The Road to Zero: Taking a Safe System Approach

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“Imagine that, in 2050, not a single person in the United States dies in a traffic crash.”

This powerful—but hard-to-imagine-scenario—is the premise behind a comprehensive stakeholder effort captured in the RAND report for the Road to Zero (RTZ) Coalition titled, The Road to Zero: Achieving Zero Deaths by 2050. The report further describes what a future 2050 could look like:

Given that it’s impossible to eliminate human error entirely, planners and engineers began thinking of ways to design roads and vehicles to accommodate human error to make the entire system safer. This was paired with efforts toward creating a “Safety Culture” that emphasizes the value of safety in every decision made by every person. Safety has become a shared responsibility among those who use the system and those who design and operate the system. A whole generation is now using these approaches.

But how is this scenario possible—especially 30 years in the future, at a time when the U.S. population is estimated to soar above 400 million? In 2019, an estimated 38,000 people lost their lives on U.S. roadways, according to the National Safety Council (NSC). While this figure represents a slight decline in fatalities from the previous two years, the number of pedestrian deaths has risen, and the amount of people lost to these preventable crashes has been deemed unacceptable by transportation professionals everywhere.

ITE firmly believes that getting to zero by 2050, as described in the RAND report, should be our goal, and is achievable with the right set of actions. That is why ITE has joined the RTZ effort to prevent crashes by adopting best practices and utilizing technology that can change the way our roads are used, and how users are affected.

This article will describe the Road to Zero Coalition, ITE’s role in this Coalition’s efforts, and the Safe System Framework that can help guide changes in practice by infrastructure owners and operators that can support this effort to reach zero roadway fatalities by 2050.

Road to Zero Coalition

The Road to Zero (RTZ) Coalition was established in 2016 through the leadership of the US Department of Transportation and the NSC. The RTZ Coalition’s purpose is to bring together a broad coalition of organizations in support of the goal of achieving zero roadway deaths in the United States by 2050. The Coalition is managed by the NSC and is made up of more than 1,500 professional associations, business and industry associations, safety groups, government agencies, and non-profit organizations. ITE is a member of the RTZ Steering Committee and a founding member of the Coalition. Other partners that make up the RTZ Coalition are federal, state, and local officials; auto manufacturers and technology developers; emergency medicine and trauma academics, practitioners, and advocates; safety researchers and advocates; business community and fleet owners, and more. All RTZ stakeholder groups are providing leadership within their industries and greater communities, prioritizing achieving zero roadway fatalities by 2050.

To help the RTZ Coalition work to achieve zero deaths by 2050, NSC commissioned the RAND Corporation to help the RTZ Coalition create an overall vision and strategy. Three intensive workshops were held in 2017 to discuss the group’s vision, goals, approaches, potential obstacles, and strategies. As a result, three interrelated approaches were determined.

1. Double Down on What Works – draw on the accumulated body of evidence-based countermeasures and network of professionals who can deploy them;
2. Accelerate Advanced Technology – identify and prioritize both existing and emerging safety applications and maximize their potential in a 30-year timeframe;
3. Prioritize Safety – focus on methods to facilitate change including creating a Safety Culture and adopting a Safe System approach (discussed in detail below).

ITE has been an instrumental part of the Coalition since its founding. Jeff Paniati, ITE Executive Director and CEO, has been an active contributor to the RTZ Steering Committee and provided support for many of its early efforts. ITE was a recipient of a RTZ grant focused on speed management for safety. ITE Chief Technical Officer Jeff Lindley and Technical Programs Manager Sarah Abel led this effort (see sidebar on page 29).

After the completion of the RAND report, the RTZ Coalition transitioned its efforts from vision and strategy to implementation. National leaders were identified to serve as champions for each of the three approaches identified in the RAND report. ITE under the leadership of Jeff Paniati is guiding the effort to advance the Prioritizing Safety approach.

