To: Ald. Michael J. Murphy

From: Tea Norfolk, Legislative Fiscal Analyst – Lead

Date: June 6, 2019

Subject: City-County Carjacking and Reckless Driving Task Force Engineering Solutions Subcommittee – Hot Spots, Drones, Engineering Solutions

This memo is in response to your request for information regarding the following three items:

1. National data related to how police resources are allocated for crash hot spots.
2. Use of drones for monitoring speed and issuing tickets.
3. Best practices for use of engineering solutions to address reckless driving.

Hot Spots

In 2017, City University of New York's John Jay College of Criminal Justice released a report urging additional consideration for policing crash hotspots. The report studied Indianapolis census blocks over a 36-month period from 2011 to 2013. Results indicated that both violent and property crime are significantly related to vehicle crash counts. Spatiotemporal analysis of crime and crash data can identify places for police intervention and improved evaluation. Research also indicated that disorder, such as motor vehicle crashes, concentrates in small geographies. The research showed a consistent correlation between criminality, disorder, deviance, and traffic violations.

Data-Driven Approaches to Crime and Traffic Safety (DDACTS) is the law-enforcement operational model developed by the Department of Transportation's National Highway Traffic Safety Administration (NHTSA) and two agencies of the Department of Justice: The Bureau of Justice Assistance and the National Institute of Justice. DDACTS integrates location-based crime and traffic crash data to determine the most effective methods for deploying law enforcement and other resources. The goal of DDACTS is to reduce crime, crashes, and traffic violations.

According to the National Law Enforcement Liaison Program, DDACTS integrates location-based crime and traffic crash data to establish effective and efficient methods

for deploying law enforcement and other partner resources. By using geo-mapping (software programs providing hot spot analysis include ArcGIS, CrimeStat, and CrimeView 9) to identify areas through temporal and spatial analysis, an agency identifies locations with high incidences of both crime and crashes, then deploys targeted traffic enforcement strategies to those hot spots. By saturating locations with highly visible traffic enforcement, the DDACTS agency can play a dual role of fighting crime and reducing traffic crashes and violations. The goal is to reduce the incidence of crime, crashes, traffic violations, and social harm in communities.

DDACTS relies on seven guiding principles for successful implementation:

1. Identify partners and stakeholders.
2. Collect data.
3. Analyze data.
4. Strategize operations plan.
5. Share information and conduct outreach.
6. Monitor, evaluate, and adjust operations.
   a. Implement plan.
   b. Monitor and evaluate.
   c. Readjust plan and re-implement.
7. Determine and report outcomes.

There are six cities using DDACTS protocols, and most of the efforts have generated positive results. In optimal conditions, crime has decreased by as much as 41%, and motor vehicle crashes have been reduced by 24%. The table below shows how DDACTS has impacted crime and traffic safety in six implementation sites.

Site	Results	Software
Baltimore, MD	1. Crime: Burglaries decreased by 16.6%, robberies decreased by 33.5%, vehicle thefts decreased by 40.9% 2. Crash: Crash-related injuries decreased by 0.2%, total crashes decreased by 1.2%	ArcMap CrimeStat
Nashville, TN	1. Crime: Uniform Crime Reporting Part 1 crime decreased by 13.9%, and DUI arrests increased by 72.3% 2. Crash: Crash-related injuries decreased by 30.8%, fatal crashes	ArcGIS7 CrimeView9

	decreased by 15.6%	
Rochester, NY	1. Crime: Homicides decreased by 36% and the rate of vehicle theft was the lowest. 2. Crash: Crashes reduced by 6% (374 crashes).	ArcGIS Spatial Analyst
Reno, NV	1. Crime: Burglaries decreased by 21%; vehicle thefts decreased by 8%; assaults decreased by 6% 2. Crash: The observed crash number was too small to analyze.	Unknown
Lafourche Parish, LA	1. Crime: DDACT area saw a lower crime rate (1.6%) than in the other adjusted area (2.3%) 2. Crash: Crash-related injuries decreased by 11% - 14.7% in subarea	Unknown
St. Albans, VT	1. Crime: Vandalism decreased by 27%; fraud decreased by 29%, assaults decreased by 37%, and burglaries decreased by 38% 2. Crash: Crash-related injuries and fatalities decreased by 19% and crash-related incidences of property damage only (PDO) decreased by 21%	Unknown

Crime prevention effectiveness is maximized when police focus their resources on micro-units of geography (hot spots). By allocating resources where crime is highly concentrated, strategies can be tailored to the specific types of crime most frequently occurring in those locations. For example, in Minneapolis, the Hot Spots Patrol Experiment used place-based policing. In Jersey City, NJ, the Drug Market Analysis Program Experiment employed a three-step program: 1) identifying and analyzing problems, 2) developing tailored responses, and 3) maintaining crime control gains. This strategy was used to reduce problems at drug hot spots.

