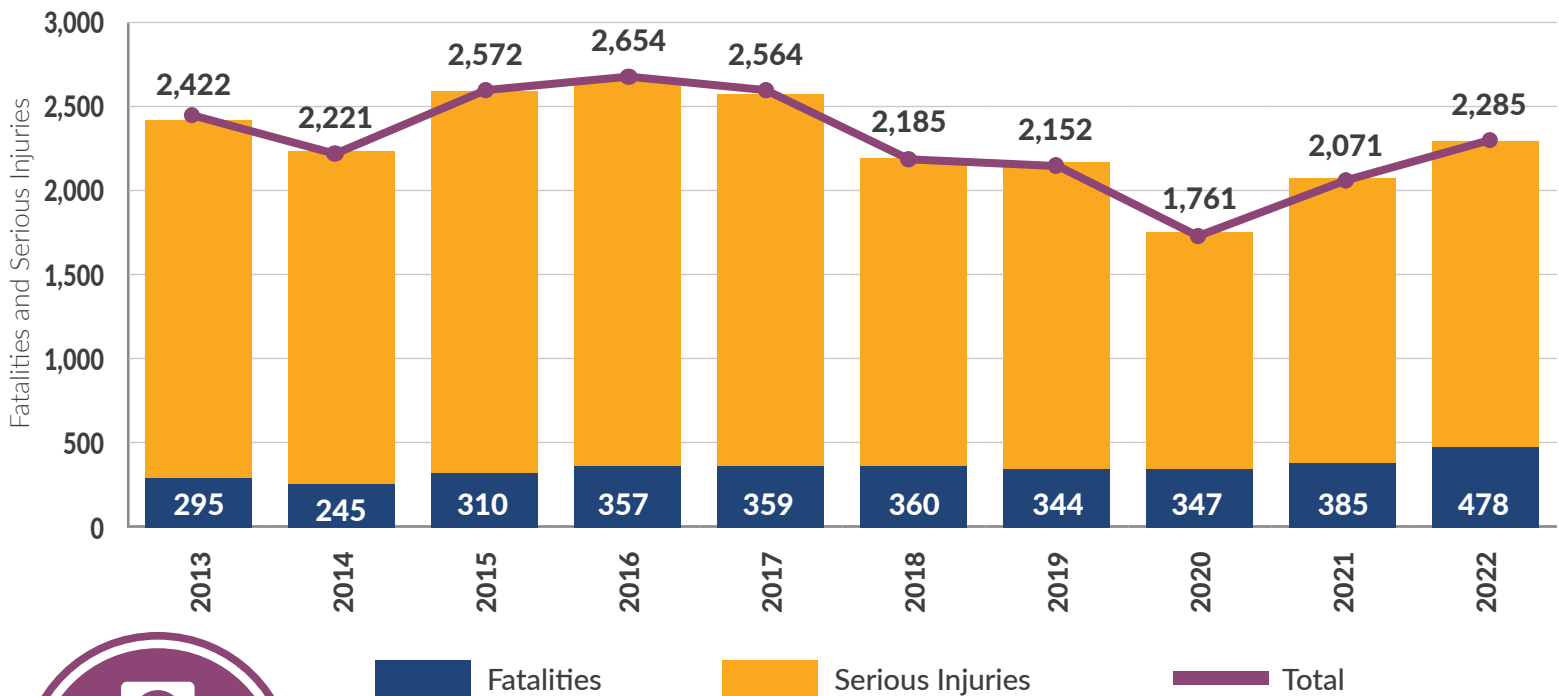


INTERSECTIONS

EMPHASIS AREA DEFINITION

Intersection related crashes are those that occur at a junction between transportation networks. This can include crashes at signalized and non-signalized intersections, highway interchanges, midblock crossings, and railroad crossings.