Under ITE’s leadership, a Prioritizing Safety Steering Committee and two working groups were formed—one on Safety Culture and a second on Safe System. More than two dozen leading national transportation and safety organizations and technical experts, including the Federal Highway Administration and the National Highway Traffic Safety Administration are participating in this effort. ITE is coordinating the overall effort and leads the Safe System work group. David Yang, executive director of the AAA Foundation for Traffic Safety, is guiding the Safety Culture work group. The efforts focus on supporting implementation by increasing the understanding and application of Safe System and Safety Culture concepts and practices in North America, identifying key tools and references, creating case studies from leading jurisdictions, and finding ways to integrate knowledge into practice.

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Resources. The Prioritizing Safety efforts have already produced a number of resources including Safety Culture and Safe System recorded webinars, identification of key resources applicable in the North America, and an initial Safe System resource webpage, an explanation and framework. More information can be found on the Road to Zero webpage hosted by the National Safety Council at https://www.nsc.org/road-safety/get-involved/road-to-zero. The Safe System related material is also on the ITE website under https://www.ite.org/technical-resources/topics/safe-systems/.

RTZ 2.0 – Prioritizing Safety
As described in the RAND report, “prioritizing safety requires methods to facilitate change. Key among these are creating a safety culture and adopting a Safe System approach. A pervasive safety culture is an essential ingredient for reaching zero roadway deaths and can be nurtured through awareness, education, and constant reinforcement.”

Safe System. A Safe System approach can help us get to zero fatalities through the aggressive use of roadway design and operational changes, shared responsibility for transportation safety, and protecting all users (pedestrians, bicyclists, older, younger, disabled, etc.) of the transportation system. Sweden was the first country to enact a Vision Zero policy as a formal goal to reduce roadway deaths and serious injuries to zero in 1997 (more information at http://www.welivevisionzero.com/vision-zero). This marked a fundamental shift to a shared responsibility and system based approach to improving safety, with increased attention on the design and designers of the roadway to prevent crashes and limit their severity. Following the introduction of Vision Zero in Sweden, numerous countries (Canada, Australia, New Zealand Sweden, The Netherlands, and the United Kingdom) and international organizations (i.e., World Road Association [PIARC/WRA], Organisation for Economic Cooperation and Development [OECD], World Resources Institute [WRI], World Health Organization [WHO], World Bank, FIA Foundation, International Road Federation) have explored and applied below principles and experienced success through a Safe System. The concepts that underpin the Safe System approach are:

- Human beings can make mistakes that can lead to road crashes.
- The human body by nature has a limited ability to sustain crash forces.
- It is a shared responsibility among stakeholders (road users, road managers, vehicle manufacturers, etc.) to take appropriate actions to ensure that road crashes do not lead to serious or fatal injuries.
- All parts of the system must be strengthened so that if one part fails, road users are still protected.
- A proactive approach should be taken to making the mobility system safe, rather than waiting for events to occur and reacting.

Safety Culture. As demonstrated in the Prioritizing Safety Wheel (Figure 1), Safety Culture must surround all we do and be advanced in parallel with the adoption of a Safe System approach to achieve maximum benefit. Safety Culture is defined as “the broad set of attitudes and beliefs that underlie people’s decisions,” according to the Road to Zero report. Safety culture affects judgment about priorities in individual behavior and support for collective decisions about what is most important in our communities. Getting to zero deaths will involve countless individual and collective decisions, and a strong safety culture is an essential prerequisite.” Safety culture must be advanced both within organizations responsible for protecting public safety and within the community itself.

Safe System Framework
A Safe System framework for achieving zero deaths by 2050 marks a shift in the way transportation professionals think about road-related crashes, injuries, and fatalities. Traditionally, responsibility has been placed largely on the user for driving safely (or walking, or biking, etc.), unimpaired and without distractions. In a Safe System approach, specific roadway and vehicle design techniques
can be used to help prevent crashes, or at least reduce the severity of injuries should a crash occur. Embracing a Safe System does not mean absolving the user of responsibility. Rather, it recognizes the important role that the planning, design and operation of the infrastructure can play. Two key Vision Zero concepts underpin the application of the Safe System framework by infrastructure owners and operators:

**Reducing Human Error.** Humans are fallible and will make errors. Safe System designs anticipate and reduce the likelihood of errors.