Drones

National Policy

According to a November 2014 report by Gregory McNeal for the Brookings Institution, the Federal Aviation Administration (FAA) Modernization and Reform Act of 2012 directed that the FAA must integrate unmanned aircraft systems (drones) into the national airspace by September 2015. A number of organizations, including the American Civil Liberties Union (ACLU), have expressed concern over the possibility of drones crowding the skies, some armed with sophisticated surveillance systems. Key sections of the law direct the Secretary of Transportation and the Administrator of the FAA to draft plans, standards, and rules to ensure that drone integration proceeds in a safe and legal manner, allowing for local government and citizen input.

For the previous 25 years, the law has allowed police to fly aircraft over private property, back yards, factory farms, industrial plants, and any other place where the average citizen may fly a Cessna. The police may make observations from the air, just like a person on a commercial flight inbound to an airport can look down and observe the yards of people below and like a utility worker on a pole can look down into an adjacent yard. Police may use such information to get a warrant to go in on foot and investigate what was previously observed from a lawful vantage point.

Critics of drones raise the concern that the government's collection of aerial imagery will enable pervasive surveillance that allows the government to know what all citizens are doing at all points in time, and will allow government officials to view footage years after its collection, revealing intimate details of people's lives. Accordingly, the Brookings Institution recommends that legislators adopt policies that address collection and retention of information in a way that focuses on information that is collected, how it is stored, and how it is accessed, rather than the particular technology used to collect the information.

According to the Brookings Institution, drone legislation is rarely tailored in such a way to prevent the harm of pervasive surveillance, but, rather, is aimed at use of the technology of drones, themselves, while still allowing use of sophisticated pervasive surveillance technologies from manned aircraft, while disallowing benign use of drones for mundane tasks like accident and crime scene documentation or monitoring of industrial pollution and other environmental harms.

In 2014, Wisconsin passed s. 175.55, Wis. Stats., to address the use of drones by law enforcement. The restricted use of drones statute provides that no law enforcement agency may use a drone to gather evidence or other information in a criminal investigation from a place where an individual has a reasonable expectation of privacy without first obtaining a search warrant. The legislation does not apply to the use of a drone in a public place or to assist in an active search and rescue operation, to locate an escaped prisoner, to surveil a place for the purpose of executing an arrest warrant, or if law enforcement has a reasonable suspicion to believe the use of a drone is necessary to prevent imminent danger to an individual or to prevent imminent destruction of evidence.

Those concerned with privacy contend that the government will be able to engage in widespread pervasive surveillance because drones are cheaper to operate than their manned counterparts. Current technology has not yet reached a level of sophistication to meet those concerns; however, technology continues to evolve.

Accordingly, the Brookings Institution makes the following recommendations with respect to tailoring legislation to balance privacy concerns with government interests in effectively using drone technology. Legislators should do the following:

1. Follow a property rights approach to aerial surveillance. This approach provides landowners with the right to exclude aircraft, persons, and other objects from a column of airspace extending from the surface of their land up to 350 feet above ground level. Such an approach may solve most public and private harms associated with drones.
2. Craft simple, duration-based surveillance legislation that will limit the aggregate amount of time the government may surveil a specific individual. Such legislation can address the potential harm of persistent surveillance, a harm that is capable of being committed by manned and unmanned aircraft.
3. Adopt data retention procedures that require heightened levels of suspicion and increased procedural protections for accessing stored data gathered by aerial surveillance. After a legislatively determined period of time, all stored data should be deleted.
4. Enact transparency and accountability measures, requiring government agencies to publish on a regular basis information about the use of aerial surveillance devices (both manned and unmanned).
5. Recognize that technology such as geofencing and auto-redaction, may make aerial surveillance by drones more protective of privacy than human surveillance.

