Thank you for the invitation to be here and speak with you all about the Safe System approach. We will be presenting this slide deck that we recently supported FHWA in developing as they launch their support of and education around the Safe System approach.

Key Message: This shows the outline for our presentation today
Interactivity: No interactivity for this slide.
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Notes: No notes for this slide.

Working toward zero deaths is our goal. How is this practically achievable?

Source: Fehr & Peers

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Key Message: Imagine in the coming decades that not a single person in Alameda County dies in a traffic crash. This is our shared regional goal of toward zero deaths. Thinking about safety this way requires a paradigm shift in how we perceive the problem. Rather than accepting fatalities and serious injuries as a price for mobility, the philosophy of the Safe System approach is grounded in an ethical imperative that no one should be killed or injured when using the roadway system. The following slides introduce the concept of the Safe System approach—how it's been applied globally and how it's being implemented in the United States.

How does Alameda CTC work toward zero deaths? Alameda CTC incorporated Safe Systems as part of the CTP and commited to safe system being a priority that should permeate all projects and program implementation activities, policies, and funding. This relies on four strategies to improve safety on the high-injury network, with an eye towards community disparities; and supporting context-appropriate speed limit setting and automated speed enforcement policies; interchange modernization; enhancing at-grade rail crossings. This a strong foundation for working toward zero that focus on engineering and speed management. As we'll see in the Safe System Elements there are several other facets of the safe system approach.

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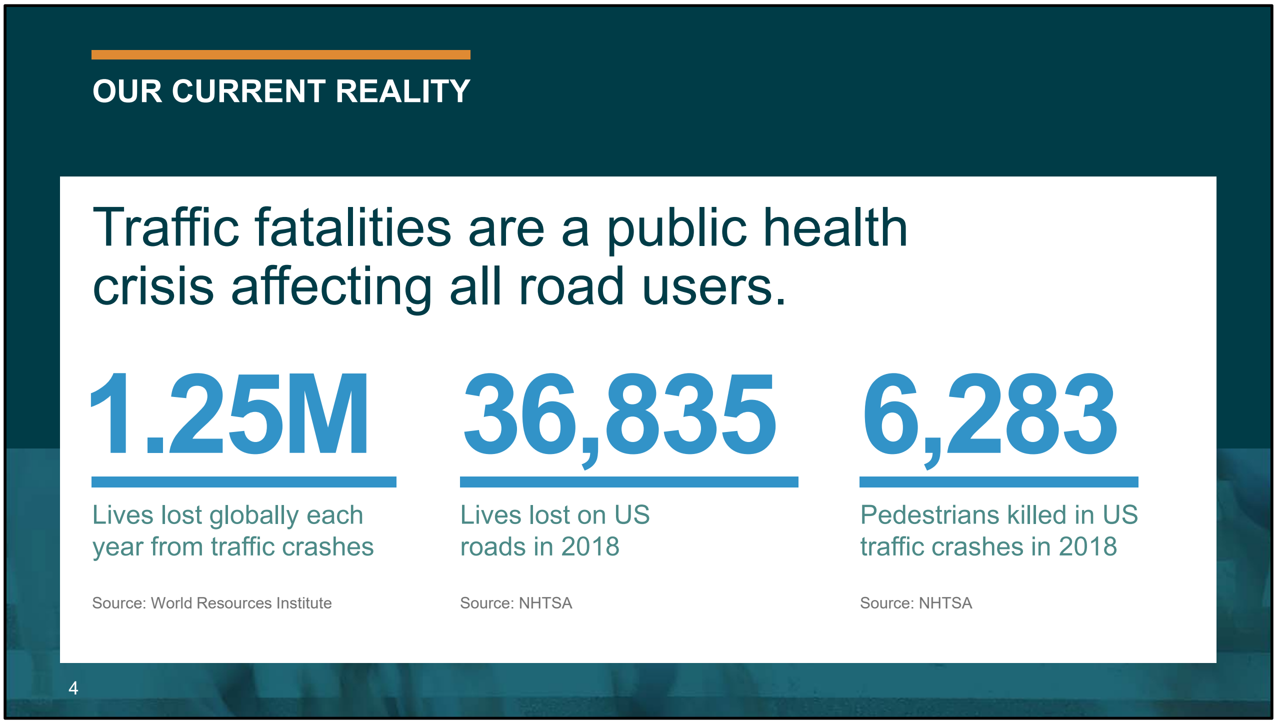
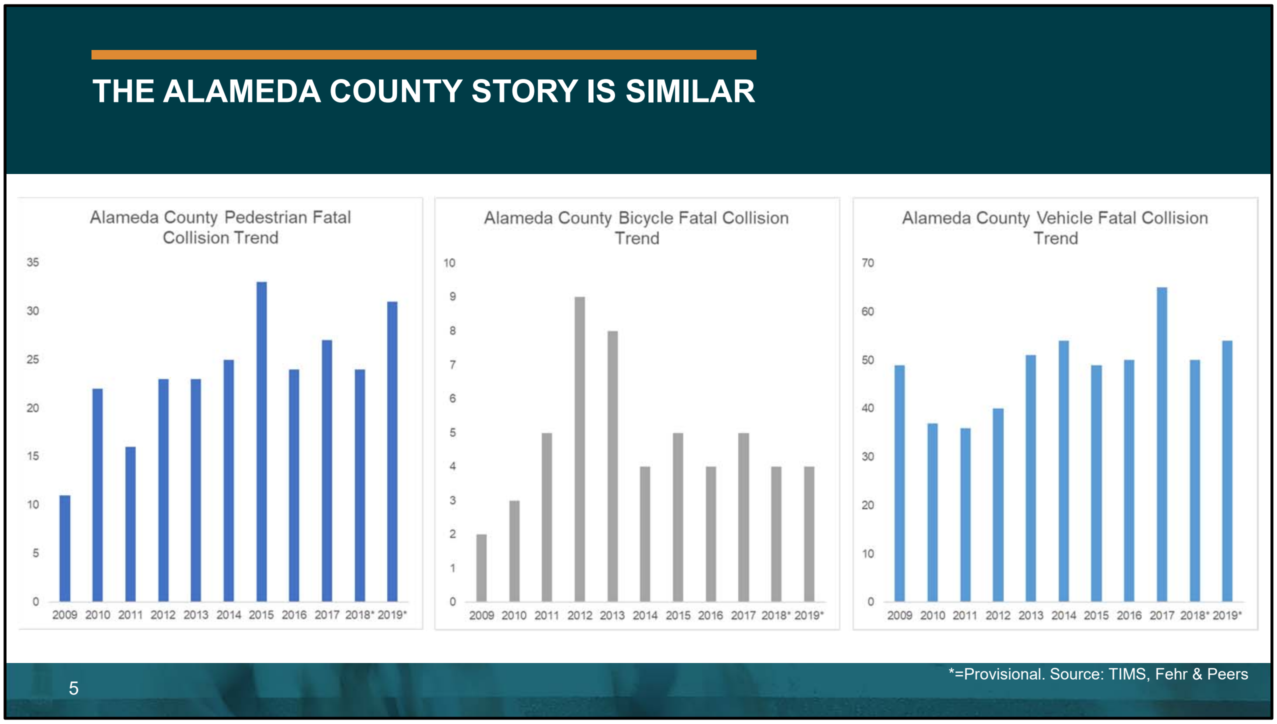


Key Message: Now let's zoom back out and start at the big picture. Traffic fatalities are a public health crisis affecting everyone and every travel mode, and it demands a concerted response. Each year, over a million lives are lost globally from traffic crashes. In 2018, an average of more than 100 people lost their lives on US roads, each day. And you may have seen just this last week, that the National Safety Council showed that as many as 42,060 people died in motor vehicle crashes in 2020. This is an 8% increase over 2019, despite fewer people driving due to pandemic conditions. **The rate of U.S. traffic deaths spiked 24% in 2020 over the previous year, despite miles driven decreasing by 13%. This dramatic increase represents the highest year-over-year growth in the rate of traffic deaths IN ALMOST 100 YEARS since 1924, or 96 years, according to NSC.**
Interactivity: Ask attendees if they know what the fatality trends are in their communities.
Background: Data are from the World Resources Institute 2018 report *Sustainable and Safe: A Vision and Guidance for Zero Road Deaths* and the National Highway Traffic Safety Administration (NHTSA) Fatality Analysis Reporting System (FARS) database.
Notes: One way to customize this slide would be to add comparable fatality data for your local jurisdiction.



