The goal of a Safe Systems approach is to design and operate our vehicles and infrastructure in a manner that anticipates human error and accommodates human injury tolerances with a goal of reducing fatal and serious injuries. The following framework is intended to assist the vehicle and infrastructure communities in making decisions in alignment with safe system principles. Consistently selecting safe system designs will incrementally improve safety and over time result in the widespread implementation of safe system practices.

Creating Safe Systems will involve both traditional and new approaches. We must embrace and expand the use of Safe Systems practices that we know work, while being willing to try and evaluate new or non-traditional approaches, particularly when it comes to protecting vulnerable users.

Adopting a Safe Systems approach necessarily means adopting a safety culture. Steady progress can be made by putting safety first and following Safe Systems principles in each of the large and small decisions that confront us every day.

Adopting a Safe Systems approach does not absolve users of responsibility. Programs such as education and enforcement will remain essential. Providing effective emergency response when crashes do occur is also a critical element of a safe system. However, safe system design choices recognize that road users make mistakes or bad decisions and seeks to reduce the opportunities to do so or mitigate the consequences.

Reducing speed is not a direct prerequisite of a safe system, but will sometimes be necessary to achieve alignment with Safe Systems principles. In locations where vehicles interact with vulnerable road users, speeds should be controlled to a level at which a collision is unlikely to result in a fatal or serious injury.

When we choose a Safe Systems approach, we must accept that doing so may result a decrease in vehicle throughput and may limit the range of behavioral choices for users. However, such decisions are part of responsible system stewardship. As transportation professionals we have a moral obligation to protect lives while creating a reliable transportation system.

I. Anticipating Human Error

Recognizing that humans are human and that they will continue to make errors when traveling, one way to implement a Safe Systems strategy is to reduce the opportunity for error by adhering to the following:

- **Separating Users in Space** - This approach segregates the physical space to provide travelers with a dedicated part of the right-of-way. Typically, travelers moving at different speeds – pedestrians, bicyclists, etc. (e.g., sidewalks, cycle tracks) – or different directions (e.g., turning vehicles in separate turn lanes) are separated in space to minimize conflicts with other users.

- **Separating Users in Time** - This approach assumes that users will need to occupy the same physical space on the roadway, but creates a safer environment by separating the users in time and reducing vehicle
interactions with vulnerable road users. An example is a pedestrian scramble phase at an intersection. During this phase, pedestrians have exclusive access to the intersection without having to worry about vehicle encroachment.

Note: Sometimes a combination of both techniques is used, such as a protected left turn bay where the turning vehicles are physically separated while awaiting the opportunity to turn, and separated in time through the use of a protected left turn phase.

 ✓ **Increasing Attentiveness and Awareness** - This approach seeks to alert users to potential hazards and/or the presence of other users. These techniques can be vehicle, user, or infrastructure-based. There are a variety of areas to be explored, including the following:

- **Increasing Visibility**
  - “Daylighting” intersections by removing parking at the corners to allow greater visibility between drivers and pedestrians.
  - Street lighting that increases nighttime visibility of users.
  - Vehicle, scooter, or bicycle lights or retroreflective clothing that allows users to be visible to one another.

- **Increasing Attentiveness**
  - Rumble strips and in-vehicle lane departure systems that alert inattentive or drowsy drivers that they are leaving their lanes.
  - Rectangular Rapid Flashing Beacons that warn drivers of the presence of crossing pedestrians.

- **Reducing Impairment**
  - Alcohol detection and ignition interlock systems that help prevent intoxicated drivers from operating a motor vehicle.
  - In-vehicle systems that help prevent use of cell phones while the vehicle is moving to minimize distraction.
  - Applications and programs that incentivize and reward safe behaviors.

II. **Accommodating Human Injury Tolerance**

The laws of physics dictate that greater harm will occur at higher speeds, and that typically, the greater the mass of a vehicle, the more harm that it will inflict on others.

 ✓ **Reduce Speeds** - For vulnerable users speed is a determining factor in survivability – a human’s chance of surviving being struck by a vehicle increases from 20% at 40 miles per hour to 60% at 30 miles per hour to 90% at 20 miles per hour.

Reducing speeds increases the survival rate of a pedestrian if struck by a vehicle. Source: Seattle Department of Transportation.
Reducing speed in the presence of vulnerable users is a key Safe Systems strategy. Approaches include the following:

- Physical roadway designs (width, horizontal alignment) to limit free flow speeds.
- Traffic calming treatments that induce slower speeds.
- Traffic signal timing that minimizes high speed flow.
- Traditional or automated enforcement that discourages speeding.

✔ **Reduce Impact Forces** - A variety of methods can be used to increase crash survivability by reducing the impact forces. These include the following:

  - **Intersection Design** - alternative intersections, such as roundabouts, reduce the angle and speeds of entering vehicles to limit impact forces. Designs which limit right-angle conflicts can also achieve this goal.
  - **Occupant Protection** - this can include interior design of the vehicle, seat belts, air bags, etc. Much work has been done in this area in recent decades.
  - **Exterior Vehicle Design** - the aggressiveness of the exterior of the vehicle can affect the consequences of a collision. Increasing size of vehicles in recent years has worked against this goal, but recent innovations in vehicle front-end design offer the potential to create softer vehicle-to-vulnerable user impacts.
  - **Automated Braking** - automated braking systems have been introduced to detect other users or objects and slow or stop vehicles prior to a collision.
  - **Roadside Crashworthiness** - this can include clear zones, breakaway supports, etc. Much work has been done in this area in recent decades.