According to research by the Center for the Study of the Drone at Bard College, as of May 2018, at least 910 state and local public safety agencies have purchased drones (based on Federal Aviation Administration and other records). Of those, 599 are law enforcement agencies. The survey identified the make and model of drones owned by 627 of the 910 agencies.

Drones have been used in pilot programs in various jurisdictions, and some communities have created policies for drone use. A summary of those programs is provided below.

California

The California Highway Patrol's Central Division Air Operations unit uses regular aircraft equipped with the same camera technology used by the military on its predator drones to assist with crimes in progress, such as searching for suspects on foot and in cars. The camera has a mapping system that identifies street names integrated over the image, can zoom in on a suspect or vehicle from 6,000 feet in the air and three miles away, and uses thermal imaging to detect heat sources. The camera is mounted on the plane's belly pod and works extremely well during nighttime because it can even show footprints from the heat trail left by a suspect running.

When patrolling in a given area, the flight officer monitors the traffic of all the agencies in the area to assist wherever needed. For example, the unit has spotted vehicles racing on a country road and notified ground units, which were then able to apprehend suspects. In 2016, the unit assisted with 216 arrests, 13 pursuits, and 472 searches. The unit has also been used to catch speeders, although that use is rare.

Chula Vista, CA

In December 2015, the Chula Vista Police Department formed the Unmanned Aerial Systems Committee to study the use of technology in its public safety operations. Committee members met dozens of times to study best practices, policies, and procedures regarding the use of drone technology in law enforcement. The committee's research efforts focused on addressing concerns of public trust, civil liberties, and the public's right to privacy. Prior to implementing use of drones, the Police Department discussed its plan in the media, public forums, and information posted to the Police Department's website. There were numerous points of contact for public feedback. Out of respect for civil liberties and personal privacy, the Police Department developed a

drone policy that specifically prohibits the use of drone technology for general surveillance or general patrol operations.

The program was launched in the summer of 2017 to support tactical operations by first responders. Drones are used for critical incidents, such as missing persons, crime scenes, traffic collisions, wildfires, or special events. The use of drones by government agencies is subject to federal and state laws as well as the agency's policies.

In June, 2018, the Chula Vista Police Department was selected by the Federal Aviation Administration (FAA0 as one of ten drone-testing sites in the United States that are part of the Unmanned Aircraft System Integration Pilot Program. The program was developed to help FAA create regulations when it comes to low-flying drone use by companies and cities. Missions include international commerce and border security, which involves traffic management and identification of vehicles and vehicle-to-vehicle communications as well as public safety, which involves traffic collisions.

On March 15, 2019, the FAA granted Chula Vista a Certificate of Authorization to fly drones beyond the visual line of sight, which allows police officers to fly drones without maintaining direct eye contact with drones. The FAA granted the Palm Beach Police Department in Florida similar permission to fly beyond the visual line of sight. Since 2018, drones have responded to 328 emergency calls and contributed to 45 arrests in Chula Vista. Drone deployment also negated the use of 38 officers, which allowed them to respond to other emergencies.

Regulations still require the Police Department to have a spotter looking at the airspace the drones are flying in to protect them from obstacles, such as incoming aircraft or light poles. Police data shows that drones respond to emergency calls in less than 2 minutes, which is faster than the department's current response time of more than 6 ½ minutes. Drones help police determine how to respond because live video streams show them the situations they are about to approach.

Grand Junction, CO

The Mesa County Sheriff's Office has been using drones for four years. One is a small helicopter, which can stay airborne for 15 minutes. The other is a fixed-wing aircraft, which can remain aloft for about an hour. The drones are deployed approximately two times per month. The fixed-wing aircraft has been used for search-and-rescue missions, and the helicopter has been used to take aerial photographs at crime and accident

scenes. Photographing accident scenes helps officers determine what occurred by viewing the debris field and skid marks.

Drones are not, however, used for every fender bender. One researcher states it would not be fiscally responsible to use drones for this purpose, as they cost from $25,000 to $175,000. Operating a drone costs approximately $25 per hour.