Key Message: In the past decade, the number of pedestrians struck and killed in motor vehicle crashes increased by more than 50% nationally. 2019 was the highest year since 2015 for deadly crashes in Alameda County with 89 total fatalities, including 31 pedestrians.

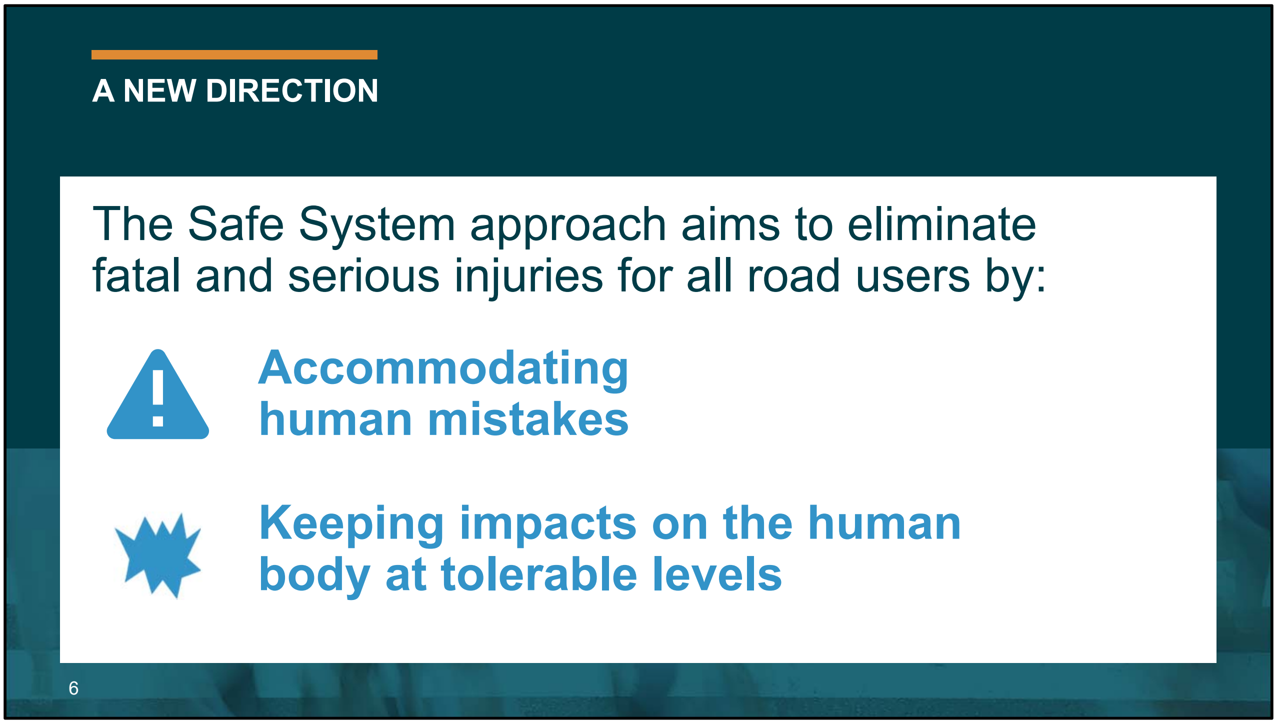
There are several reasons identified nationally for this trend that likely apply in Alameda County, including people driving more miles during this time, increasing numbers of larger vehicles such as SUVs and trucks on the road, and more people walking in areas with high-speed vehicles from urbanization in cities with high-speed streets and the suburbanization of poverty.

Interactivity: Ask the audience if they know and want to share traffic fatality and/or pedestrian fatality trends in their respective jurisdictions.

Background: This data is based on the UC Berkeley SafeTREC Transportation Injury Mapping System (TIMS).

Notes: No notes for this slide.

Note that the y-axis is different between the three graphs to show the trends over time.



Key Message: The Safe System approach aims to eliminate THESE fatal and ALSO serious injuries for all road users by accommodating human mistakes and keeping impacts on the human body at tolerable levels. This is the fundamental objective of the Safe System approach. What separates the Safe System approach from the traditional approach to safety is the ethical imperative that not even one death is acceptable in our roadway system.

Interactivity: No interactivity for this slide.

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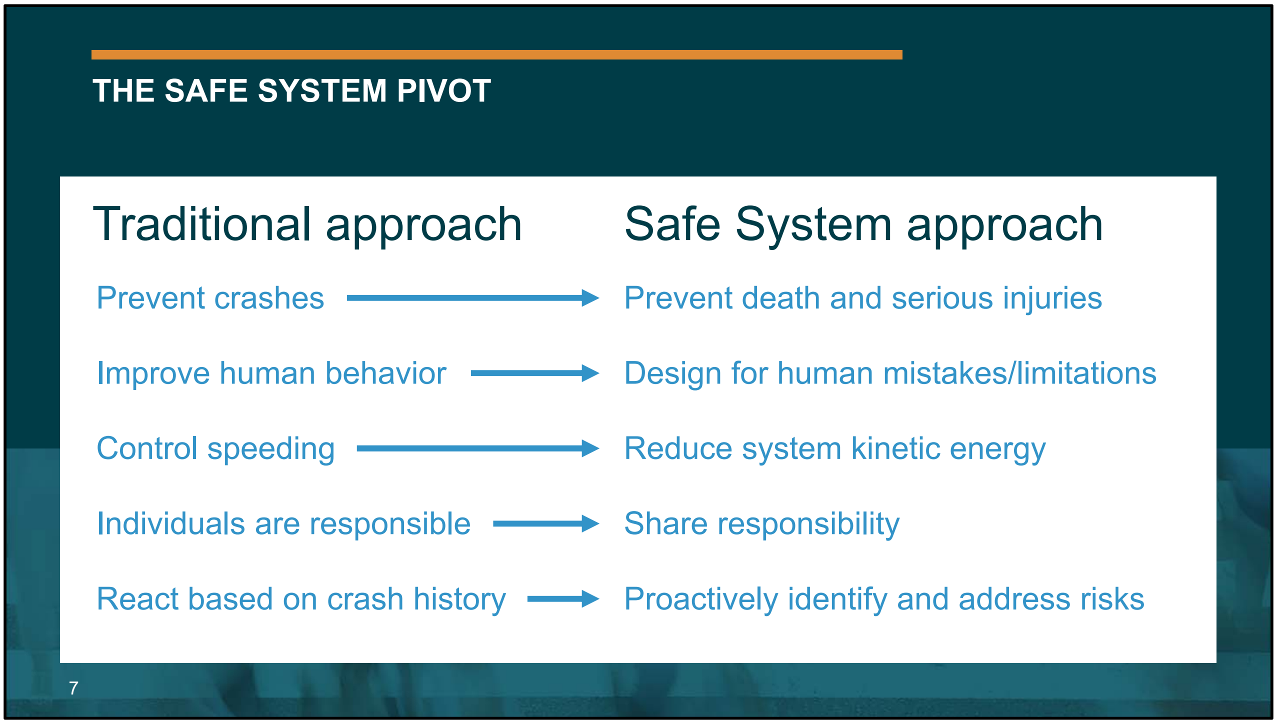
Notes: Examples of accommodating human mistakes include roadway design features like rumble strips, which alert a driver when they are unintentionally departing the roadway, or vehicle design features like autonomous emergency braking, which activate to stop the vehicle when the driver may not be able to do so. Examples of keeping impacts on the human body at tolerable levels include measures to control speed, physically separating users travelling at different speeds (e.g. drivers and people riding bikes), and vehicle safety features like seatbelts and airbags.

