010. The creation of the ANSV allowed for better sequencing and planning of initiatives as well as creating resources and capacity to roll out a road safety improvement plan.

Sources: Case study: The Argentina Road Safety Project: lessons learned for the Decade of Action for Road Safety, 2011–2020 - PMC (nih.gov)

Key Takeaways on a Safe System Approach

- A Safe System Approach protects all road users by building and reinforcing multiple layers of protection to prevent crashes and minimize injuries.
- There are five key principals: Death and serious injury are unacceptable, humans make mistakes, humans are vulnerable, responsibility is shared, safety is proactive, and redundancy is crucial.
- In addition to reducing crashes, a Safe System Approach can result in social, environmental, and health benefits.

For more information:

- Federal Highway Administration Making Our Roads Safer through a Safe System Approach
- U.S. Department of Transportation Safe Streets and Roads for All Action Plan Components
- U.S. Department of Transportation National Road Safety Strategy and the Safe System Approach
- Institute of Transportation Engineers Safe Systems
- World Resources Institute Sustainable & Safe: A Vision and Guidance for Zero Road Deaths

SAFER PEOPLE

People who are using the roads play a critical part in increasing road safety. They are prone to making mistakes that can lead to crashes, whether they are inside a vehicle or outside a vehicle and walking or biking. To increase road safety and reduce fatalities and serious injuries, how people behave needs to be considered and addressed in safety interventions. A robust and comprehensive approach to influencing and changing human behavior requires deepening our understanding of the underlying causes. Connecting with local communities and creating outreach to those most impacted by crashes can help shift the narrative of road safety and cause more trust between government agencies and the communities they serve. Building a safety culture within organizations and leveraging public health approaches can help create a practical and well-implemented Safe System Approach.

By considering human vulnerabilities, you can design transportation systems that protect people when mistakes do happen. While creating safer roads and transportation systems is important, encouraging safer practices in people is equally important. Everyone involved in a roadway system – including users – shares the responsibility of safety. Enabling people to be safer includes encouraging safer behaviors among the driving public, commercial drivers, and all road users. There are many strategies to promote safe road use, including community and coalition engagement and educational campaigns on road safety practices.

Source: Adobe Stock

There are various behavioral safety factors that impact the level of crashes that include fatalities and serious injuries: Not wearing seat belts; driving while distracted (e.g., texting), impaired (e.g., under the influence of drugs or alcohol), drowsy; and speeding. Government agencies should consider these behavioral factors when designing safer roads and using safe system strategies to mitigate these unsafe behaviors by both educating the public on the risks and using design to account for human vulnerability. In the table below, common behavioral safety issues are identified as well as different policy and programmatic strategies agencies can use to try and influence human behavior.

Programmatic interventions that support behavioral changes that promote safety include:

Safety Issue	Examples
Incentive Programs	
Impaired Driving	• Incentive programs for not driving impaired
Educational Campaigns	
Impaired Driving	• Promoting rideshare and/or public transit for people who are under the influence • Educational campaigns for designated drivers
Drowsy Driving	• Education on medications that may cause drowsiness and impairment • Educational campaigns on risks of driving while drowsy
Distracted Driving	• Increased road attentiveness campaigns (e.g., no texting and driving) • Educational campaigns promoting "designated texters"
Occupant Protection	• Seat belt campaigns • Child restraint and car seat education
Reducing Injuries	• Promoting helmet wearing
Equitable Enforcement	
Impaired or Distracted Driving	• Equitable enforcement of impaired and distracted driving laws
Impaired Driving	• Ignition locks
Policy and Regulation	
Reckless Driving	• License and educational requirements
Low Visibility	• Requiring the usage of headlights at night

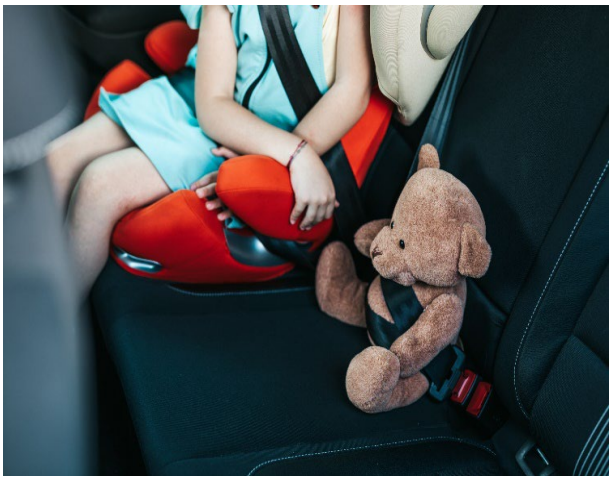
How can education and engagement promote safer behaviors?

Community investment and input is crucial in creating safer roads that meet community needs as well as helping engage community members in safer practices while on the road. It is important to engage communities to ensure equitable implementation of road safety strategies and policies. Activities to elevate community inclusion can include holding public meetings, allowing time for public feedback on plans, administering surveys of community needs, tabling and providing information at already scheduled events, and educating community members on road safety and how road safety measures can be implemented in their communities. When communities are involved, there is a higher chance of success, political buy-in, and improved safety behaviors.[8] Meeting the community where they are and engaging in open discussions about safety programs cultivates a sense of ownership among members. Similarly, educational road safety campaigns – those with clear, strong, and targeted advertising – have proven to be the most effective in creating measurable changes in public behavior. Setting safety goals and developing a communications plan is the first set to any educational campaign. It is important that policies and programs be clearly defined and agreed upon by stakeholders. Government agencies may garner increased buy-in from communities when practicing road safety planning that leverages education and engagement.

Child restraints and child passenger safety

According to the WHO, motor vehicle injuries are a leading cause of death among children and young adults aged 5-29 years. Buckling children in age- and size-appropriate car seats, booster seats, and seat belts reduces serious injuries and death by up to 80 percent. Seat belt laws help increase awareness of the risks and are improve safety when accompanied by incentive and educational programs. Some education programs help parents and caregivers obtain new, unused car seats and learn how to properly use them. These programs can help increase access to safe car seats and change behaviors.

Source: Child Safety | NHTSA



Source: Adobe Stock

[8] The Safe System Approach in Action: Vision Zero for Youth in Mexico City, International Transport Forum

The Value of Buckling Up

Seat belts are critical for ensuring passenger safety. Wearing seat belts prevents passengers from colliding with the vehicle interior or being ejected in the event of a crash. When worn properly, seat belts are designed to spread the impact of force across more durable, bony parts of the body. The risk of death in a crash reduces by more than 50 percent when putting on a seat belt. Seat belts also work together with airbags to protect passengers in the event of crashes. Deployed air bags can be extremely harmful to passengers that are not buckled up. Additionally, many modern vehicles have visual or audio reminders that activate when seat belts are not engaged.

The WHO maintains a database of seat belt wearing percentages by country. For the countries reporting, the average percentage in 2017 of all passengers in a vehicle wearing seat belts was 64 percent. Many countries with national or sub-national laws regulating the use of seat belts have some level of exemptions for antique vehicles, emergency responders, and certain medical conditions, but the reduced risk from wearing a seat belt should be carefully weighed against perpetuated reasons not to.