In locations where aircraft are involved in catching speeders in Mesa County, marks are painted one-quarter mile apart on the side of the road. Officers in the air start a timer when the vehicle reaches the first mark and stop it when it passes the second mark. Then they consult a chart to determine the driver's speed. If the driver has been speeding, they radio a unit on the ground, which stops the vehicle and writes a ticket. Drones cannot get high enough to see the start and stop marks. Additionally, they are not useful for surveillance because the battery life curtails their flight times.

Houston, GA

The Houston County Sheriff's Office debuted a drone in May 2019. The Sheriff stated the drone can help locate missing children and fleeing suspects from traffic stops. Deputies who fly the drone must log when and for what purpose the drone is flown, and a sheriff's incident report is filed for each drone flight.

For traffic stops, the drone would be used, for example, if a suspect ran from the scene. The drone was used before its unveiling. In April, it was used to help search for a suspect in a killing in a wooded area and in searching a capsized boat. The drone may also be used by the Fire Department and surrounding agencies in the County.

Ohio

Ohio State University led a pilot program that used drones for roadway and traffic monitoring along a 35-mile highway stretch between Dublin and East Liberty. Tracking data is sent to the Ohio Department of Transportation's Traffic Management Center to complement data from existing systems. Drones may help spot traffic-disruptions, such as a crash or washed-out road, sooner. The pilot program will also help researchers see what drones can do while finding a way to safely integrate them into crowded airspace. The three-year research project started July 1, 2018 and is partially funded by DriveOhio, which is interested in how drone oversight could help its efforts to boost self-driving and connected cars.

Orange County, CA

The Orange County Sheriff's Department is scheduled to start its drone program in May and June, 2019. The department will start with 5 drones and 24 pilots, 14 of which are civilians. The department's aviation support unit, which controls 5 helicopters, will administer the program. The department will continue to use its other aircraft, and drones will allow for better efficiency in certain circumstances. The department requires drone pilots to undergo a training program and background check that takes approximately 4 to 6 weeks. Civilians are subject to the same standards as sworn officers.

The sheriff's department will use drones when responding to hazardous material spills, bomb squad missions, traffic collisions, search and rescue missions, hostage situations, while serving search warrants, disaster response and recovery, for fire response and prevention, and inspecting county property and facilities. The program will be regulated by the FAA's rules, which address commercial and personal drone use, and it will be accredited by the Public Safety Aviation Commission, which develops standards of accreditation for operations performed by public safety aviation units. The commission works with the National Transportation Safety Board.

The sheriff stated following the FAA's rule book, and accreditation will ensure a higher degree of safety compared to a certification of authorization, which can be used by law enforcement agencies when establishing drone programs. The department addressed privacy concerns in its policy honoring residents' reasonable expectation of privacy. The policy states that a drone may be used "when there is probable cause to believe that (1) the drone may record images of a place, thing, condition or event, and (2) that those images would be relevant in proving that a certain felony had occurred or is occurring, or that a particular person committed or is committing a certain felony and use of the drone does not infringe upon the reasonable expectation of privacy.

Critics are concerned that the policy does not provide for limitation on the use of drones. Additionally, the policy does not address plans to maintain the footage captured by drones.

Polk County, FL

The Polk County Sheriff's Office has one of the biggest drone fleets in law enforcement, with 29 drones. They are able to fly 24 hours a day, 7 days a week and are used to track suspects. Drones used during the day cost approximately $1,600. Night drones

cost approximately $27,000. The Sheriff's Office uses drones during emergencies, and are required to obtain a court order to use them for any other purpose.

Virginia

Virginia changed its law in 2015 to allow law enforcement to use drones. However, the law requires a waiver from the Federal Aviation Administration to monitor traffic conditions. Drones cannot be flown over crowds or moving vehicles without permission from the FAA. The state police do not currently have plans to do so, due to funding. There have been discussions regarding whether there is a benefit to the public, but use of the technology would likely be limited to search and rescue operations.

Engineering Solutions

Tens of thousands of drivers and vehicle occupants die in traffic crashes each year, along with more than 4,000 pedestrians, who are killed by motor vehicles. A 2011 National Highway Traffic Safety Administration (NHTSA) report revealed that pedestrian deaths accounted for 12% of all traffic fatalities and 3% of all people injured in traffic crashes in 2009. When measured per miles drive, the death rate on residential streets is more than twice the highway death rate.

Communities and traffic engineers have developed and employed several types of traffic-calming measures to encourage safe speeds and to increase driver awareness. Summarized below are specific traffic-calming tools, programs that have been created, and community campaigns.