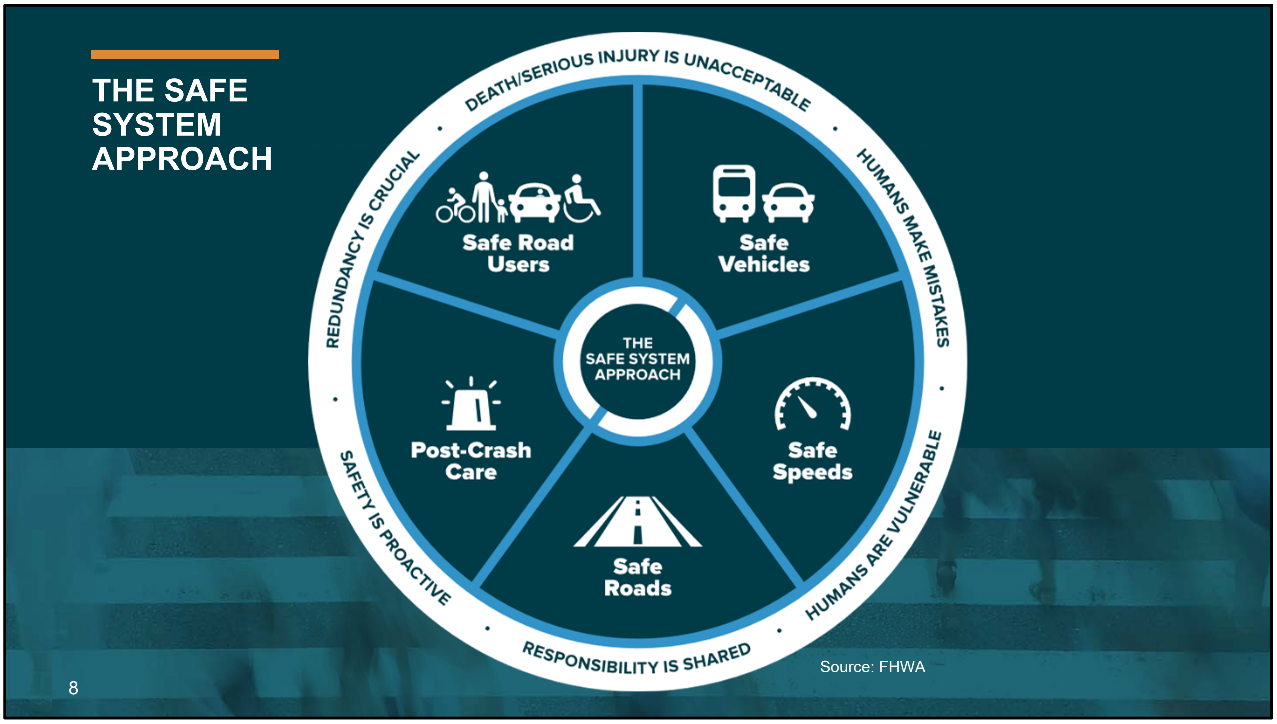


Key Message: Implementing the Safe System approach requires moving away from several traditional safety paradigms.

- Animation 1: Rather than preventing crashes, the Safe System approach seeks to prevent death and serious injuries
- Animation 2: In addition to trying to improve human behavior, the Safe System approach designs for human mistakes and limitations
- Animation 3: While the traditional safety approach focuses on controlling speeding, the Safe System approach attempts to reduce system kinetic energy.
- Animation 4: Rather than asserting that only individuals are responsible, the Safe System approach aims to share responsibility among system users, managers, and others
- Animation 5: Instead of reacting based on crash history, the Safe System approach proactively identifies and addresses risks

Implementing the Safe System approach is our shared responsibility, and we all have a role. The next slide introduces FHWA resources to help agencies implement the Safe System approach.

Interactivity: This slide has 5 animations that require the speaker to click through each one at a time.
Background: No background for this slide.
Notes: The Safe System approach encompasses the elements of the 4Es (Enforcement, Education, Emergency Response, and Engineering). It refocuses efforts on reducing death and serious injury through accommodating human mistakes and reducing impact forces to tolerable levels.



Key Message: This graphic presents an overview of the Safe System approach. There are three key components to understand, which will be explained on this and the following slides. These are the Safe System "approach," "principles," and "elements." The Safe System "approach," shown by the graphic on this slide, is the broadest term and describes all aspects of the Safe System.

Note that the term "Safe System" is singular to depict an overall Safe Road System. The National Safety Council and our international partners also use this version.

Interactivity: No interactivity for this slide.

Background: This graphic was created for FHWA drawing inspiration from similar designs by the Institute of Transportation Engineers (ITE), the Road to Zero Coalition, and the Royal Society for the Prevention of Accidents (ROSPA) in the United Kingdom.

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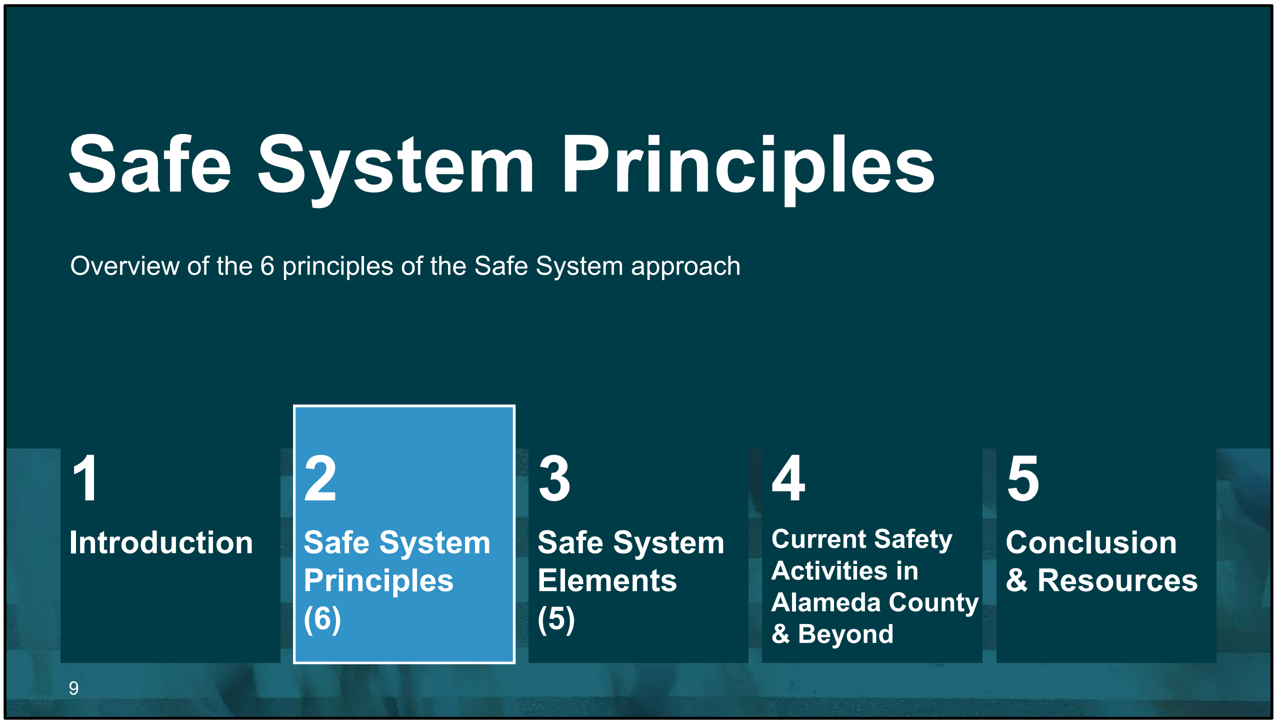