HIGHLIGHTS

28%

of total fatalities
occur at an
intersection.*

57%

of intersection
fatalities and
serious injuries are
left turn/angle.*

68%

of left turn/angle
fatalities and
serious injuries
occurred during
daylight hours.*

*Data taken from 2013-2022, crashes may overlap with other Emphasis Areas

INTERSECTIONS

STRATEGIES

ID	STRATEGY	TIMEFRAME	COST/ EFFORT
 SAFE ROADS			
INT.1A	Select appropriate intersection control.	Medium term	Medium
INT.1B*	Reduce high-risk movements.	Medium term	Medium
INT.1C	Separate VRUs from vehicles using space and time.	Long term	Medium
INT.1D*	Improve visibility for all users.	Medium Term	Medium
INT.1E	Simplify intersections.	Long Term	Medium
 SAFE ROAD USERS			
INT.2A*	Conduct high-visibility enforcement at intersections.	Short term	Medium
INT.2B	Improve road user education for newer treatments.	Short term	Low
 SAFE SPEEDS			
INT.3A	Utilize context-appropriate speeds.	Medium term	Medium
INT.3B	Reduce speeds on intersection approaches.	Long term	High
INT.3C*	Increase automated/mobile enforcement of speeds.	Short term	Medium
 SAFE VEHICLES			
INT.4A	Promote advanced warning technology.	Medium term	Low
INT.4B	Support additional needs for advanced warning technology.	Medium term	Low
 POST-CRASH CARE			
INT.5A*	Promote safety at crash scenes.	Short term	Medium
INT.5B	Improve access to intersection cameras.	Medium term	Medium
INT.5C	Share agency data.	Medium term	Low

**High Priority Strategy*

STRATEGY EXAMPLES

SELECT APPROPRIATE INTERSECTION CONTROL

Evaluate intersections using available traffic data and analytic methods.

Technical approaches may utilize:

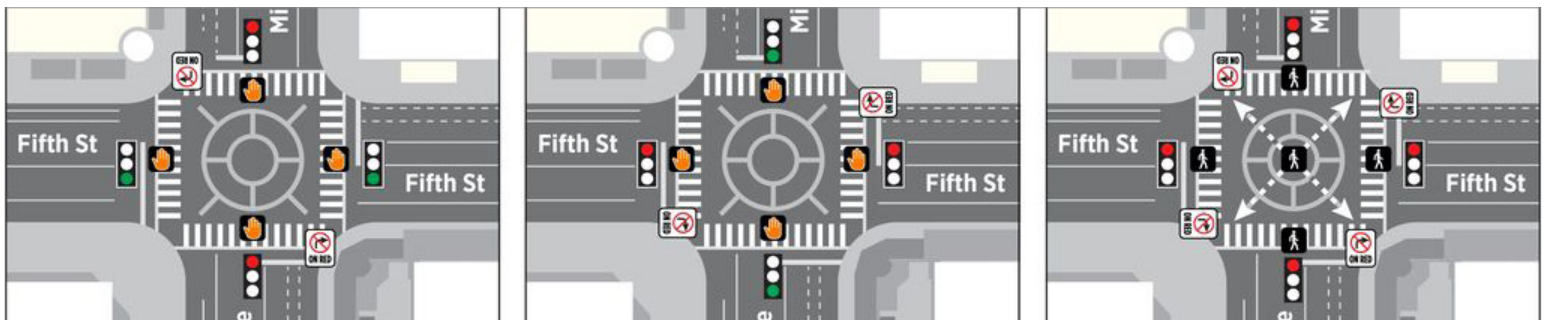
- » HCM
- » Synchro
- » Intersection Control Evaluation

Intersection traffic control may include:

- » Two-way stop control
- » All-way stop control
- » Signalization
- » Roundabout

Traffic safety analysis should be integrated with traffic operations in the selection process.

Controlled Intersections



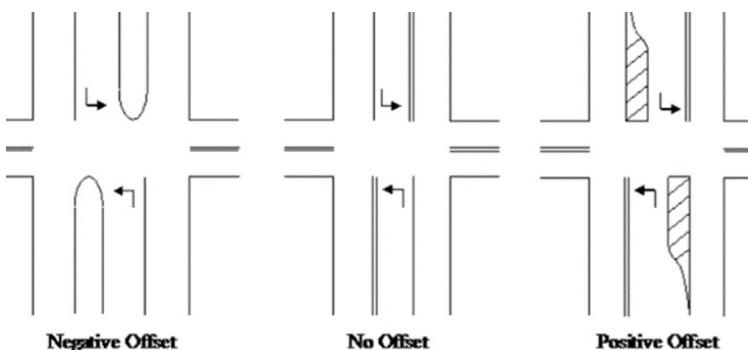
Source: City of Tempe

REDUCE HIGH-RISK MOVEMENTS

Examples:

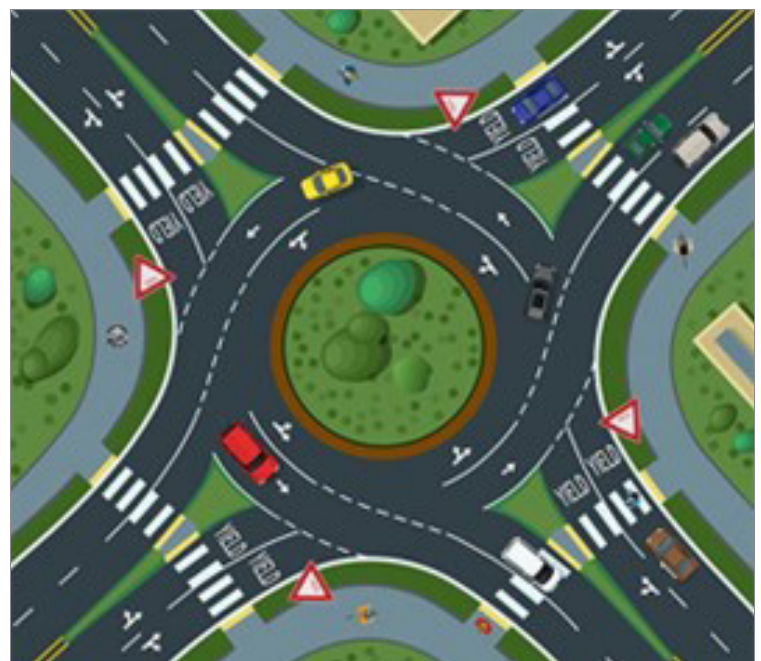
- » Protected left-turn signal phasing
- » Minimize negative offsets
- » No right-turn-on-red
- » Conversion to roundabouts

Establishing access management adjacent to intersections can minimize the number of driveways and reduce conflict points.



Source: FHWA

Roundabout



Source: FHWA

INTERSECTIONS

SEPARATE VEHICLES FROM VULNERABLE ROAD USERS USING SPACE AND TIME

Separation of space:

- » Continuous sidewalk and bicycle lanes
- » Grade separated pedestrian crossings
- » Protected intersections

Separation of time:

- » Pedestrian signals
- » Pedestrian hybrid beacons
- » Leading pedestrian interval signal phase
- » School crossing guards

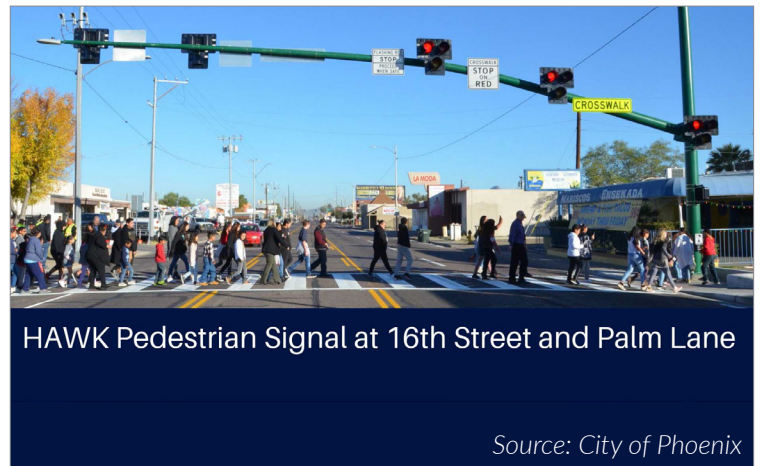
Priority should be given to locations that experience a high volume of pedestrians and/or bicycle crossings.