TRAFFIC CALMING TOOLS

Gateway Treatment

A gateway device marks a threshold, such as increased density, where lower speeds are required from drivers. Gateways rely on highly visible markings to capture driver attention, such as the following:

- Large signs conveying the message that it is an entry to a location where pedestrians and other vulnerable road users are about to be encountered in greater numbers.
- Pavement markings to narrow the perceived width of the roadway, including painted central medians for a short distance.

- Large speed limit signs showing the lower speed limit that applies.
- Other pavement markings to indicate clearly that a threshold is being crossed into a different environment.
- Architectural treatments, such as a picket fence or gate, earth mounds, and rock walls.

Markings can also be used to indicate an approach to a pedestrian crossing or other changed traffic conditions where drivers should slow their vehicles in the interest of safety.

Pavement Narrowing

Wider roads invite drivers to travel at higher speeds. Pavement narrowing and engineering treatments at curves tend to slow traffic speeds. Narrowing the roadway for motorized traffic assists in speed reduction. This can be done with painted markings in the roads, creating an optical illusion.

Pedestrian Traffic Signals

Pedestrian traffic signals are installed at intersections or crosswalks to allow pedestrians an opportunity to cross the street safely. Pedestrian activated traffic lights inform pedestrians with a "WALK" or "DON'T WALK" message when it is safe to cross and may include countdown signals. Rapid flashing rectangular beacons, at crosswalks, alert motorists to pedestrians who have manually activated the beacon.

Radar Speed Signs

Radar speed signs (driver feedback signs) alert drivers to their actual speed, remind them of the speed limit, and are scientifically proven to reduce speeding.

Roundabouts

Roundabouts require traffic to deviate from a straight path and slow down to undertake the maneuver. Roundabouts provide a combination of reduced speeds and a decrease in right-angle side-impact crashes due to the geometry of the roundabout, which also results in reduced crash severity. Effective roundabout installation also relies on careful design of approach islands, clearly visible signs and markings, and effective public information campaigns about how they should be navigated by drivers. Care must be taken, however, in addressing pedestrian and bicycle navigation of roundabouts

because drivers tend to concentrate more on the task of navigating the roundabout than watching for pedestrians and cyclists.

Rumble Strips

Lengthy sections of raised materials, sometimes called rumble strips, provide audio and tactile signals when driving over them, which can lower traffic speed.

School Zone Signage and Street Markings

Well-placed signs and pavement markings provide critical information to drivers and students within a school zone. Speed limit signs announce school zone speed limits, which typically range from 15 to 25 mph. School zone advance warning and end school zone signs alert drivers that they are entering or leaving the reduced speed limit area. School crossing signs notify drivers of crosswalks. Flashers may be installed at speed limit signs or crosswalks to call attention to critical traffic points.

An example of an effective educational sign is the following:

Vehicle Speed	Chance of Fatality
40 MPH	80%
30 MPH	40%
25 MPH	20%
20 MPH	5%

Separation of Vulnerable Users

Pedestrians have twice the risk of injury when they are not separated from motor vehicle traffic. Pedestrian fencing is useful for improving road safety of pedestrians by directing larger flows of pedestrians away from random crossing locations to safer crossing points, which may be equipped with treatments such as speed humps or raised platforms in the roadway. Refuge islands and medians can assist pedestrians in crossing the road by allowing a staged crossing and simplifying decision-making. A curb extension can improve pedestrian safety by reducing the crossing distance and the area and time in which the pedestrian is at risk. This is particularly helpful for older and disabled pedestrians who may have difficulty choosing a safe gap in traffic at a conventional crossing point.

Networks of separate pedestrian and bicycle routes connecting to a public transportation system can be crated with sections of footpaths or bicycle paths separate from roads, sections running alongside roads, and particular attention paid to safe crossings at junctions.

Speed Humps and Raised Platforms at Pedestrian Crossings and Intersections

Single raised structures in the roadway (such as speed humps) are effective, especially in urban road environments. Speed humps force drivers to slow down before intersections or pedestrian crossings. A speed hump or raised platform is usually constructed of bituminous concrete, cement concrete, or rubber. Its vertical cross section can be semi-circular or parabolic. Its dimensions should be designed to ensure the safety of vehicles crossing it. At each end of the hump, near the curb, the treatment should ensure that road drainage is not impeded. The road should be clearly marked with signs to warn drivers, and the hump should be painted with reflective markings.