Key Message: This section provides information on the

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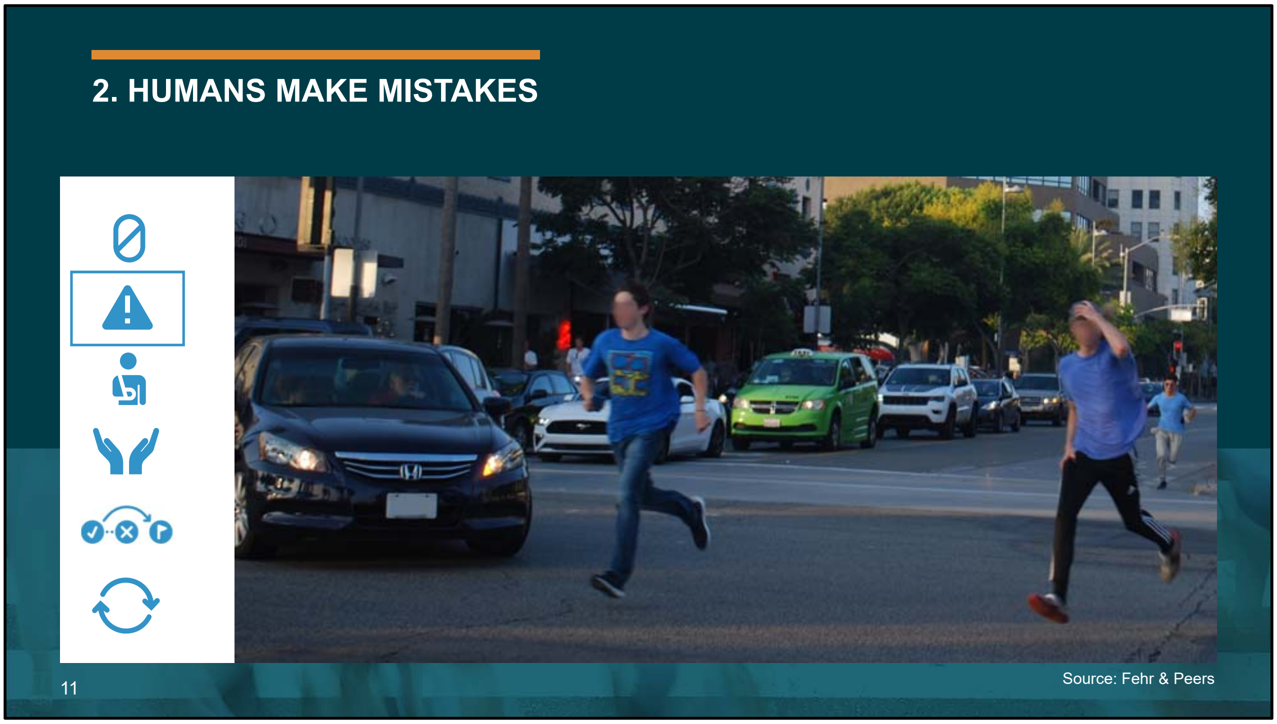
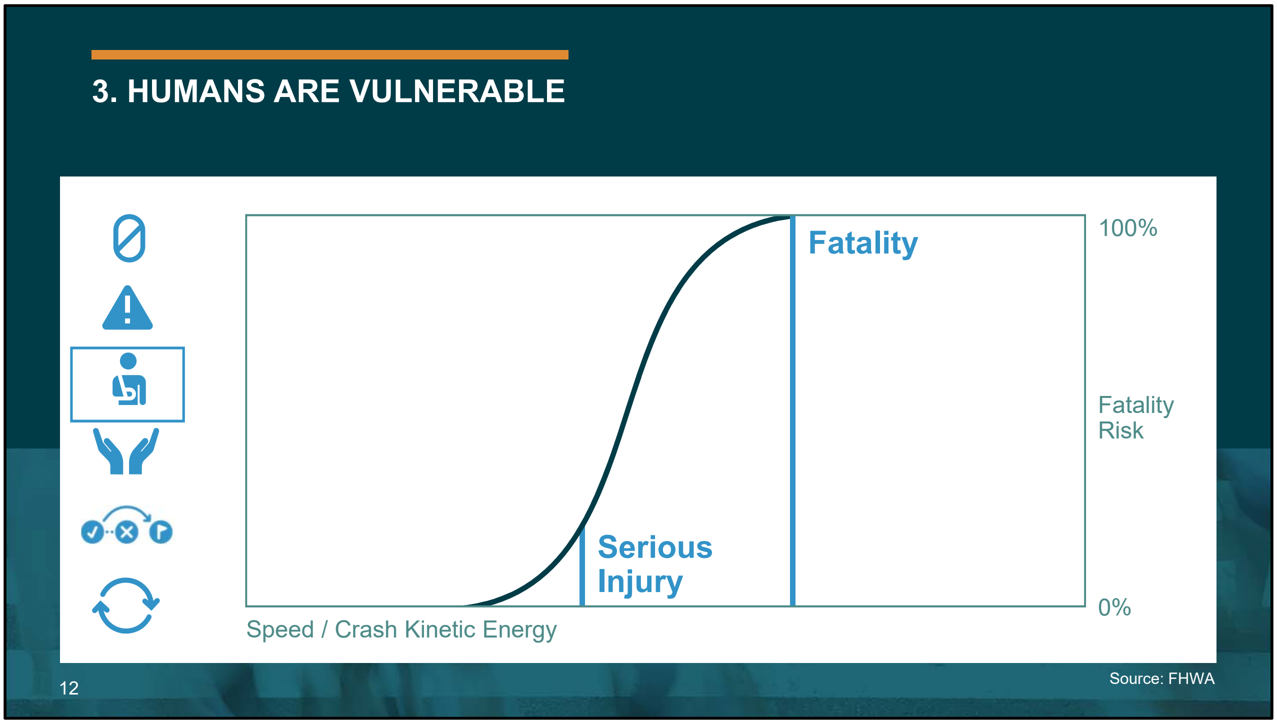
Key Message: The first principle is that death and serious injury is unacceptable. While no crashes are desirable, the Safe System approach prioritizes crashes that result in death and serious injuries, since no one should experience either when using the roadway system. The goal is to modify how users, vehicles, transportation infrastructure, and emergency response operate to reduce the likelihood of crashes happening at all, and to reduce their severity when they do happen.
Interactivity: No interactivity for this slide.
Background: The image shows a memorial to people killed in traffic crashes.
Notes: This Toward Zero Deaths video is an option for speakers (note that it is 3:44 minutes long): https://youtu.be/_AIubBHtz7g



Key Message: The next principle is that humans make mistakes. People will inevitably make mistakes that can lead to crashes, but we can design and operate the roadway system to accommodate human mistakes to avoid death and serious injuries.
Interactivity: No interactivity for this slide.
Background: The image shows two people making a mistake by violating traffic rules and risking a collision.
Notes: An example of designing a roadway to accommodate human mistakes is adding a median to prevent errant drivers from entering oncoming traffic.



Key Message: The next principle is that humans are vulnerable. On the horizontal axis is speed/kinetic energy, with crash kinetic energy increasing with the mass of a vehicle and quadrupling when speed doubles, and the vertical axis is the risk of a crash resulting in death. As the chart shows, people have a limited ability to tolerate crash impacts before death and serious injuries occur. Human tolerance to crash impacts is central to the Safe System approach. The management of kinetic energy transfer to within survivable limits is important for understanding how to design and operate the road system consistently with the Safe System philosophy. The Safe System approach focuses not just on managing speed but managing transfer of kinetic energy.

Interactivity: No interactivity for this slide.
Background: The graphic was created for FHWA to explain the concept that as crash kinetic energy increases, so too does the potential of serious injury and death. It does not take particularly high kinetic energy levels for the potential of serious injury to occur.
Notes: No notes for this slide.

Key Message: The next principle is that responsibility is shared. System managers, vehicle manufacturers, law enforcement, post-crash personnel, and system users all have a responsibility to promote safe behavior and ensure that crashes don't lead to fatal or serious injuries.

Interactivity: No interactivity for this slide.