In the U.S., the Buckle Up Campaign is a social norming campaign that aims to increase seat belt usage in communities. with lower-than-average seat belt use, including Hispanic and African American communities. This campaign creates content that relates to community-specific experiences, encouraging seat belt use by using campaigns that speak directly to the experiences of these communities. Source: NTHSA Buckle Up Campaign

Reducing Distracted Driving

The increasing use of technology in our daily lives leads to increased distraction, which in turn leads to increased crashes due to distracted driving. The most common form of distracted driving is cell phone use. Texting is considered the most dangerous form of distracted driving because it combines visual, manual, and cognitive distraction.

In the U.S., the U Drive. U Text. U Pay. campaign is an educational campaign that seeks to remind drivers of the deadly dangers and legal consequences of texting and other forms of messaging while driving. The campaign creates relevant images and videos to educate drivers on the dangers of texting and driving. Source: NHTSA U Drive. U Text. U Pay.

Key Takeaways on Safer People

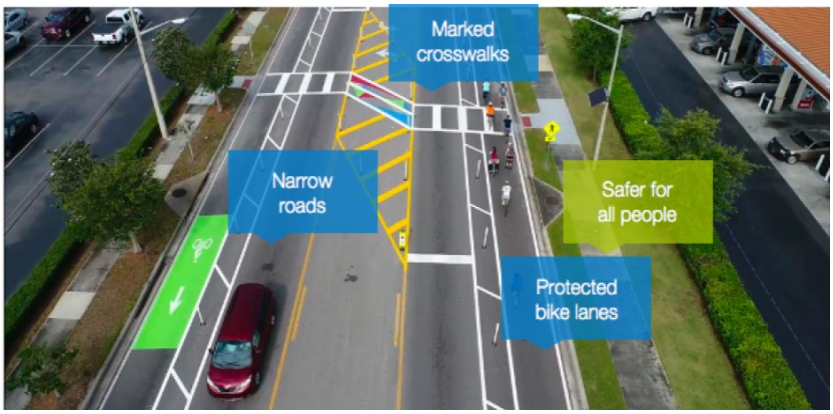
- To increase road safety and reduce fatalities and serious injuries, road user behaviors need to be considered and addressed as a part of a Safe System Approach.
- Educational safety campaigns that have clear, strong, and targeted advertising with high visibility have proven to have the most effective in creating measurable changes in public behavior.

For more information:

- Institute of Transportation Engineers Safe Systems
- National Highway Traffic Safety Administration, Countermeasures That Work
- Institute of Transportation Engineers Recommendations of the Safe System Consortium
- Federal Highway Administration Highway Safety Programs
- National Highway Traffic Safety Administration, Traffic Safety Marketing
- World Health Organization Road Safety
- World Resources Institute Sustainable and Safe Report
- World Health Organization Global Status Report On Road Safety 2018
- Centers for Disease Control and Prevention Global Road Safety

SAFER ROADS

Governments can improve safety outcomes through roadway design. Roadways and their related infrastructure can be engineered to mitigate road user errors and encourage safer driving behaviors. Creating safe spaces for non-vehicle users on the roads can create traffic calming opportunities and accommodate multi-modal users. Using physical elements to separate cyclists and pedestrians from drivers can reduce the likelihood of collisions with vulnerable road users. Roadway design improvements can also reduce crashes caused by roadway or land departure where a vehicle crosses a curb, line markings, or otherwise leaves the way of travel. Infrastructure modifications can designate spaces for bicyclists and pedestrians to travel and communities to gather and connect help drivers maintain attentiveness, keep vehicles on the roadway, provide for safer recovery, and reduce crash severity.



Source: Smart Growth America

Complete Streets is a holistic transportation planning approach that centers on the road users of all ability, ages, and vehicle-types to design and construct roads that are beneficial to all travelers. Safety is a key priority in the Complete Streets process. Corridors featuring Complete Streets elements might include median islands, wide sidewalks, frequent and highly visible crosswalks, pedestrian plazas, traffic calming, curb extensions, and accessible and well-protected public transit stops. Through Complete Street policies and designs, transit agencies can be leaders in providing an equitable and safe transportation network for travelers of all ages and abilities, including those from underserved communities.

Pursuing Complete Streets can be cost-effective and scalable for communities of all sizes and capacities. Planners need to be considerate of their community's local context and geographic constraints and opportunities when selecting roadway modifications. Agencies can employ pilot solutions with low-cost, short-term materials – a strategy known as "quick-builds." For example, delineating pedestrian-only areas with signage and physical barriers and providing space for social gatherings can reduce crashes involving people who are walking. Complete Streets are an opportunity for governments to increase both safety and connected outcomes for all roadway users.

Slow Zones, Safe Zones in Pleiku City, Vietnam

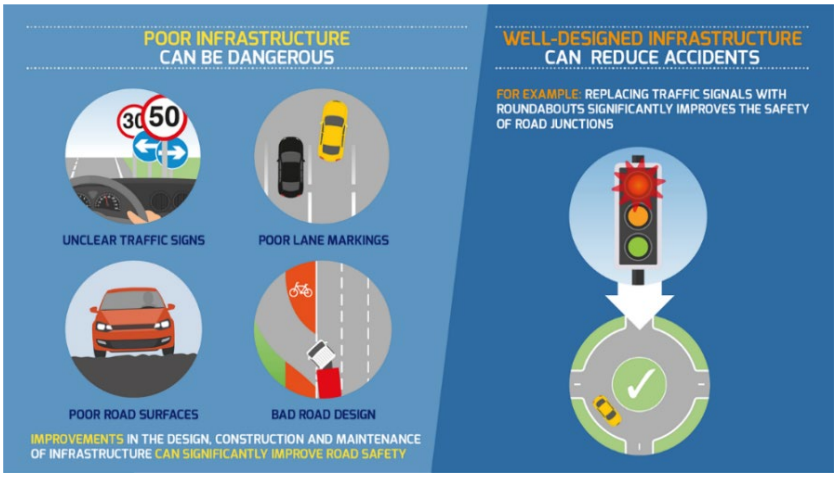
Slow Zones, Safe Zones is a road safety program aimed at reducing fatalities and serious injuries in school zones in Pleiku in Vietnam's Gia Lai Province. In partnership with the FIA Foundation for the Automobile and Society and the Fondation Botnar, the program has expanded beyond its two-school pilot to 31 schools that have undergone road safety improvements. Road modifications include posting slower speed limits during school drop-off and pick-up times, new pedestrian crossings, new pavement, steel railings to separate the footpath, and parking areas for parents. There are also new signs communicating reduced speed limits for the school zones. Pleiku is the first city in Vietnam to apply speed limits of 30-40 km/h for school zones.