Trapezoidal Humps

The concrete trapezoidal hump is 10 cm high with a ramp on each side that is 1 m long with a corresponding gradient of 1:10. The length of the flat area ranges from 4 m to 7 m, depending on the type of traffic traveling the road. The ramps can be extended to 1.7 m or 2.5 m, depending on the desired vehicle speed. Painted black and yellow stripes on ramps and hump signs ahead of humps warn drivers to lower their speed.

PROGRAMS

Bait Cars

Placing cars in plain view can provide a target for police to observe and catch offenders in the act. Maintaining cars under continuous surveillance is labor-intensive, although technological innovations such as GPS tracking and cars that automatically broadcast to patrol cars when they are broken into have made this easier. Some research has suggested that this type of program might be effective in reducing car crime. This response is more effective when it is known what type of car is most often targeted for theft, or when a particular area is experiencing a very high volume of thefts from cars.

In British Columbia, Canada, police officials have formed a task force of seven provincial and local police agencies that use bait cars which, when stolen, immediately notify dispatchers and transmit their position via GPS tracking. Once police are in place

behind the car, the engine is disabled with the click of a mouse button, allowing apprehension without the concern of a pursuit situation developing.

Centipede Enforcement

Six or more speed-enforcement cars are placed approximately two miles apart to stop speeding drivers who think it is safe to speed up after passing a police officer who has pulled another driver over. Centipede enforcement is useful for apprehending aggressive drivers by distinguishing them from motorists who maintain lower speeds after they pass the initial visible enforcement officer.

Crossing Guards

Crossing guards serve an integral role in school zone safety. They help pedestrians and bicycles cross roadways and remind motorists of their presence. And, just as importantly, they serve as excellent role models for the behaviors required to safely cross the street. From a simple pause to look left, right, and left again to reminding drivers of their role in safety, crossing guards model best practices for students and adults alike.

The following factors must be considered when placing crossing guards in a school zone: the students who will be crossing; the width of the roadway and the number of lanes which will be crossed; the presence of traffic signals, signs and pavement markings; and the speed and volume of traffic on the roadway.

Portable or stationary driver feedback signs, used in conjunction with crossing guards, provide a visual enforcement measure to slow traffic at the most critical path where children are crossing the street. Strategically-placed driver feedback signs can serve as triggers—stimulating drivers to transition from autopilot to attentive. Portable signs can be placed at the side of the road, or in the center line if there is enough room, to assist in slowing traffic prior to the crossing guard entering the crosswalk.

Enforcement Crackdowns

Aggressive driving enforcement crackdowns, properly timed and executed, can be effective. For example, saturation police patrols on congested streets or around aggressive driving hot spots focus enforcement geographically. In addition to enforcing actual aggressive driving violations, enforcing precursors or actions that commonly trigger aggressive driving—such as blocking intersections during rush hour, failing to

yield the right-of-way, and abruptly changing lanes—can also help reduce aggressive driving.

High-Visibility Enforcement

High-visibility enforcement has the effect of calming the driving behavior of a greater number of motorists than those police actually stop. Using marked vehicles can increase visibility, as well as adding magnetic "aggressive driving patrol" signs to enforcement vehicles.

Keep Kids Alive, Drive 25

The Keep Kids Alive, Drive 25 campaign develops traffic safety initiatives in conjunction with law enforcement agencies, neighborhood and civic organizations, city services agencies, and businesses. Communities begin by assembling a traffic safety task force comprised of neighborhood residents, area school officials, businesses in or near the target neighborhood, traffic engineers, law enforcement, and sometimes even city council members. The purpose of the task force is to look at what needs to be done to engage and educate the community.

Most task forces identify speeding and running red lights or stop signs as the most common infractions observed in residential neighborhoods. Results from a Safe Kids-FedEx study showed that less than 30 percent of observed drivers braked correctly at stop signs. The Keep Kids Alive, Drive 25 program implements awareness campaigns that feature messages such as , "Stop. Take 3 to See," "Be Aware. Drive with Care," and "It's Not a Race! Create Space." Follow-up studies suggest drivers take these messages to heart. In one California pilot project, neighbors placed signs in their yards reminding drivers to slow down, which resulted in a 6 mile-per-hour average speed reduction. In Tucson, AZ, residents, local Boy Scouts, and a public utility company collaborated to fund and launch a trash container decal campaign that resulted in a residential speed decrease to an average of 24 miles per hour.