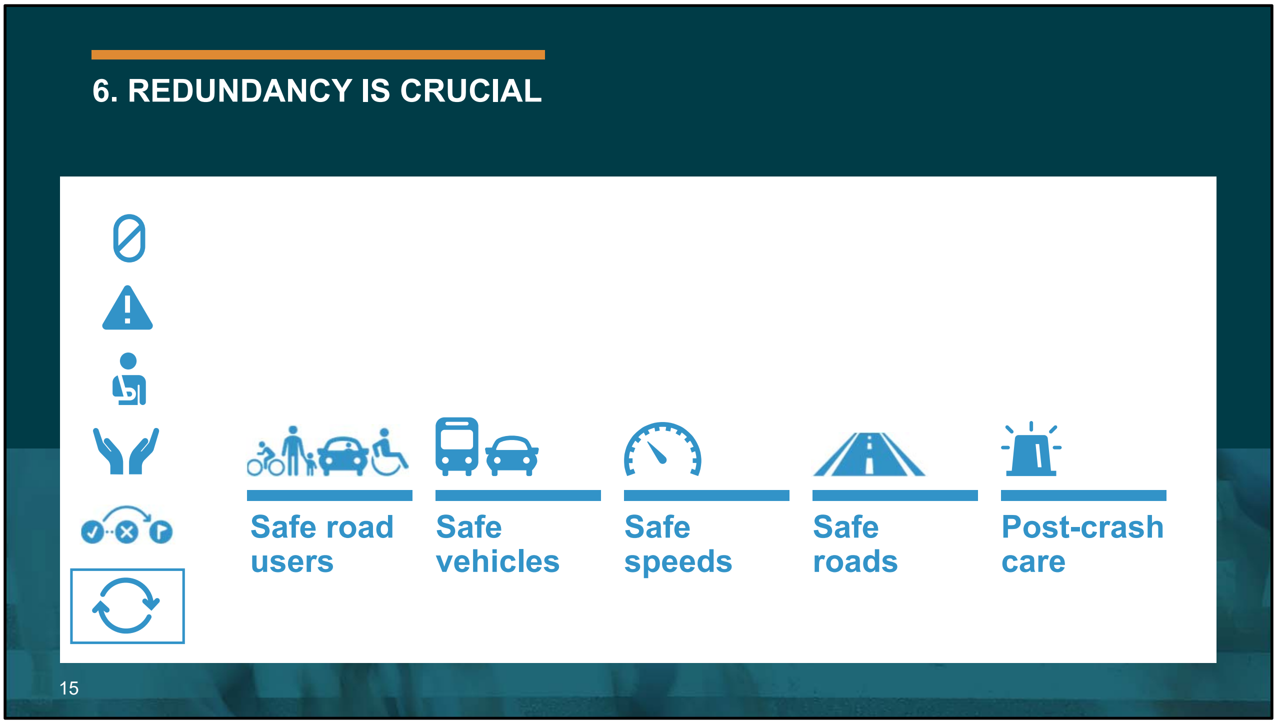
Background: No background for this slide.

Notes: Examples include system managers designing facilities with proven safety countermeasures, like roundabouts or median barriers; system managers keeping roadway systems in good state of repair; vehicle manufacturers applying the latest safety features in vehicles; law enforcement equitably enforcing traffic safety laws; and users of all travel modes safely moving through the roadway system. "System managers" includes planners, designers, builders, operators, and maintenance.

Key Message: The next principle is that safety is proactive. In addition to crash-based analysis, transportation agencies should use proactive tools to identify and mitigate latent risks in the roadway system, rather than waiting for crashes to occur and reacting afterwards. This process, known as the Systemic Approach to Safety, uses crash history, roadway design, and other data to identify patterns in geometric design that lead to certain crash types. System designers then identify appropriate countermeasures to mitigate the crash types. These countermeasures are systemically applied at all locations meeting the particular geometric design, irrespective of crash history. Rather than managing risk at certain locations, a systemic approach takes a broader view and evaluates risk across an entire roadway system. A system-based approach acknowledges crashes alone are not always sufficient to determine what countermeasures to implement, particularly on low-volume local and rural roadways where crash densities are lower, and in many urban areas where there are conflicts between vehicles and vulnerable road users (pedestrians, bicyclists, and motorcyclists).

Interactivity: The speaker may want to facilitate a discussion among the audience: "I have limited funds. How can I justify addressing latent risks when I have other locations with a history of crashes? I don't have funding to do both.“

Background: No background for this slide.
Notes: Additional information on the Systemic Approach to Safety is available at https://safety.fhwa.dot.gov/systemic/



Key Message: The final principle is that redundancy is critical. Reducing risks requires that all parts of the roadway system are strengthened, so that if one part fails, people are still protected. This is the last of the six Safe System principles. The next section will address the five Safe System elements.

Interactivity: Ask the audience if they have questions about the principles.

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Notes: An example of redundancy is rumble strips, which protect people when their own ability to be safe road users is compromised by distraction or drowsiness.

Key Message: [For presentation only, when the last four principles are not shown individually] The remaining principles are that Humans are Vulnerable, Responsibility is Shared, Safety is Proactive, and Redundancy is Crucial
Interactivity: No interactivity for this slide.
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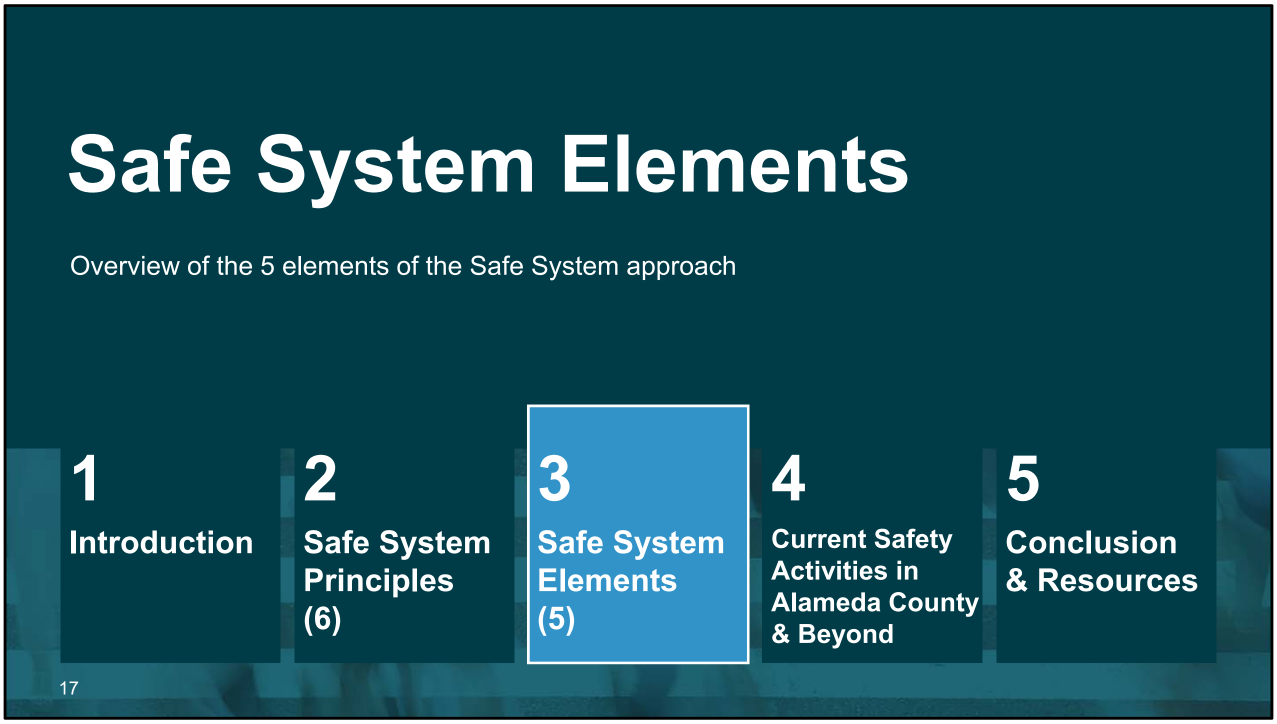
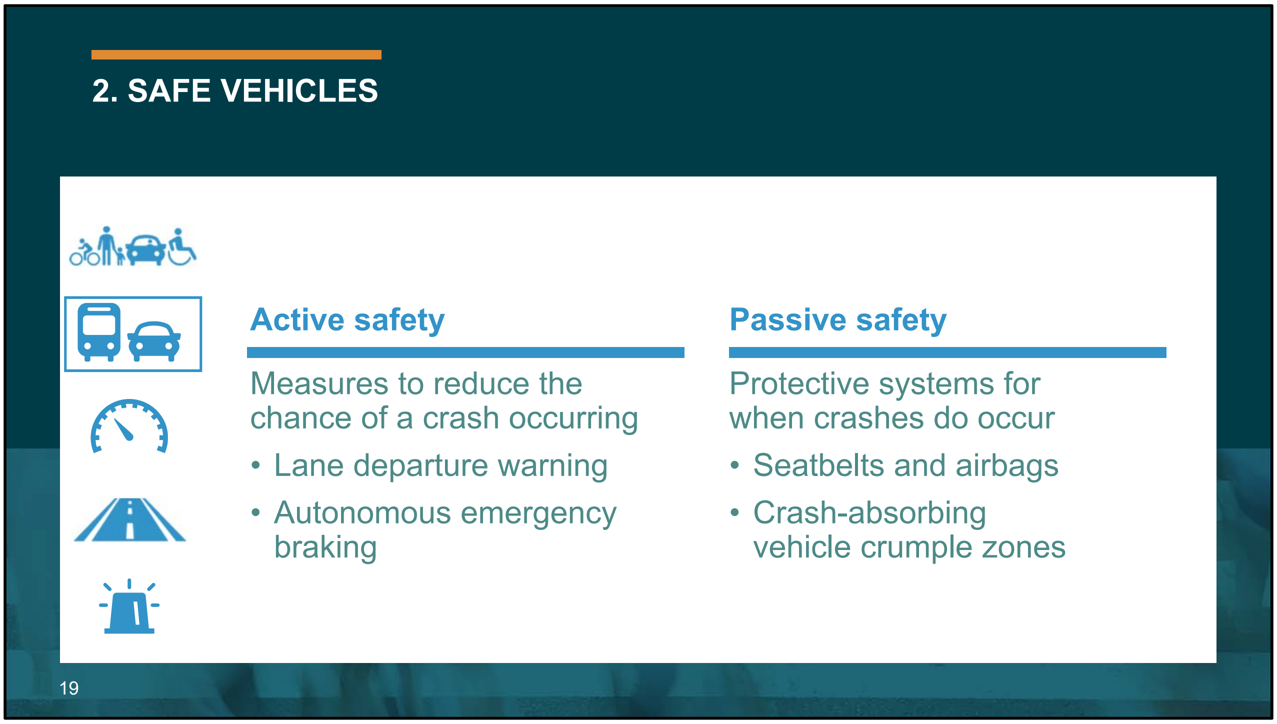