Source: BMJ Blog

Sources: Vietnamese Slow Zones, Safe Zones Programme Receives Vision Zero for Youth and Prince Michael Awards, 30 km/h in Vietnam: Slow zones, safe zones

Road Safety and Infrastructure Planning

When governments are developing roadway improvement plans, a systemic approach to including road safety can help improve outcomes for all road users. Systemic infrastructure planning prompts governments to allocate safety measures to roadways with the highest average crash rates, or crash frequency, rather than the greatest traffic flow. A systemic approach involves the installation of low- to moderate-cost countermeasures at locations with the highest risk of severe crashes.[9] Crash frequency is often calculated using crashes per year over a specified time period at a particular location (e.g., two-lane roads, highways, rural roads).



Source: How can infrastructure improve road safety?

[9] Systemic Safety Project Selection Tool, Federal Highway Administration, 2013

Funding Data-Driven Road Safety Improvements in India

India accounts for almost 10 percent of worldwide crash-related deaths, but only has about 1 percent of the world's vehicles. Improving road safety across the country will involve considerations for how lower-income communities are disproportionately affected by roadway crashes. To combat high rates of road crashes, especially those resulting in death and serious injury, India established a Vision Zero strategy and the Program for Strengthening Road Safety. The Program is jointly funded by the Government of India, the World Bank, and the Asian Development Bank. The Program targets 14 states that experience 85 percent of the road fatalities in the country. The funds will target education and safety management and administration, infrastructure-based roadway interventions, and post-crash care capacities. The national Program is intended to help standardize a roadway safety approach across the states and sub-national governments. To better measure and report India's crash rates, the Program will establish a national database, the Integrated Road Accident Database, for crash data and informing improvement projects. The country's current goal is to reduce the crash fatality rate by 30 percent by 2027.

Source: iRap

Sources: World Bank Approves $250 million Program for Making India's Roads Safer, $1 billion to Improve India's Road Safety

Geographic Considerations

When evaluating a roadway network for safety improvements, consider the geographic context. Some roadways at lower elevations can be prone to accumulations of water runoff from nearby water sources. Roadways in areas with severe grades present their own challenges regarding constructability and safety that can limit visibility and feasibility. Weather conditions in the area, such as heavy rains, high winds, snow, and ice, can contribute to crashes and will help determine your government's road safety countermeasure priorities. Other geographic or environmental factors might be part of the built environment, such as lighting along a roadway or surrounding trees and plant life that can limit a traveler's visibility.

Source: Road Safety Audits, FHWA

From a broader planning perspective, governments can use surveys or travel demand models to understand how, why, when, and where their populations are traveling daily. Neighborhood density impacts how many motorized and nonmotorized vehicles might be moving throughout the area. The location of business districts, downtowns, and employment hubs could be considered high-risk areas for conflicts between bicyclists and pedestrians and motorized vehicles because of the higher

volumes of traffic and pedestrians. Transportation networks are also shared with transit systems. Roadway infrastructure modifications must consider transit routes and service schedules to improve safety outcomes for each local context.

There are many countermeasures, ranging from low-cost to more sophisticated strategies, that can have positive impacts in mitigating the risk of roadway fatalities and serious injuries. FHWA develped the Proven Safety Countmeasures initiative to evaluate the effectveness of various road safety strategies.[10] Governements can leverage this research to determine the best countermeasure and application for addressing their unique mix of road safety challenges.

A Bike Lane Quick-Build in Jakarta, Indonesia

During the COVID-19 pandemic, the Jakarta Provincial Government used low-cost materials to install pop-up bike lanes, improving safety and access for cyclists. The temporary bike lanes were implemented along Sudirman-Thamrin Street, one of the main thoroughfares in Jakarta. The bike lanes were delineated using planter boxes, green paint, or traffic cones.

To evaluate the broader interest in cycling as a travel mode for commuting, the government conducted an online survey and field interviews. The findings indicated that many people are willing to cycle to commute, even longer distances, if the cycling infrastructure is safe and accommodating. In addition to observing a tenfold increase in cyclists counts, the Provincial Government committed to making the pop-up lanes permanent, protected cycle lanes. In early 2021, the government introduced a proposed 11.2-kilometer protected bike lane project in Central Jakarta.

Source: Bicycles: The Future Mode for Traffic Choked Jakarta

Lower-Cost Countermeasures

Countermeasure	Description	Safety Issue Addressed
Signage	Visual signs of various shapes and colors providing instant directions, warnings, and notices through words or symbols	Advise drivers of traffic laws, hazards, guidance, directions, and service information
Markings	Warning signs, icons, or alerts painted directly onto the roadway to indicate roadway elements and provide continual feedback to road users for how to navigate the roadway, and at what speed	Improve visibility and recognition of lane divisions and edges
Corner clear/parking daylights	Using pavement markings to eliminate parking at corners	Improve visibility and shortens ped crossings
Flashing advanced intersection warning signs	Visual elements to indicate intersection, curve, or stop ahead	Improve visibility and recognition of a stop-

[10] Proven Safety Countermeasures, Federal Highway Administration

and dynamic warning signs for stop-ahead		controlled intersection or impending roadway curve
Shoulder and edge line rumble strips	Features added to the edge line or centerline causing tactile vibration and audible rumbling	Reduce lane departures, sideswipe, and run-off road crashes
Retroreflective strips on signposts	Reflective material added to signposts	Improve visibility and recognition of stop-controlled intersection or crosswalk
Post-mounted delineators and chevrons	Reflective devices mounted above the roadway and along the side of the roadway to indicate roadway alignment	Reduce crashes and speeds in curves
In-street pedestrian crossing signs	Signage alert road users to pedestrian crossing zones	Increase driver's recognition of upcoming crosswalk
Raised pavement markers	Reflective markers added along the edgeline or centerline	Reduce crashes on roads, especially if roadway is prone to snow or water accumulation
Crosswalk visibility enhancements	Pavement markings and signage identifying where the crosswalk is located	Reduce risks to pedestrians by indicating the crosswalk location to roadway users
Flexible delineators	Recognizable, flexible vertical posts	Can provide guidance at night or during severe weather
Concrete Wheelstops	Precast concrete wheel stops used in parking lots.	Provide substantial physical separation to delineate space on the road for non-motorized users, particularly on higher-speed roads
Bollards	Short vertical posts affixed to the ground	Improve channelization of all travel modes at key locations where traffic conflicts are more likely to occur

Larger Investment Countermeasures

Countermeasure	Description	Safety Issue Addressed
Medians	Paved or grassy islands located between opposing lanes of traffic that may include crashworthy barriers	Separate motorized and nonmotorized users to better protect crossing pedestrians and reduce high-severity head-on vehicle-vehicle crashes
Roundabouts	A circular intersection or junction where road traffic flows in one direction around a central island	Significantly reduce conflict points from traditional stop-controlled or signalized intersections and greatly reduces the severity of crashes due to lower operating speeds and less-severe angles
Pedestrian refuge islands	A median with a pedestrian refuge area	Provide intermediate points for pedestrians to stop at when crossing multiple lanes of traffic