Protected Intersection



Source: Arlington County, VA

HAWK Signal



HAWK Pedestrian Signal at 16th Street and Palm Lane

Source: City of Phoenix

IMPROVE VISIBILITY FOR ALL USERS

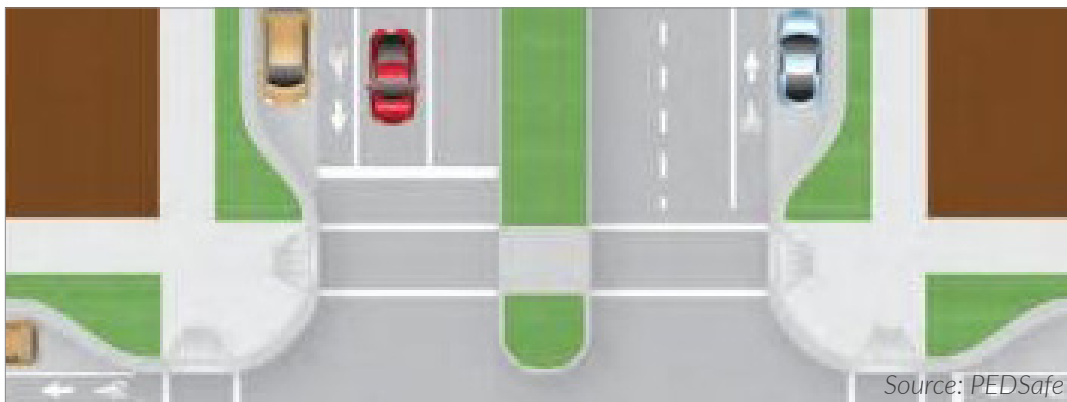
Short term projects:

- » Static warning signs
- » Activated flashing beacons
- » Retroreflective backplates on signal heads

Long term projects:

- » Overhead lighting
- » Modify offset left turn-lanes
- » Curb bulbouts or other physical features

Curb Bulb Outs



Source: PEDSafe

Retroreflective backplates



Source: FHWA

INTERSECTIONS

SIMPLIFY INTERSECTIONS

Minimize visual distractions and/or reduce the number of decisions required by drivers at intersections.

- » Reduce sign clutter or excess pavement markings so that focus is on the most critical information.
- » Where possible, provide clear direction at decision points using physical elements to minimize error in decision making.

Examples:

- » Channelization
- » Pavement marking arrows and legends
- » Exclusive turn lanes

Channelized Intersection



CONDUCT HIGH-VISIBILITY ENFORCEMENT AT INTERSECTIONS

Conduct at locations with a high number of violations or crash patterns. The purpose of high-visibility enforcement is to educate the public on existing laws and increase long term voluntary compliance. Utilize automated systems where feasible to reduce the need for resources and increase the efficiency of the effort. Utilize mobile systems where feasible to target more areas and increase the efficacy of the effort.

Enforcement activities:

- » Red-light-running
- » Failure to yield to VRUs in the crosswalk
- » Distracted/aggressive driving.



Source: Governors Highway Safety Association



Source: Oro Valley Police

IMPROVE ROAD USER EDUCATION FOR NEWER TREATMENTS

Develop education campaigns and/or informational guides on new intersection treatments to support driver education.

Provide education on:

- » Roundabouts
- » Pedestrian hybrid beacons
- » Flashing yellow arrows
- » Diverging diamond interchanges
- » Rectangular rapid flashing beacons
- » Single point urban interchanges

Similar information and user guides regarding the operations and safety of these treatments are readily available at the national level. Statewide and regional efforts can be combined to reach larger audiences and increase efficiency of resources.

Outreach:

- » Online campaigns
- » Social media
- » In-person presentations to community groups



Source: MAG

UTILIZE CONTEXT-APPROPRIATE SPEEDS

Utilize context-appropriate speed limits through the use or establishment of policy, education, and enforcement

A complete street design encourages safe driving habits and reduces excessive speeds.

Examples:

- » Narrower travel lane widths
- » Colored and marked bike lanes
- » Raised median islands
- » Landscaping

Complete Streets Graphic



Source: Smart Growth America

INTERSECTIONS

REDUCE SPEEDS ON INTERSECTION APPROACHES

Infrastructure examples:

- » Roadway curvature
- » Tighter curb radius
- » High friction surface area
- » Transverse rumble strips

Visual examples:

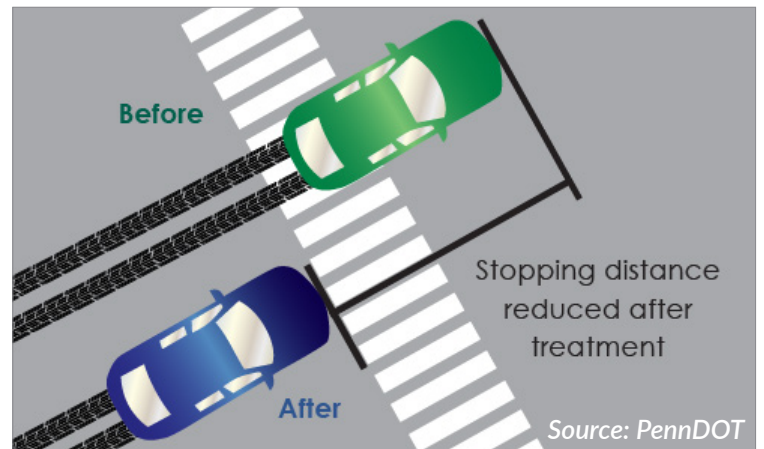
- » Landscaping
- » Speed warning signs
- » Advance flashing beacons

Landscaping



Source: City of Scottsdale

High Friction Surface Area



INCREASE AUTOMATED/MOBILE ENFORCEMENT OF SPEEDS

Utilize existing data and statistics. Priority should be given to locations with a high number of speed violations or fatalities and serious injuries. Utilize automated systems where feasible to reduce the need for resources and increase the efficiency of the effort. Utilize mobile systems where feasible to target more areas and increase the efficacy of the effort.

Red Light Camera



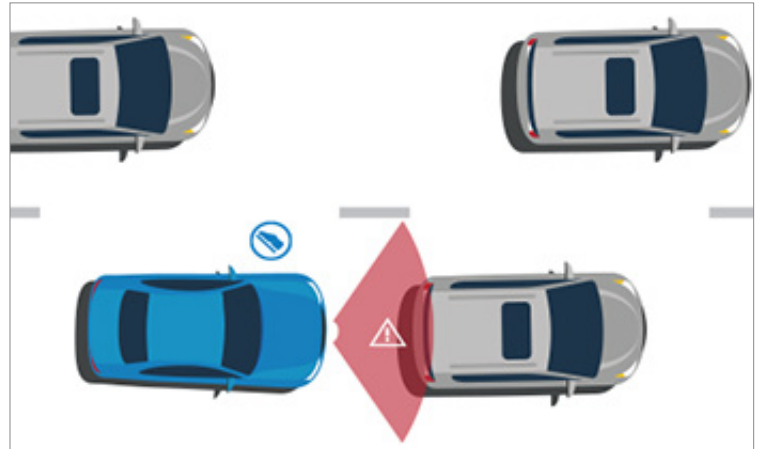
PROMOTE ADVANCED WARNING TECHNOLOGY

Provide support to the automotive industry for implementation. Offer existing data. Support potential new vehicle equipment and design initiatives that aim to reduce driver error through advance warnings.

Support technologies:

- » Lane departure warning
- » Blind-spot warning
- » Vehicle eye tracker
- » Emergency braking
- » Future connected vehicles (V2X)

Forward Collision Warning



Source: NHTSA

SUPPORT ADDITIONAL NEEDS FOR ADVANCED WARNING TECHNOLOGY

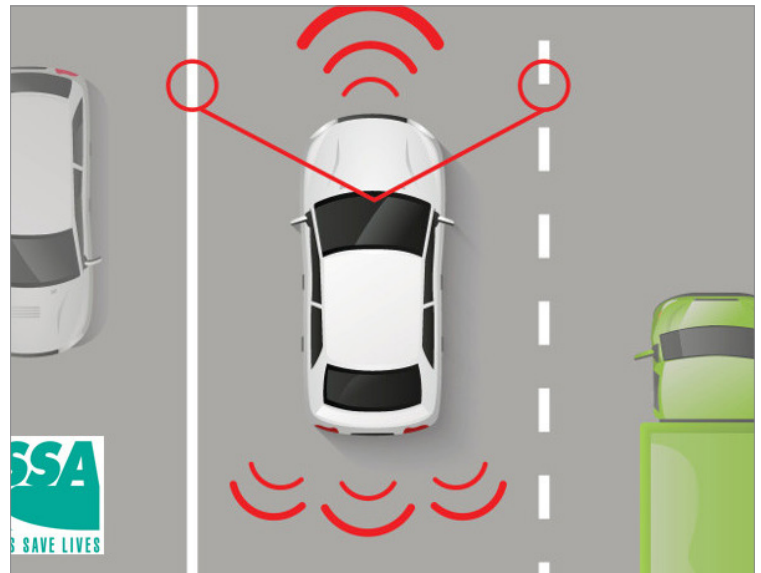
Evaluate infrastructure to support and/or improve the accuracy of on-vehicle advanced warning technologies. Many of the systems rely on information provided by signs, pavement markings, and other assets maintained by public agencies.