In the next section we'll review the five elements of the Safe System approach: Safe Road Users, Safe Vehicles, Safe Speeds, Safe Roads, and Post-Crash Care.

The first Safe System element is safe road users. The Safe System approach addresses the safety of all road users, including those who walk, bike, drive, ride transit, and travel by other modes. It considers all road users equal regardless of how they choose to travel. While we all make mistakes, each road user has a responsibility to operate to the best of their ability within the boundaries set by system managers. Education, encouragement, engagement and enforcement are additional tools that can help modulate user behavior.

An example of safe walking is starting to cross the street at a signalized intersection during the “walk” phase. An example of safe biking is riding with the direction of traffic. An example of safe driving is following signs and speed limits. An example of safe transit riding is not running for a transit vehicle. An example of safe travel by an “other” mode, such as a motorcycle, includes wearing proper protective equipment.



The next Safe System element is safe vehicles. Safe vehicles include “active” safety measures that help prevent crashes from occurring in the first place, such as autonomous emergency braking. They also include “passive” safety measures, which protect occupants when a crash does occur, such as seatbelts and airbags. Vehicle manufacturers are a key stakeholder in the Safe Vehicles element, and play an important role in supporting the continuous evolution of safety.

Safe vehicles must account for safety of other users on the road through elements such as size, design, and materials. Thinking ahead to the near future, elements such as bicyclist and pedestrian detection on connected vehicles (CVs) and automated vehicles (AVs) will be necessary to ensure vehicles are safe for all road users in the future.

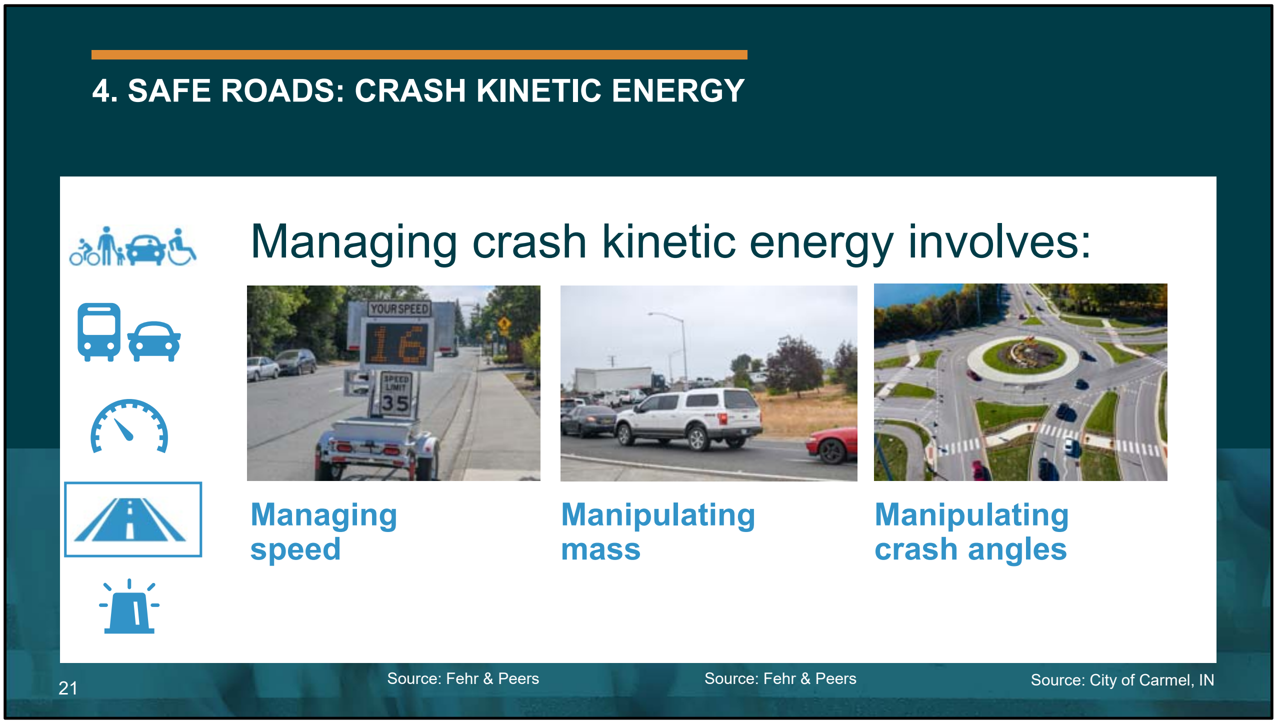
The new designs for the USPS trucks are a good example of safe vehicles in action, with features such as the back-up camera, blind spot warning, and large front window to improve the driver’s view. It also has a low front bumper, which is better for pedestrians if a crash occurs because they are more likely to land on the hood rather than under the vehicle. As you can see in the photo on the right, many SUVs and other large vehicles have a front bumper that extends above most people's center of gravity, which increases the risk of pedestrians ending up under the vehicle in a crash and obscures the driver's view of shorter people including children.

We understand that cities are asking Alameda CTC to pay more attention to technology in legislation. There are lots of innovative ideas in this space that are not currently part of safety regulations or car standards in the US. For example, in Europe, there are crash safety ratings for how a car strikes peds. It's good to keep in mind that other "new" technologies in their time, such as seatbelts, were a fight to be included in vehicle design.

The next element is safe speeds. There is a direct relationship between the speed at which a vehicle is traveling and a person’s likelihood of survival when hit. 9 out of 10 pedestrians are likely to survive if hit by a vehicle traveling at 20 mph, while only 1 in 10 pedestrians will likely survive an impact at 40 mph. Put simply, humans are not made to survive high-speed crashes, and Safe System treatments help minimize injuries by reducing kinetic energy transfer through reduced impact speed of a crash. Studies show that even a small change in vehicle operating speed can have a large safety impact. Adjusting speeds can accommodate human injury tolerances in three ways: reducing impact forces, providing additional time for drivers to stop, and improving visibility.

[Animation] You can see how high speeds through a typical straight intersection are reduced due to the required deflection in the roundabout.

Roundabouts also greatly reduce the risk for T-bone collisions



The fourth Safe System element is safe roads. Safe roads are designed and operated to keep impacts on the human body at tolerable levels. We do this by avoiding crashes altogether and by managing kinetic energy transfer when a crash does occur.

Avoiding crashes involves:

•Separating users in space, especially those that travel at different speeds or in different directions

•Separating users in time. For example a pedestrian scramble phase at an intersection

•Increasing attentiveness and awareness by alerting users to potential hazards or the presence of other users on the roadway.