Separated Bicycle lanes	Delineated parts of the right-of-way exclusively for bicycling	Reduce potentially risky interactions between bicycles and motorized vehicles trying to share the same road lanes
Road diet	Reduce four-lane undivided roads to two lanes plus a center turning lane, often adding bicycle lanes	Reduce crashes by calming traffic and mitigating the consequences of distracted driving
Median barriers	Barriers that separate opposing traffic on a divided highway	Reduce head-on crashes with opposing traffic
Bollards	Short vertical posts affixed to the ground	Direct traffic to designated areas and keep motorized vehicles from veering off course
Pedestrian hybrid beacons	A pedestrian-activated warning device located on the roadside or mounted over mid-block pedestrian crossings	Increase driver awareness of pedestrian crossing mid-block or at unsignalized intersections
Shoulder widening	Replace unstable or narrow shoulders with wider shoulders	Increase usable width for all vehicles, especially emergency response services
Pavement edge improvements	A modification to asphalt paving equipment that result in a sloped edge in place of a vertical edge at the outside shoulder	Reduce the risk of a driver overcorrecting as they reenter the roadway and losing vehicle control
Roadside barriers	A physical, and often large, device placed along the roadside	Help keep vehicles within the roadway and prevent them from steep slopes and hazards or colliding with objects
Widening clear zones	Eliminating, relocating, or redesigning fixed objects such as utility poles, culvert headwalls and other structures, and removing trees in high-geometric risk locations	Reduce the risk of vehicle-object collusion in the event of roadway departures
Crashworthy appurtenances	Traffic control devices or signs that have been successfully crash tested	Reduce crash severity by preventing a roadway departure in the event of a crash
Traffic Signal Improvements	Signal optimization	Improve traffic flow, allow for pedestrian phases, transit priority, bike signal phases
Colored surface treatments	Uniform color treatments to delineate dedicated ROWs	Create dedicated space for buses, bikes, or pedestrians on the roadbed
High-friction surface treatments	Pavement treatments to improve driving conditions	Reduce crashes, injuries, and fatalities associated with wet or otherwise hazardous conditions

Key Takeaways on Safer Roads

- Incorporating a Complete Streets design approach can improve accessibility, mobility, and connectivity, as well as safety.
- Hardware like signage and barriers can help to reduce crash severity.
- Physical road modifications that can improve road safety outcomes can include low-cost, high-impact countermeasures and implementation strategies.

For more information:

- Institute of Transportation Engineers Safe System
- National Roadway Safety Strategy Safer Roads
- Federal Highway Administration Potential Risk Factors
- Federal Highway Administration Vulnerable Road User Assessment Guidance
- Federal Highway Administration Low-Cost Safety Improvement for Rural Intersections
- Federal Highway Administration Road Safety Audits
- Federal Highway Administration Complete Streets
- Federal Highway Administration Proven Safety Countermeasures
- Federal Highway Administration Local Road Safety Plans
- Federal Highway Administration Manual on Uniform Traffic Control Devices for Streets and Highways

SAFER VEHICLES

Implementing vehicle safety measures can have substantial impacts on road safety outcomes. Some vehicle safety improvement measures are physical and improve crashworthiness, like seat belts and air bags. At the same time, electronic sensing technologies can improve crash avoidance by detecting roadway changes or barriers to alert the driver.

Vehicle-based solutions can also improve driver behavior by, for example, mitigating the risks of impaired driving. Means to accomplish this include ignition interlock systems help prevent intoxicated drivers from operating a motor vehicle after they've had a repeated instance of impaired driving.

Federal Motor Vehicle Safety Standards

In the U.S., the Federal Motor Vehicle Safety Standards (FMVSS) are established and enforced by the U.S. Department of Transportation's (USDOT) National Highway Traffic Safety Administration (NHTSA). Vehicle manufacturers must self-certify that their vehicles and equipment comply with the FMVSS. The FMVSS are divided into three categories: crash avoidance, crashworthiness, and post-crash survivability. Other countries similarly have their own vehicle safety standards and processes for certifying manufacturers and testing vehicles, such as the Canada Motor Vehicle Safety Standards.

Sources: Regulations - NHTSA, Safety Standards for Vehicles

In-vehicle systems can help reduce driver distraction by preventing the use of cell phones while the vehicle is in motion. Vehicles are equipped with a combination of physical and electronic safety features that can be technologically simple or highly complex.

Physical Vehicle Safety Features	
Air Bags	Inflatable cushions built into a vehicle that protect the driver and passengers from hitting the vehicle interior or objects outside the vehicle.
Seat Belts	Cross-body belts are designed to restrain and protect drivers and passengers against the frontal or lateral momentum during a collision or sudden stop. During normal vehicle operations, inertial reels will allow occupants freedom of movement. However, the event of a collision or sudden stops, pretensioners will tighten the belts and lock them in place.
Deformation Zones	Also known as crumble or crush zones, these areas on a vehicle are designed to absorb the kinetic energy of a crash in a controlled manner.
Reflectivity	A fixed reflex reflector designed to reflect light and provide visibility of and to a person or vehicle visible on the road.
Reinforced Occupant Compartments	Occupant compartments are the spaces in the vehicles that the driver and passengers occupy. Improved occupant compartment integrity leads to reduced injuries in a collision due to intrusion.
Collapsible Steering Columns	In the event of a frontal collision, collapsible steering columns impact and reduce the airbag effect on occupants.
Energy Absorbing Dash & Seat Structures	Energy absorbing materials used in the dashboard and seat structures to absorb energy in a collision to protect occupants.

Electronic Vehicle Safety Features

Backup Camera	A backup camera, also known as a rearview video system, helps prevent backover collisions with persons outside and to the rear of a vehicle.
Blind Zone Warning	Alert for drivers with an audio or visual warning if there are vehicles in adjacent lanes that the driver may not see when making a lane change.
Automatic Emergency Braking	Automatically applies the brakes when a potential for a collision is detected.
Anti-Lock Braking	Applies an anti-skid braking system that prevents wheel lock-up and restores traction to tires in sudden stops and slippery roadway conditions.
Speed Adaptation	Automatically adjusts a vehicle's speed to keep a pre-set distance between that vehicle and the vehicle in front of it.
Automatic Lights	Automatically turns on a vehicle's headlights in dark conditions and switches the vehicle's headlights between low and high beams when an oncoming vehicle approach based on lighting conditions and traffic.
Collison Warning	Many different systems working together to alert the driver of a potential collision. These systems alert the driver of several potential collision types – forward, blind spot, rear, cross traffic, fixed objects, pedestrians.
Lane Assistance	Alerts the driver as the vehicle approaches or crosses lane markers and actively helps keep the car in its lane.
Lane Departure Warning	An alert to the driver when the car is leaving its lane.
Automatic Crash Notifications	A system that notifies emergency responders that a crash has occurred and provides its location.
Motorcycle Stability Control	A system that adjusts brake pressure on each wheel independently to maintain maximum traction (electronic stability control) and regulates the maximum engine torque if the rear wheel spins during acceleration (traction control).
Anti-Lock Braking System (Motorcycles)	Motorcycle anti-lock braking systems work to stop the wheels locking via wheel speed sensors that detect the rate at which the wheels are spinning. These sensors relay the rotational speed of the wheel and detect if the wheel has stopped rotating, sending a signal to the bike's control system (electronic control unit). This technology is present on about 60 percent of motorcycles on the road in the U.S.