Public Information Campaigns

Stigmatizing aggressive driving through public information campaigns can be effective. The most promising education approach for educating antisocial drivers involves stigmatizing aggressive driving behaviors in much the same way advertising campaigns transformed social perceptions of drunken driving. Targeted campaigns are more effective than general campaigns.

Sitting in Unmarked Cars

One tactic that has been employed in some communities is having police officers sit in unmarked cars and call ahead the speed and license plates of speeding vehicles to marked cars. The marked cars then pull over the speeding drivers and issue tickets.

Vision Zero

Vision Zero began as an initiative of the Swedish government in 1997. In urban areas, the government built separated bike lanes, lowered speed limits, and created pedestrian-only zones. By 2017, Sweden had one of the lowest traffic fatality rates in the world. Since its inception, nearly two dozen U.S. cities have adopted Vision Zero, including New York City, Los Angeles, Chicago, Seattle, Pittsburgh, and Portland (OR). Emphasis on street design is one of the hallmarks of the program. Instead of attempting to eliminate all crashes, the program's plan is to lessen the severity of crashes.

Three core functions make up the Vison Zero design standard: (1) discourage speeding by design, (2) encourage walking, biking, and/or public transportation use, and (3) provide accessibility to all, regardless of age or physical ability. There are 10 essential elements:

1. ADA accessibility. Design sidewalks to meet full ADA compliance and enable pedestrian access by people of all abilities.
2. Public amenities. Install amenities like wayfinding, benches, bus stops and shelters, greenery, and bioswales to enhance the public realm.
3. Protected bike lanes. Install Class 1 Protected Bicycle Paths to reduce speeding and protect people on bicycles.
4. Narrow vehicle lanes. Reduce road lane width to 10 or 10.5 feet to reduce speeding – the driving behavior most likely to injure or kill.
5. Pedestrian islands. Install pedestrian islands of at least 5 feet on all 2-way multilane streets to provide safe harbors for people walking. Crosswalks leading to and from them should have high visibility.
6. Wide sidewalks. Expand sidewalks to offer no less than 8 feet of unobstructed width in order to encourage walking and reduce speeding.
7. Dedicated mass transit facilities. Prioritize mass transit riders and efficient surface transit operations to encourage public transit use.

8. Signal-protected pedestrian crossings. Give pedestrians exclusive crossing time to reduce turning conflicts. Consider hardened centerlines and slow-turn wedges to calm turning traffic.
9. Dedicated unloading zone. Make commercial curb regulation business-friendly with dedicated unloading zones, which reduce double-parking and the disruption it causes.
10. Signal retiming. Retime traffic signals for a 25 mph speed limit.

By employing the core functions and essential elements of Vision Zero, cities have employed the following strategies in street design:

1. Reduce the width of travel lanes. Wide lanes send a message to drivers to speed up.
2. Make crosswalks and bike lanes more visible. Elevate them above street grade, mark them with bright, wide swaths of paint.
3. Separate bike lanes on busy streets. Protected bikes lanes increase bike commuting.
4. Shorten crosswalks. A shorter trip across an intersection is a safer one. This is done by extending the sidewalk out into the intersection (known as a curb extension or bump-out).
5. Add raised median islands in the middle of busy streets. This creates a refuge for crossing pedestrians and has been shown to reduce traffic accidents by 56%.
6. Give pedestrians and bicyclists a head start at traffic lights. Five seconds will allow pedestrians and bicyclists to enter the intersection first and be more visible to motorists.
7. Ban right-on-red turns at busy intersections. Drivers, busy watching for other cars, often do not see pedestrians and bicyclists crossing the street on green lights.
8. Keep the turning radius 90 degrees at intersections. Rounded street corners tempt drivers to turn without stopping or looking for walkers and bikers.
9. Install traffic circles, roundabouts, speed humps, raised crosswalks, bike lanes, and other traffic-calming devices, which help motorists drive safely and be more aware of pedestrians and bicyclists.
10. Convert one-way streets to two-way, encouraging safer, slower driving.
11. Pay close attention to road designs at bus stops. Pedestrians often rush across the street to catch a bus, not paying attention to oncoming traffic.
12. Create pedestrian streets, bridges, and underpasses in busy areas where other measures are not feasible. These help minimize conflict with traffic and make walking and biking more convenient.