Managing crash kinetic energy transfer involves:

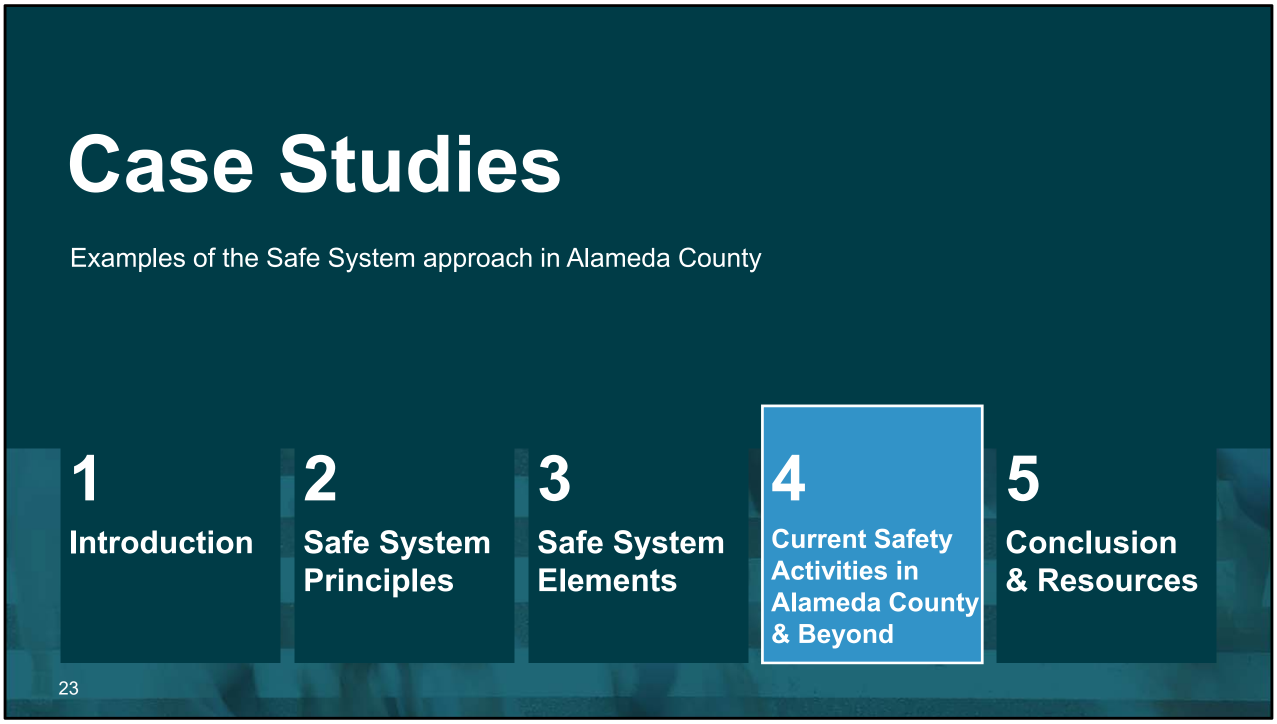
•Managing speeds, because kinetic energy quadruples as speed doubles.

•Manipulating mass, referring to the size and design of vehicles

•Manipulating crash angles. For example, road design that eliminates right angle crashes through the use of roundabouts

The final Safe System element is post-crash care. When a person is injured in a crash, they rely on emergency first responders to quickly locate them, stabilize their injury, and transport them to medical facilities. The post-crash care in a Safe System extends beyond emergency services. These include quick-response and investigation by police and road managers can help ensure crash factors are documented and reported correctly, clearing traffic incidents so that traffic flow may be restored safely and quickly, the justice system taking appropriate action, and mitigating the risk of future crashes through changes to design and programs or policies.

Crash reporting practices, such as complete data collection and documentation of road user behavior and infrastructure, and sharing data across agencies or organizations (e.g., among police departments, transportation officials, and hospitals) can help lead to a greater understanding of the holistic safety landscape, and thus lead to improved investments in safety.



Case studies help illustrate how components of the Safe System approach have been implemented in Alameda County.

SAFE SYSTEM IN ALAMEDA COUNTY

San Leandro Boulevard Road Diet, Bike Lanes, and Crosswalk Enhancements
San Leandro

Ashby Avenue & Hillegass Avenue PHB Bicycle Boulevard Crossing
Berkeley

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Sources: Google Maps, Fehr & Peers

The San Leandro example on the left illustrates Safe Road users, Safe Speeds, and Safe Roads and proactive approach to safety with a recent road diet project that also created bike lanes and enhanced crosswalks, both safety countermeasures.

The Berkeley example on the right of a Pedestrian Hybrid Beacon on a Caltrans facility is an example of Safe Road users and Safe Roads

SAFE SYSTEM IN ALAMEDA COUNTY

Stanley Boulevard/Valley Avenue/Bernal Avenue Protected Intersection (Left) and Separated Bike Lane (Right) Pleasanton

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Source: Fehr & Peers

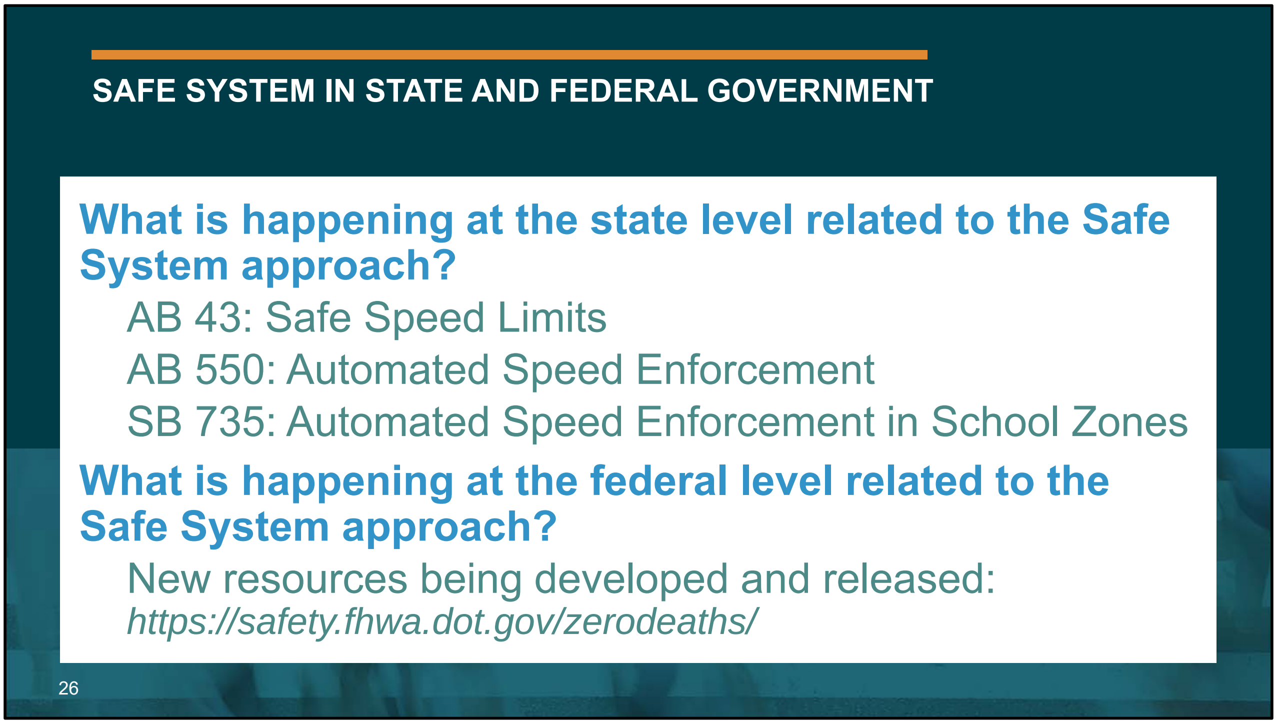
This example is from the Pleasanton/Valley Protected Intersection in Pleasanton, and addresses Safe Road users, Safe Speeds, and Safe Roads. This improvement was prompted in part by a fatal collision at the intersection. But proactive treatments are important, because crashes don't just happen at locations that have had crashes in the past. Reactive has a role where systems break down, and great designs can be achieved sooner too.

In addition to these infrastructure examples, cities are making plans that support Safe System principles.

The City of Fremont created a Vision Zero plan back in 2016, and this past month completed a five-year update that reported a 45% reduction in major crashes since the start of the Vision Zero program. Fremont's three themes of actions for the new action plan are: Getting State Legislation for Safer Speed, Continue Local Actions for Safer Streets, and Encourage Support from Regional Partners. This follows Safe System principles with a focus on elements where the City has control and influence, including Safe Roads, Safe Road Users, and Safe Speeds.