**Accommodating Human Injury Tolerance.** The human body has a limited ability to absorb energy. Safe System designs reduce or eliminate opportunities for crashes resulting in forces beyond human endurance.

The Safe System framework takes these two concepts and attempts to provide the practitioner with a methodology for applying them in practice.

**Reducing Human Error**

To reduce the likelihood of human error, there are three principles that transportation professionals can put into place.

*Separating users in space.* Creating separate spaces for different users creates physical separation enhancing safety. Elements such as separated bike lanes, pedestrian refuge islands, and protected left-turns physically separate cars from vulnerable users helping reduce the likelihood of a crash and injury/death.

*Providing space for recovery* is also key in the Safe System approach, particularly in rural areas. Studies have found that shoulder width and clear zones can lead to an increase in safety. To separate users in time allows different users to use the same space at different times. For example, a pedestrian scramble phase at a traffic signal provides pedestrians with exclusive use of the intersection and ensures that pedestrians are not crossing at the same time cars are turning.

*Improving user awareness, attentiveness, and performance.* Improving the performance of all road users increases the likelihood of safety, and can be achieved through these measures:

1. **Increase pedestrian/bicyclist visibility** (and other non-motorist users). Seventy percent of pedestrian fatalities occur at night, according to the National Highway Traffic Safety Administration. Increased visibility can be achieved through designs that place pedestrians in a more visible position to drivers at intersections, encouraging pedestrians to wear reflective colors at night, increased lighting, etc.

2. **Increase attentiveness by limiting distractions for all users** (cell phones use when driving and walking, other in-car activities not related to driving). To decrease distractions, applications and programs that incentivize and reward

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**ITE Develops Speed Management Resources with RTZ Grant**

In 2018, in collaboration with the Vision Zero Network, ITE received a RTZ Grant, to advance speed management within the context of a Safe System approach in the United States.

Through this grant, ITE developed tools and resources to support a Safe System approach to setting speed limits. ITE developed a resource hub, found on the Setting Speed Limits section of the ITE website. Several resources are available there, including an explanation of the elements of speed management for safety; webinars; case studies; and an online community portal where speed management is discussed. Two speed management workshops were held in Austin, TX, USA and Durham, NC, USA in 2019 to advance discussions on how these resources could be applied in real-world settings.

ITE has also increased its focus on identifying broader efforts by others who integrating speed management in a Safe System approach. The April 2019 issue of ITE Journal included two articles on the Safe System approach: “Speed, Kinetic Energy, and the Safe System Approach to Safer Roadways” from the Highway Safety Research Center, and “Canada and the Safe System Approach to Road Safety” by Neil Arason.

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**Figure 2: Key behavior identified in the AAA Foundation 2017 Safety Culture Index that resulted in transportation safety concerns.**

- Texting/talking on the phone
- Driving drowsy
- Speeding
- Running red lights

Source: National Highway Traffic Safety Administration

AAA Foundation
safe behaviors should be developed. For example, the Texas A&M Transportation Institute is working on a program that provide rewards for users who do not access their phone during a trip. In-vehicle systems that help prevent use of cell phones while the vehicle is moving to minimize distraction.

3. Decrease impairment by all users. The use of alcohol and drugs—prescription or illicit—is known to cause fatal and serious crashes. Increased enforcement alone will not prevent users from getting behind the wheel when they should not. Data linkage is one promising strategy, which pulls together driving records, adjudication, and citations to show the community and law enforcement who should not be behind the wheel.

Accommodating Human Injury Intolerance

In the Safe System framework, accommodating human injury intolerance is the second key element. Two principles are at play in helping humans survive a crash and limit their injuries: reducing speed, and limiting impact forces. Reducing speed in the presence of vulnerable users is a key Safe System strategy.