13. Strictly enforce laws against speeding, failure to yield to pedestrians, drunk driving, and reckless driving. Injuring or killing people with a car is no less tragic than doing it with a gun.
14. Install red-light cameras and other means of photo enforcement. Washington, D.C., now uses cameras to detect and fine drivers who fail to yield right-of-way to pedestrians as well as those who speed or run red lights.
15. Establish safe routes to school. This promotes walking and biking to school.
16. Set up training programs about pedestrian safety for traffic engineers, transportation planners, police, city officials, citizens, and children.

COMMUNITY CAMPAIGNS

Massachusetts

The Massachusetts State Police use an aggressive driving team of troopers who are assigned to the team for one year. The team uses marked and unmarked patrol vehicles as well as unmarked or non-traditional vehicles, typically seized from drug or criminal cases. They equip vehicles with video cameras, radar units, and emergency lights. A uniformed officer assigned to the unmarked vehicle works in conjunction with two more marked patrol vehicles. The unmarked or non-traditional vehicles work in areas that have been identified as aggressive driving problem areas, such as areas of high incidences of crashes, congestion, or fatalities. When they observe a violation, the officer in the unmarked or non-traditional vehicle positions the vehicle so the driving behavior can be videotaped. The officer gives the marked patrol vehicle the location. The unmarked vehicle maintains contact with the violator until the marked unit is behind the violator and a stop is initiated. The officer in the unmarked or non-traditional vehicle may also initiate a traffic stop if the driving behavior is egregious. When the unmarked vehicle is following an aggressive driver, the deck lights are activated, which provides other surrounding drivers with notice to slow down and avoid collision. The use of videotapes has also decreased court time for troopers. Boxing-in a violator until a marked police vehicle can make the traffic stop allows the State Police to maintain control of the stop. The concern of the public of stopping for an unmarked police vehicle is reduced because a marked law enforcement vehicle makes the traffic stop.

Seattle (WA)

To implement traffic-calming measures in Seattle, residents with traffic complaints are asked to complete a request-for-service application that identifies the location and nature of the traffic problem Applicants must select the calming devices or services

desired from a list of options that includes speed humps and cushions, radar speed signs, traffic circles, and speed monitoring. If a complaint is suitable for consideration, the applicant is invited to enroll in the Seattle Traffic Calming Program. A minimum of 4 neighbors must sign the enrollment form. Applicants are encouraged to attend a regularly-scheduled neighborhood traffic safety meeting to discuss the traffic calming options and to be trained to use a radar speed gun.

Neighborhood speed monitoring is the next step in the process. Resident volunteers use the radar device to collect and document vehicle speeds on their street. City staff sends letters to drivers, whose speed was measured at more than 30 miles per hour. Staff reviews data from the radar device and uses it to determine the approximate traffic volume and to calculate the speed at which 85% of drivers are traveling. Based on these findings, the department works with residents to develop appropriate community-oriented traffic-calming measures, which may include signage, parking management, driver awareness campaigns, and other tools.

One popular measure is the use of street murals. Street murals send the message to drivers that residents take pride in their neighborhood, which, in turn, results in drivers responding by taking care when driving through the neighborhoods. Seattle's "street art" residential safe driving program is being replicated nationwide.

St. Petersburg, FL

The St. Petersburg Police Department developed a program called "Where's Jockers?" It was based on the children's book, *Where's Waldo?* The children's book has several pages of thousands of faces, and the reader is supposed to find Waldo. Patrol Officer Mike Jockers developed and initiated a program whereby he was equipped with a radar gun and hand-held radio and sat in a variety of non-traditional city vehicles to observe traffic and call ahead to marked patrol vehicles to take enforcement action. Locations he used included riding lawn mowers, bus benches, and road construction vehicles. Initially, the Police Department did not advise the media of the special enforcement efforts. The effort soon gained media attention, however, which raised public awareness. By working with the media, the Police Department was able to employ education about aggressive driving as well as information about enforcement measures.

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