The City of Berkeley approved a Vision Zero Action plan in 2019. Berkeley's three themes of actions for the action plan are: The Vision Zero Program, Safer Streets for Everyone, and Safer Streets By Everyone

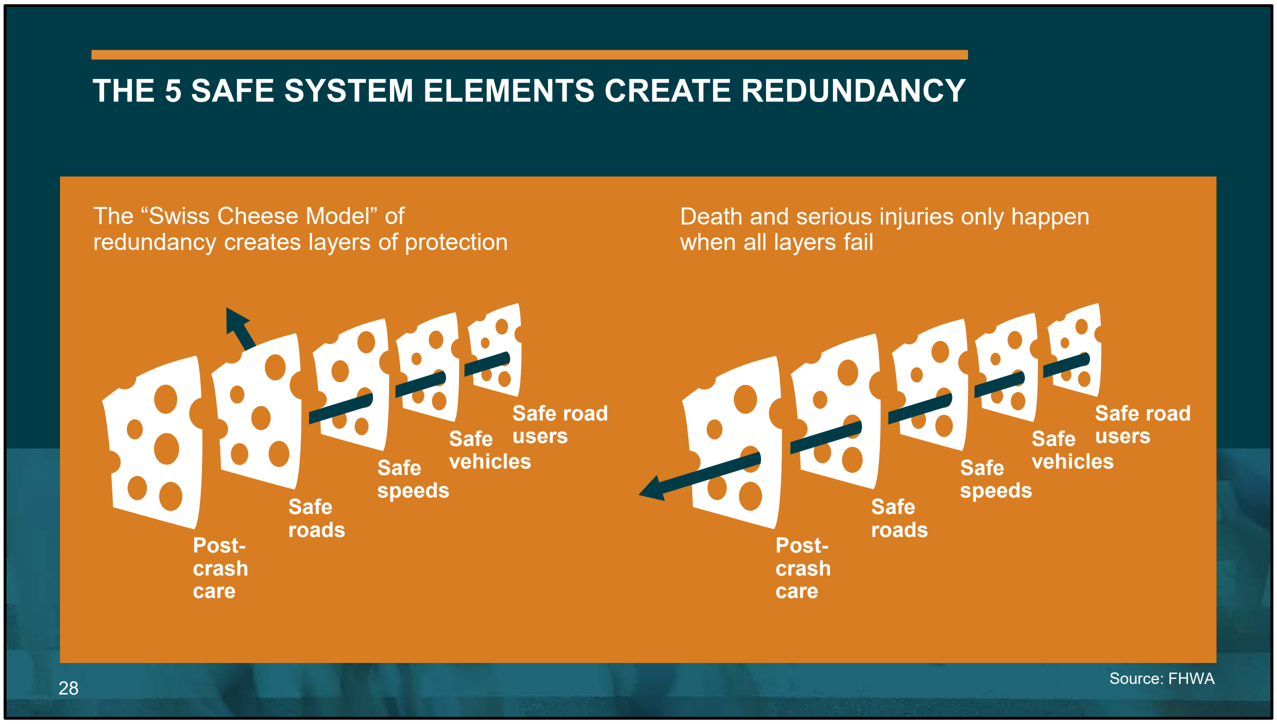
And the City of Oakland is rolling out a "Safe Oakland Streets" initiative as a collaboration between OakDOT, the City Administrator's Office, Department of Race and Equity, and Police Department



There are three state legislative items we want to highlight related to the Safe System approach, shown here. AB 43 would provide more flexibility in how speed limits are set beyond the 85th percentile. AB 550 and SB 735 would allow automated speed enforcement in different contexts, with several conditions to limit inequitable outcomes from fines, along with strong privacy protections.

We understand that the federal government is going all in on the Safe System approach, including funding the original development of this presentation. The website shown here has various resources, and you can expect more to come soon.

We'll leave you with a final unique perspective on the Safe System approach



The "Swiss Cheese Model" helps illustrate the important principal of redundancy and shared responsibility in the Safe System approach. Layered safety measures are represented as slices of swiss cheese with the holes representing weaknesses in individual parts of the system. The cheese slices act as successive layers of defenses, and when the holes are not lined up, a person is protected, as on the left. If one part fails, there are redundant systems in place. The right graphic shows that a failure results only in the rare cases when the holes in each slice momentarily align, permitting a hazard to pass through. The basic principle is that lapses and weaknesses in one part of the system can occur and do occur, but other parts compensate to not allow an overall system failure.

A good example of how the five Safe System elements work together to create redundancy is distracted driving. Education campaigns focused on alert driving—avoiding behaviors like texting while driving—help create safe road users. Vehicle safety systems, like lane departure warnings, create safe vehicles that alert distracted drivers to potential hazards. Infrastructure like rumble strips creates safe roads and an additional layer of redundancy to warn distracted drivers about a potential roadway departure. Sometimes, all these measures are not enough to prevent a distracted driving crash from occurring, but efficient, rapid post-crash care can help this mistake not be fatal.

DISCUSSION

For the cities that have advanced elements of the Safe System approach, how have those efforts been successful and how might they be replicated by other cities, including key inter-departmental or stakeholder steps?

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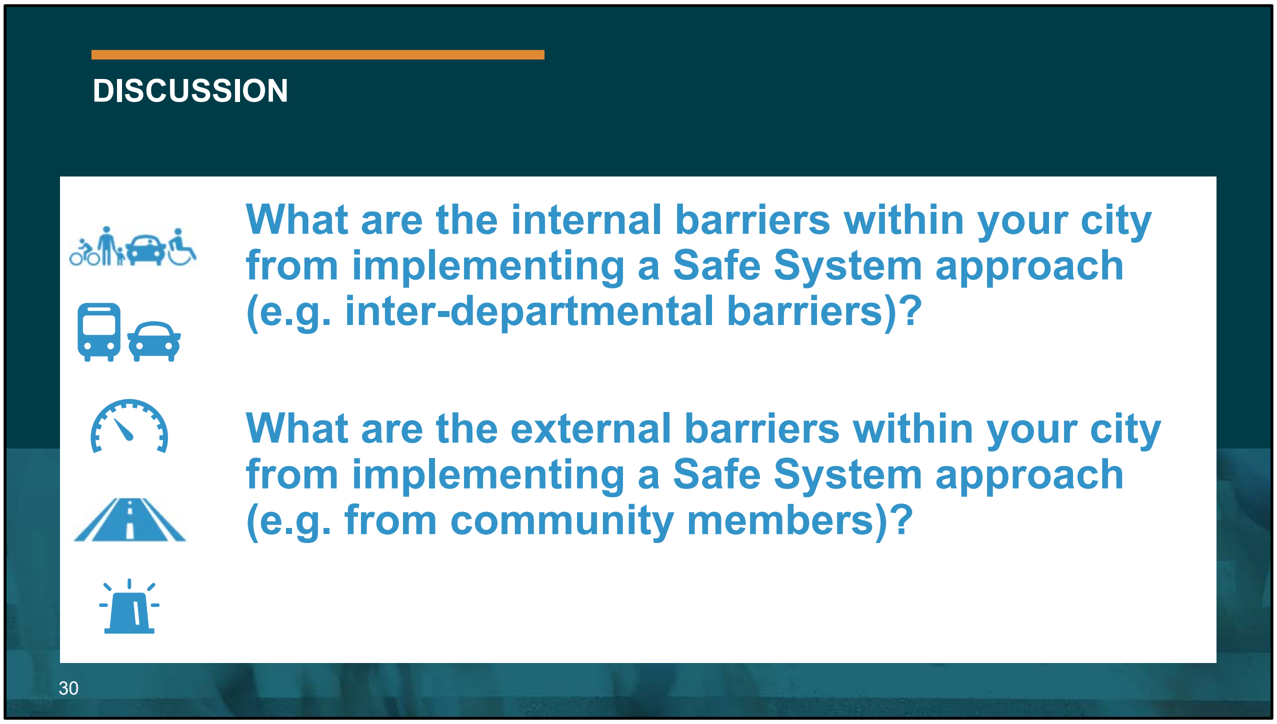
For the cities that have advanced elements of the Safe System approach, how have those efforts been successful and how might they be replicated by other cities, including key inter-departmental or stakeholder steps?



Additional discussion questions:

- Where have you valued county-level support, or what else does your City need for support?
- How do you think cities could support each other for Safe System goals?

Questions?

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