Rating systems that provide comparative performance information can be a valuable strategy for governments to measure and evaluate vehicle safety and enable consumers to identify and purchase safer vehicles. The U.S. Government created the New Car Assessment Program (NACP) and 5-Star Safety Ratings Program to provide information about the crash protection and rollover safety of new vehicles beyond what is required by law. These ratings help consumers quickly and simply gauge the safety rating of cars on the market and make an informed decision. National governments should establish minimum vehicle safety standard and leverage vehicle safety ratings to encourage improved vehicle safety industry wide. National agencies should work with both manufacturers and local governments to collect and report information on lagging (i.e., post-crash) indicator metrics such as:

- Number of roadway fatalities
- Rate of fatalities per vehicle miles traveled (VMT)
- Number of serious injuries
- Rate of serious injuries per VMT
- Number of combined non-motorized fatalities and non-motorized serious injuries

Source: Motortrend

Governments should work with relevant stakeholders to establish data collection timeframes, reporting methodologies, and evaluation processes. Understanding how vehicles historically and currently impact road user safety is critical to establishing and amending the standard manufacturers must comply with.

The Global Plan for the New Decade of Action for Road Safety (2021-2030) recommends that countries make increased use of technologies to increase the safety of both people inside and outside the vehicle. Many newer vehicles include increasingly advanced and complex systems of sensors, controllers, displays, and other instruments to electronically improve safety and vehicle performance. Ensuring the safe and reliable performance of these advancements require government agencies to reassess their safety standards alongside evaluation of current and emerging vehicle technology advancements. Data collection and analysis are key to identifying the need to amend existing vehicle safety standards and developing new ones. The impetus for new standards can come either from a legislation at the national or sub-national level, or from a new technology or vehicle design that may have difficulty in complying with existing applicable standards or in achieving a sufficient level of reliability or effectiveness. For example, NHTSA's method for developing and adopting new standards and amending existing ones includes interpretating statutory laws from the authority, conducting research to validate performance metrics and test procedures, conducting regulatory impact analyses, conducting notice-and-comment rulemaking, and eventually carrying out defects and enforcement actions.

How do vehicle types influence a government's safety standards?

The type of vehicle is important for governments to consider when developing and implementing vehicle safety standards. This toolkit considers multiple vehicle types: commercial motor vehicles (i.e., trucks and vans not for personal use), passenger vehicles e.g., passenger cars, trucks and vans for personal use, and sports utility vehicles), PTWs (i.e., motorbikes/cycles and scooters), and buses. Some countries, such as Thailand and Vietnam, have significantly higher shares of PTWs than passenger vehicles. Approximately 80 percent of households in Thailand, Vietnam, Indonesia, and Malaysia own a motor scooter.[11] In 2021, per the data available, road deaths decreased in 2021 across the 31 countries who IRTAD Road Safety Annual Report – except for users of PTWs. Road safety on a motorbike can be influenced by how large the engine and engine capacity are.

Source: Vehicle Size Differences

The size and weight of a vehicle impacts the vehicle's collision response. For the vehicle's occupants, larger vehicles can often provide greater protection through a sturdier frame and chassis. In larger vehicles, the longer distance from the front of the vehicle to the occupant can mitigate the risk to the occupants in front crashes. While larger vehicles may be safer for the occupants in those the vehicles, when those vehicles collide with smaller vehicles, they make things less safe for those in the smaller vehicles and the people outside of those larger vehicles (e.g., pedestrians). Larger vehicles can pose greater safety risks by virtue of having more weight and surface area to collide with. The weight of a vehicle directly contributes to a vehicle's kinetic energy and the potential injury severity as a product of a crash. Because of this, when a larger vehicle collides with a smaller vehicle, the occupants of the latter are at greater risk of injury than the occupants for the former. To protect people outside the larger vehicles, protective measures like underride guards and direct vision standards are important. Underride guards are steel bars attached to the back of larger trucks to prevent a passenger vehicle from sliding under those trucks in the event of a rear crash (known as an underride crash).

Key Takeaways on Safer Vehicles

- Motor vehicles are equipped with physical and electronic safety features to aid in the mitigation or prevention of road crashes.
- Governments should work alongside the motor vehicle industry to develop and enforce safety standards.
- The size and weight of a motor vehicle can impact safety outcomes relevant for to other road users when a crash occurs.

[11] Car, bike or motorcycle? Depends on where you live, Pew Research Center

For more information:

- World Health Organization Vehicle Safety Standards
- National Highway Traffic Safety Administration 5-Star Safety Rating
- National Roadway Safety Strategy Safer Vehicles
- National Highway Traffic Safety Administration Federal Vehicle Motor Safety Standards (FVMSS)
- United Nations 2030 Agenda for Sustainable Development
- OECD Recommendations of the Council on Regulatory Policy and Governance

SAFER SPEEDS

Source: Adobe Stock

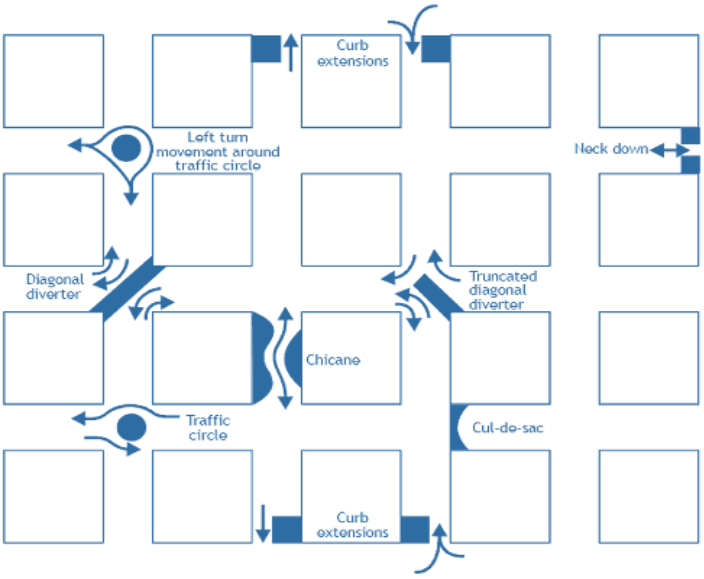
Motorized vehicle speeding (traveling faster than the posted speed limit or driving too fast for conditions) is a safety concern for all motorized and nonmotorized travelers. In Europe, approximately 10-15 percent of all crashes and 30 percent of fatal crashes are speed-related.[12] Vehicle speed is a significant indicator of roadway safety. Studies clearly show that higher speeds result in greater impact at the time of a crash, which leads to more severe injuries and fatalities. Setting context appropriate speed limits is a key part of the Safe System Approach. When setting appropriate speed limits, it's important to incorporate the needs of all road users rather than focusing on vehicle operational speeds. Setting appropriate speed limits reduce the risk drivers impose on others, especially VRUs and on themselves. Creating road environments that promote safe access and ease of travel for all modes of transport requires intentional roadway design, targeted education, outreach campaigns, and context-appropriate enforcement measures.