Reduce Speeds. The laws of physics dictate that greater harm will occur at high speed, and that, the greater the mass of a vehicle the more harm that it will inflict on others. Reducing speed in the presence of vulnerable road users is a key Safe System strategy. In urban areas this strategy starts will reassessing speed limits and moving toward the use of context-specific target speeds in lieu of the 85th percentile speed for speed limit setting. The use of traditional or automated enforcement is also a key tool to support lower speeds. However, lower speed limits and enforcement along are unlikely to result in sustained decreases without accompanying changes in the infrastructure. These changes can include narrowing the width of the traveled lanes and introducing horizontal alignment changes to reduce free flow speeds, using traffic calming treatments, or implementing traffic signal timing changes to minimize high speed flow.

Reduce Impact Forces. A variety of methods can increase crash survivability by reducing impact forces. Traditionally, this has been accomplished by protecting the user inside a vehicle by improving the crashworthiness of the vehicle, advocating the use of restraint systems and through mitigation devices such as air bags. Similarly, roadside hardware has been designed to improve crashworthiness through the use of guardrails and crash cushions to protect drivers from hazards and breakaway devices to lessen impact forces.

The angle of a vehicle also has an influence on crash impact. At 90 degrees, there is a large amount of kinetic energy transferred between the vehicle and the colliding object. That kinetic energy drops off as the angle decreases, so transportation professionals can reduce the severity of a crash by employing designs that lessen speed and angle. The roundabout is one of the most common and impactful ways to reduce both these elements.

This framework represents starting point for the development of a Safe System toolbox that can aid practitioners in the implementation of design and operational treatments that will save lives and reduce serious injuries. Additional development of this framework is needed to fully incorporate lessons learned from other countries that are applicable to the United States. The development and trial of novel or innovative techniques needs to be encouraged and expanded so there are more tools available to address the wide

Figure 3. Vehicle impact speed and a pedestrian’s chances of survival.
range of roadway environments and users found across the United States. The Safe System approach is a work in progress, and it will take the dedication and commitment of transportation leaders and those in other industries to help fully realize zero deaths by 2050.

Next Steps
Currently, the Prioritizing Safety Steering Committee and the Safe System and Safety Culture working groups are developing a Prioritizing Safety Roadmap and Action Plan that will guide RTZ efforts in the coming years. This Roadmap and Action plan seeks to identify near term (within one year), mid-term (two to five years) and long-term (five-plus years) efforts that could be undertaken by the RTZ Coalition, its members or others. The goals of this Roadmap and Action plan are to make safety a priority in the United States, to increase the adoption of safety culture at the organizational and community levels, and to advance the practice of Safe System techniques. More information on the Roadmap and Action Plan and near term efforts to be undertaken by the RTZ Coalition will be available later this year. Itel

References

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Jeffrey A. Lindley, P.E. (F) serves as associate executive director and chief technical officer for ITE, where he leads the development and delivery of technical activities focused on serving the needs of the organization’s 16,000+ members. Prior to joining ITE in October 2016, he completed a 31-year career with the Federal Highway Administration, serving in a variety of technical and leadership positions, including California division administrator, associate administrator for safety, and associate administrator for operations. Jeff holds a bachelor’s degree in civil engineering from Virginia Tech and a master’s degree in transportation engineering from the University of Maryland. He is a registered engineer in the state of Virginia.

Jeffrey (Jeff) F. Paniati, P.E. (F) is the executive director and CEO of ITE. Prior to joining ITE in October 2015, Jeff had a 32-year career with the Federal Highway Administration (FHWA), including serving as Executive Director from 2008–2015. As executive director he was responsible for the day-to-day operations of the agency, overseeing 2,900 transportation professionals and a $400 million operating budget. Under Jeff’s leadership, FHWA was recognized as a Best Place to Work by the Partnership for Public Service. Jeff has received numerous honor awards, including the prestigious Presidential Rank Award of Distinguished Executive. He has been inducted into the University of Connecticut Academy of Distinguished Engineers, the ITS America Hall of Fame, and the ITS World Congress Hall of Fame. He has a bachelor’s degree in civil engineering from the University of Connecticut and a master’s degree in civil engineering from the University of Maryland. He is a register engineer and an ITE Fellow.