Maintenance initiatives:

- » Replace missing, damaged, or non-reflective pavement markings
- » Replace missing or damaged roadway signs
- » Replace missing or damaged traffic signals

Similar care may be needed when obliterating pavement markings.

Pavement Markings



Source: ATSSA

INTERSECTIONS

PROMOTE SAFETY AT CRASH SCENES

Promote traffic safety at crash scenes through internal training on traffic incident management (TIM), incident command system (ICS), and other topics to law enforcement, first responders, and other public agencies. Provide public education on the need for safety around active crash scenes and the importance of responder safety. Educate on supporting initiatives such as “Move Over” law and clearing roadway with minor crashes.

Promote stop-the-bleed and CPR training for all motorists and bystanders so they can render emergency care at crash scenes as needed until emergency responders arrive. Support training of emergency medical care technicians and job placement in rural and medically underserved areas.

Move Over AZ



Source: NHTSA

IMPROVE ACCESS TO INTERSECTION CAMERAS

- » Improve interagency and inter-department access to existing intersection cameras to provide increased situational awareness particularly for first responders and others involved.
- » Install additional pan-tilt-zoom (PTZ) cameras, mounted on signal poles and luminaries, at intersections with high crash severity rates and lack of visibility.



Source: ADOT

SHARE AGENCY DATA

Share traffic-related data amongst statewide, regional, and local agencies to improve post-crash care, identify hot spots, and assist in evaluating speed limits, safety improvements, design advancements, and staffing resources.

Crash and violation data should be limited to an aggregate level and not include any personally identifiable information.

Examples:

- » Traffic volumes
- » Crash statistics
- » Violation frequency
- » Signal timing
- » Emergency medical services
- » Trauma registry data

STRATEGY RESOURCES

FHWA – Safety Resources	https://highways.dot.gov/safety
Proven Safety Countermeasures	https://highways.dot.gov/safety/proven-safety-countermeasures
Zero Death Resources	https://highways.dot.gov/safety/zero-deaths/resources
Intersection Safety Resources	https://highways.dot.gov/safety/intersection-safety/resources
Safe System Intersections	https://highways.dot.gov/safety/intersection-safety/safe-system-intersections
Transportation Safety Planning	https://highways.dot.gov/safety/other/transportation-safety-planning-tsp
Intersection Control Evaluation	https://highways.dot.gov/safety/intersection-safety/ice
Bicycle and Pedestrian Safety	https://highways.dot.gov/safety/pedestrian-bicyclist
Local & Rural Safety	https://highways.dot.gov/safety/local-rural/training-tools-guidance-and-countermeasures-locals-practitioners
Speed Management Safety	https://highways.dot.gov/safety/speed-management/reference-materials
Roadway Departure Safety	https://highways.dot.gov/safety/RwD
NHTSA – Safety Resources	https://www.nhtsa.gov/
Risky Driving	https://www.nhtsa.gov/risky-driving
Vehicle Safety	https://www.nhtsa.gov/vehicle-safety
Road Safety	https://www.nhtsa.gov/road-safety
Other Resources	
Arizona–Move Over AZ	https://moveoveraz.org/
BIKESAFE–Bicycle Safety	http://www.pedbikesafe.org/BIKESAFE/countermeasures.cfm
FHWA - Bicycle and Pedestrian Program	https://www.fhwa.dot.gov/environment/bicycle_pedestrian/resources/
GHSA – Speed and Red Light Cameras	https://www.ghsa.org/issues/speed-and-red-light-cameras
IIHS – Highway Loss Data Institute	https://www.iihs.org/
MAG – See Me AZ	https://azmag.gov/Programs/Transportation/Safety-Programs/See-Me-AZ
PEDSAFE–Pedestrian Safety	http://www.pedbikesafe.org/PEDSAFE/countermeasures.cfm
TZD–Marketing & Communications Toward Zero deaths	https://www.towardzerodeaths.org/marketing-communications/#plans
USDOT – Preparing for the future of transportation	https://www.transportation.gov/AV
USDOT – Traffic Safety Marketing	https://www.trafficsafetymarketing.gov/