Speed Safety Cameras (SSCs) are an effective and reliable technology to supplement traditional enforcement, engineering, and education to reduce speeding behavior. Agencies should conduct a network analysis to identify locations to implement Speed Safety Cameras and only install them in coordination with infrastructure changes. It is to be noted that SSCs should not be used primarily for revenue generation but as a tool to curb speeding habits.

Implementing reduced speeds requires governments to strategize on how they will determine, communicate, and enforce speed limits for their jurisdiction. Many motor vehicle drivers may need to be aware of the ways speed limits changes can impact crash frequencies. Governments should prioritize strategies such as surveys, focus groups, and open houses to gather feedback directly from communities affected by areas of high crash frequencies and a need for appropriate speed limits. Designing education strategies that effectively combat speeding behaviors must consider the primary reasons people speed, such as evading traffic congestion, running late, and experiencing distractions. Some public campaigns are focused on communicating crash fatality statistics and how speeding can increase chances of death or serious injury on the road.

[12] Road Safety Thematic Reporting: Speeding, European Road Safety Observatory, 2020

How Can Agencies Design Roads to Reduce Vehicle Speeds?



Source: FHWA

Governments might find motorists traveling at reduced speeds can be achieved through roadway design and engineering. Implementing a self-enforcing road is a method of designing or altering roadways that guide road users toward safer speeds. These specific design elements alter driver behavior to be more cautious, improving travel conditions for motorists and non-motorists. Infrastructure modifications to induce driving at lower speeds can often be achieved through low-cost modifications including diagonal diverters, curb extensions, speed humps/bumps/tables, center islands, or curved road alignments. Similarly, complex road environments, like higher-density urban environments, can induce lower speeds by signaling to motorists that an area might have heavier pedestrian traffic. Reducing speed through roadway design can be a low-cost option that also adds to roadway aesthetics, such as using planter boxes to create curb extensions.

Increasing safety with speed reduction in Buenos Aires, Argentina

In 2016, Argentina documented 5,530 fatalities resulting from road traffic incidents, highlighting safety concerns inherent in urban road networks, particularly in zones characterized by close vehicular-pedestrian interactions.

The Autonomous City of Buenos Aires, in collaboration with the Partnership for Healthy Cities and local stakeholders, has been actively engaged in enhancing road safety since 2017. A recent initiative targeted the densely populated transit hub along Saénz Avenue in southern Buenos Aires, prompted by its disproportionately high pedestrian fatality rates. A 2020 study of speeding behaviors identified Saenz as one of four points in the metropolitan area with the highest number of incidents involving vehicle users and pedestrians. Findings revealed that around 8% of drivers exceeded speed limits, with buses and trucks exhibiting a notably higher propensity for speeding. Supported by the Partnership and the World Resources Institute, a series of anti-speeding measures were deployed following the study.

The interventions at Saénz Avenue encompassed various anti-speeding measures, notably the implementation of a reduced 50km speed limit. Traffic calming techniques such as elevated crossings were installed to enforce lower bus speeds. A central crossing island was introduced to bolster pedestrian protection. The city implemented a road diet and removed a full traffic lane to accommodate continuous pedestrian crossings and expanded sidewalks. Projections indicate a 35% reduction in severe crashes attributable to the island's addition and a 15% decrease facilitated by the lane removal. Simultaneously, the new crossings aim to mitigate pedestrian injuries and fatalities by motor vehicles by up to 6%. According to a report by the World Resources Institute in 2023, there has been a decrease in the percentages of buses exceeding the speed limit at all observation points. Speeds above 40 km/h dropped to zero at redesigned intersections. Community surveys indicate that pedestrian's safety perceptions of the area have increased 42%.

Source: Buenos Aires: Improving safety by reducing speeding

Saenz Avenue before (top) and after (bottom). Source: WRI

Key Takeaways on Safer Speeds

- Agencies must set speed limits that reflect the maximum reasonable and safe speed for typical traffic conditions.
- To optimize effectiveness, law enforcement strategies should be coupled with communications and community engagement strategies.
- Infrastructure design can be leveraged to encourage drivers to be more cautious, improving travel conditions for motorists and non-motorists.

For more information:

- Federal Highway Administration Speed Safety Cameras
- Federal Highway Administration Speed Management
- Federal Highway Administration Appropriate Speed Limits for All Road Users
- National Association of City Transportation Officials Speed Limit Changes Have Big Impacts
- U.S. Department of Transportation Traffic Calming to Slow Vehicle Speeds
- National Highway Safety Administration Reduce and Enforce Speed Limits
- National Association of City Transportation Officials Speed Reduction Mechanisms
- National Highway Safety Administration Speeding and Aggressive Driving Prevention

POST-CRASH CARE

Source: NHTSA Post-Crash Care

The ability to save lives does not end when a crash occurs. Appropriate medical care for people injured in a crash can prevent their injuries from becoming fatal. In the U.S., EMS clinicians respond to nearly 1.5 million motor vehicle crashes on the nation's roadways every year. Saving lives following a car crash depends on a well-resourced EMS system that can provide the right care at the right time. Ensuring that high-quality EMS care is accessible and available is critical to effective post-crash care. This is especially true in rural communities with limited access to medical care, where response times are longer and EMS resources are more limited. Communicating goals with EMS providers allows for efforts to be made in tandem to achieve zero fatalities and create another layer of protection. Notification of a crash to 911 is critical to deploy expedient EMS. While efforts to improve EMS systems are critically important to provide safeguards for when crashes do happen, ultimately, the goal is still to see zero fatalities.

How Can Effective Post-Crash Care Save Lives?

Post-crash care is the last line of defense to prevent fatalities and serious injuries. Approximately 40 percent of crash victims were alive when first responders arrived on the scene of the crash, but later died.[13] Shortening the time that it takes EMS staff to be notified and to get to the site of a serious crash is critical to offering lifesaving care. One important factor in shortening response time is offering accessible emergency communication. When a crash occurs, the public most frequently requests help from first responders by placing a call to the national emergency contact number, 911, this initiates emergency communications.. Working with agencies across the transportation and medical sectors to identify strategies and operational processes that can shorten response time and improve delivery of EMS are critical steps to take in improving overall road safety.

[13] EMS & Post-Crash Care | EMS.gov

In addition to providing important medical care, EMS staff collect and share important crash data. A centralized emergency services information system will allow for more uniform data collection that can be shared nationally and contribute to better strategic planning for future EMS systems.

Traffic Incident Management

Traffic incidents are unplanned roadway events that affect or impede the normal flow of traffic. These include crashes, breakdowns (e.g., flat tire), and other issues. Crashes and other roadway incidents affect travel reliability and the performance of transportation systems. One of the essential responsibilities of transportation and public safety agencies is to ensure the safe and quick clearance of traffic incidents. It is important to create an environment that is safe for first responders and prevents secondary crashes from happening through robust traffic incident management practices. It is crucial to have a plan in place to clear and safely manage the scene of a crash to provide a route for first responders and to allow other vehicles to pass safely. Not only is this crucial for providing post-crash care but it also ensuring secondary crashes do not occur. Responding to traffic incidents can be a safety risk for first responders, and secondary crashes often cause injuries to first responders.

A Traffic Incident Management (TIM) plan is a coordinated effort by multiple stakeholders (e.g., transportation agencies, first responders, law enforcement officers, medical authorities) to detect, respond to, and quickly clear incidents so that traffic flow can be restored as safely as possible. An effective TIM plan supports policies and strategies that reduce the duration and impacts of traffic incidents and minimize the secondary crashes that can happen as a result. It also improves the safety of all road users, including crash victims and emergency responders.

Improving post-crash capacity in Moldova

In Moldova, while road crash fatalities have decreased by 44 percent in the last few decades, the road crash fatality rate remained high at about 12 per 100,000 population in 2020. The WHO has identified good post-crash care can help reduce fatalities by one-third. In 2013, a study in partnership with a British charity, FIRE AID, found that the emergency services in Moldova needed to improve its capacity to respond to roadway crashes. Moldova's first responders had very limited vehicle extrication and poor safety systems. FIRE AID provided professional training and access to decommissioned (but still usable) fire and rescue equipment to improve first-responder capacity in Moldova. Between 2013 and 2018, FIRE AID delivered 45 modern fire and rescue equipment and fully operational ambulances which have been used to respond to over 20,000 incidents. No equipment was donated without an initial assessment of whether Moldovan authorities would be able maintain the vehicles. To combat the challenges of procuring essential equipment and developing workforce training for first responders, the country established a national system for emergency calls with the simple number 112. This initiative reduces public confusion and reduces the time it takes for first responders to arrive on the scene of road traffic collision. Ultimately, it took cooperation between multiple stakeholders, political buy-in, and sustainable practices to radically change the success of first responders in Moldova.

Source: Case Study: Improving post-crash capacity in Moldova (itf-oecd.org)

Post-crash response also entails addressing the safety issue that caused the crash in the first place. Post-crash responders are the first line of data collection and following that initial data collection

and immediate crash response, it is important for agencies to use the data collected to address the safety issue. This is an integral step of the Safe System Approach: using traffic and crash data to resolve potential conflict points and safety issues that might be causing fatalities and injuries.

National Emergency Medical Services Information System

In the U.S., National Emergency Medical Services Information System (NEMSIS) is a national system used to collect, store, and share standardized EMS data from states. NEMSIS is a universal standard for how patient care information resulting from an emergency 911 call for assistance is collected. The uniform dataset and database help local, state, and national officials and stakeholders assess their emergency medical services needs and performance and document successes and strategies for shortening response time and providing quality care. The dataset also facilitates cost-benefit analyses.

For more information: What is NEMSIS - NEMSIS

Key Takeaways on Post-Crash Response

- Post-crash care is the last best chance to prevent fatalities or serious injuries. Shortening the time that it takes to get well trained EMS staff to arrive at the site of a crash is critical to offering lifesaving care.
- A Traffic Incident Management (TIM) plan is a coordinated effort by multiple stakeholders to detect, respond to, and quickly clear incidents so that traffic flow can be restored as safely as possible.

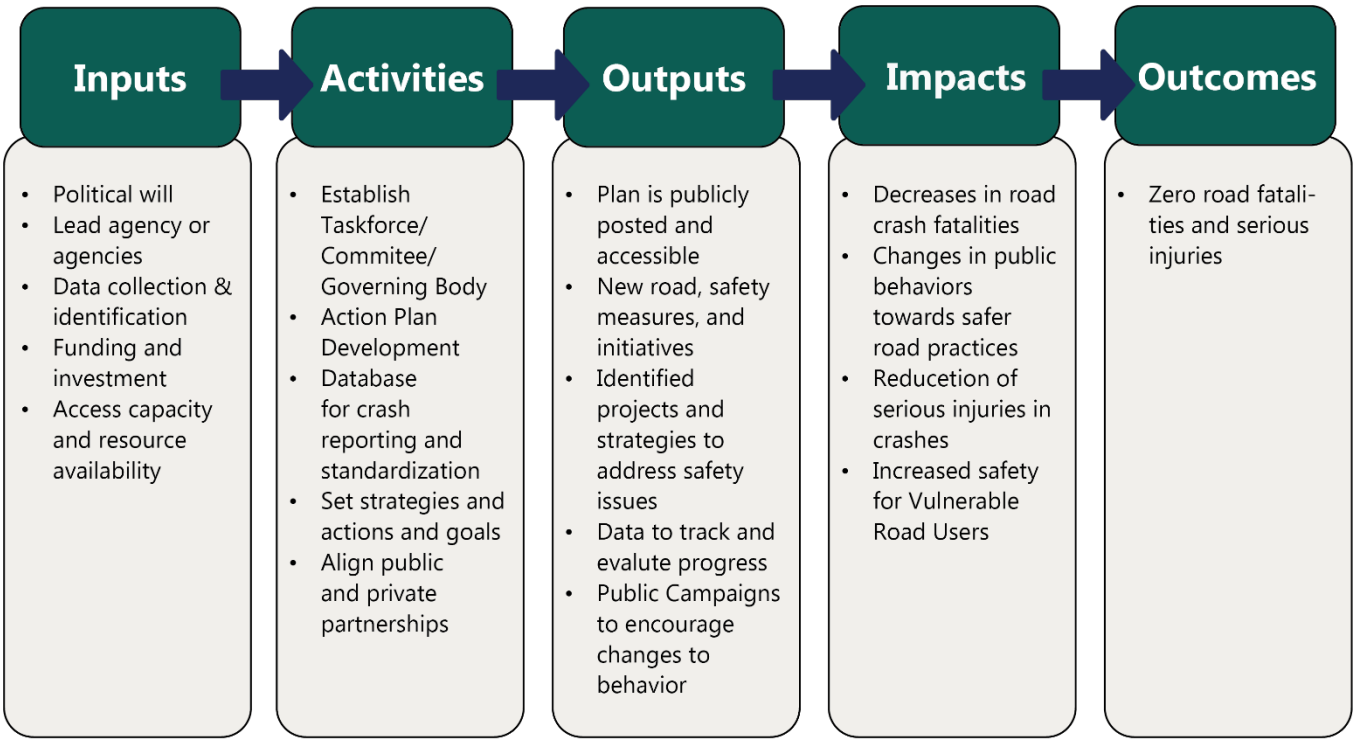
For more information:

- U.S Department of Transportation Post-Crash Care
- U.S. National 911 Program
- National Highway Traffic Safety Administration Emergency Medical Services
- National Highway Traffic Safety Administration Post-Crash Care
- National Highway Traffic Safety Administration National EMS Information System (NEMSIS)
- U.S. Office of Operations Traffic Incident Management
- U.S. Department of Transportation National Road Safety Strategy and the Safe System Approach

PUTTING STRATEGIES INTO ACTION

The Safe System Approach is a strategy, guided by fundamental principles rooted in human behavior, infrastructure design, emergency response, and responsible oversight, to advance towards zero road crash fatalities. The strategies and steps in this toolkit are resources in achieving that goal. It is a commitment to a holistic approach to improve road safety. To achieve road safety goals, government agencies must commit the resources needed to address the issues. Once an agency has identified road safety goals, strategies, and resources, it is important to monitor success and track the strategies that work best and further implement change. The road to safety can begin in a singular city or neighborhood, it can start as pilot project or with high-impact and low resource changes. As momentum builds, monitoring success is a great way to encourage other areas in your country to adopt similar road safety strategies.

Governments can use the following logic model to guide the next steps in the process to implementing the Safe System Approach.



This approach requires support from local governments and politicians as well as communities. It cannot be achieved with sole support from only one agency or lead. Commitment from local leaders or governing bodies will create support for the strategies and shift public attention, resources, and funds towards improving road safety. This commitment must also come with goals or targets for the future that are tangible and achievable. To ensure an intentional and equitable approach to managing road safety alongside other priorities, government agencies should have broad representation, including community organizations representing historically overburdened populations, where decisions on road safety strategies are being made.

Engaging Stakeholder Through a Call to Action

The USDOT National Roadway Safety Strategy (NRSS) Call to Action acknowledges that the responsibility for roadway safety is on everyone and encourages government at all levels—law enforcement, industry, nonprofit and advocacy organizations, researchers, and beyond—to do their part to implement the Safe System Approach and make streets safer for people. It encourages people to join the NRSS Call to Action as a strategy to collaborate with stakeholders and improve commitment to a Safe System Approach. The Call to Action asks participants to specifically tell them what actions their taking including both new initiatives and expansions of longstanding commitments—to reduce serious injuries and deaths on roadways. They also ask participants for permission to publicize their commitment on the NRSS webpage further increasing accountability and buy-in. All "Allies in Action" are listed on the NRSS webpage with their respective commitments.

For more information: USDOT National Roadway Safety Strategy Home

GLOSSARY

Commercial Motor Vehicles: A vehicle having a gross vehicle weight rating (GVWR) of 4536.4 kg or more; designed to transport more than 15 passengers, including the driver; or transporting hazardous materials in quantities requiring the vehicle to be placarded.

Complete Streets: Streets designed and operated to enable safe use and support mobility for all users. Those include people of all ages and abilities, regardless of whether they are travelling as drivers, pedestrians, bicyclists, or public transportation riders.

Countermeasure: An action taken to counteract a danger or threat. A safety countermeasure is an action designed to counteract a threat to safety.

Crash Modification Factors (CMFs): A multiplicative factor used to compute the expected number of crashes after implementing a given countermeasure at a specific site.

Deformation Zone (also known as crumple or crush zones): Areas of a vehicle that take out the kinetic energy of a crash in a controlled way through specifically designed areas of the vehicle that deform and crumple during a crash to absorb the impact. Deformation zones are part of a range of built-in mechanisms that protect occupants of a car in case of a crash.

Direct Vision Standard: A policy mechanism requiring operators of commercial vehicles over a certain size to obtain a safety permit before operation. The standard measures the operator's visibility through the cab windows to indicate the level of risks to road users like pedestrians and bicyclists.

Distracted Driving: Drivers doing any activity that diverts attention from driving, this includes activities such as talking or texting on a phone, eating and drinking, talking to people in the vehicle, adjusting the stereo, entertainment, or navigation system.

Drowsy Driving: The combination of operating a vehicle when sleepy. This usually happens when a driver has not slept enough, but it can also happen because of untreated sleep disorders or shift work. Prescription and over-the-counter medications can also cause drowsiness, and alcohol can interact with sleepiness to increase both impairment and drowsiness.

Equitable Enforcement: The process of ensuring compliance with law and policy that considers and minimizes harms to underserved communities.

Impaired Driving: The dangerous combination of operating a vehicle while impaired by substances such as marijuana, illicit drugs, some prescription, or over-the-counter medicines, and/or alcohol.

International Road Traffic and Accident Database (IRTAD): A database that collects and aggregates international data on road crashes and provides an empirical basis for international comparisons and more effective road safety policies. The database includes validated data for 32 countries.

Model Minimum Uniform Crash Criteria (MMUCC): A standardized data set for describing motor vehicle crashes and the vehicles, persons, and environment involved.

Post-Crash Care: The practice of enhancing the survivability of crashes through expedient access to emergency medical services and care, creating a safe working environment for vital first responders, and preventing secondary crashes through robust traffic incident management practices.

Safety Performance Functions (SPFs): A mathematical relationship between frequency of crashes by severity and the most significant causal factors on a specific highway. SPFs can be used to predict the average number of crashes per year at a location as a function of exposure and, in some cases, roadway or intersection characteristics.

Self-Enforcing Roads: A roadway that is planned and designed to encourage drivers and non-drivers to select operating speeds consistent with the posted speed limit.

Traffic Incident Management (TIM): A planned and coordinated multi-disciplinary process to detect, respond to, and clear traffic incidents so that traffic flow may be restored as safely and quickly as possible. Effective TIM reduces the duration and impacts of traffic incidents; improves the safety of motorists, crash victims, and emergency responders; and reduces the frequency of secondary crashes.

Vehicle Miles Traveled (VMT): The total annual miles of vehicle travel divided by the total population in a state or in an urbanized area.

Vulnerable Road Users (VRU): Road users not in a car, bus, or truck, generally considered to include pedestrians, motorcyclists, bicyclists, children, the elderly, and users of mobility devices.

PRE-SCREENING SAFE SYSTEM APPROACH QUESTIONNAIRE

This Appendix presents a series of questions that will help you and your agency think through how you can use a Safe System Approach to build a safer more equitable transportation network. Additionally, if your agency is interested in partnering with *MOMENTUM* to share approaches or learn more about the Safe System Approach, answering these questions in advance of reaching out will help improve the quality of the cooperation between your agency and the U.S. DOT. Consider the following questions:

- **What are the most pressing road safety concerns for the government?**
  - Where do they occur?
  - How often do they occur?
  - What types of road facilities and vehicles are most often involved?
- **What are the government's road safety priorities?**
- **How does your government expect to reach or achieve zero roadway fatalities and serious injuries? And does it include a specific target date?**
- **What is your country's lead agency for road safety? How does your agency work with lead road safety agency?**
- **How does your agency assess the safety risks and outcomes on the road network?**
- **Does your government collect data on road crashes, including injuries and fatalities? If so, who collects it, reports it, and analyzes it?**
- **What current strategies does the government employ to address road safety concerns?**
  - Does the government's road safety strategy currently include a Safe System Approach?
  - Does the leadership in your government support a Vision Zero or Safe System Approach for your country's road safety planning?
- **What sources of funding are available to the development of the Safe System Approach?**
- **How is the government working with or supporting sub-national or local governments in road safety efforts?**
- **In what ways does the government engage meaningfully with the public when developing road safety strategies, plans, and policies?**
- **What additional strategies could the government employ to improve road safety?**
- **What questions do you have about adopting and implementing a Safe System Approach in your country?**

For more information about roadway safety and the Safe System Approach, or to learn more about partnering with Momentum, please contact us at momentum@dot.gov.