Aggressive Driving Enforcement

Evaluations of Two Demonstration Programs

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16. Abstract

This report presents the results of a study conducted for the National Highway Traffic Safety Administration (NHTSA) to assess the effects of two programs that were implemented to reduce the incidence of aggressive driving. The programs were conducted by the Marion County Traffic Safety Partnership (a consortium of agencies in the vicinity of Indianapolis, Indiana), and The Tucson, Arizona, Police Department. The programs each received grants of $200,000 from NHTSA to support the special enforcement and public information and education (PI&E) components. Program managers were required, as conditions of the grant, to 1) focus their enforcement efforts on key aggressive driving infractions in carefully-selected zones within their communities; 2) develop and implement PI&E campaigns to publicize the special enforcement efforts; and, 3) provide the data and other information necessary to prepare this evaluation. The programs shared additional features, but program managers were encouraged to consider innovative approaches to both special enforcement and publicity.

Samples of vehicle speed, collected unobtrusively in the special enforcement zones, and crash incidence served as the primary measures of program effect. Average speeds slightly in Marion County and at a greater rate in Tucson. The total number of crashes in the Marion County special enforcement zones increased by 32 percent, compared to the same six-month period one year earlier; the number of those crashes with primary collision factors (PCFs) associated with aggressive driving increased by 41 percent. That is, the total number of crashes increased, but the crashes with aggressive driving PCFs increased at a greater rate. The change in proportion of crashes with the target PCFs provides a better measure than crash frequency because it eliminates the effects of changes in traffic volume and other factors that might have contributed to the overall increase in crash incidence. In this regard, the Marion County zones experienced a six percent increase in the proportion of all crashes with aggressive driving PCFs, despite the extensive publicity and special enforcement efforts. The number of crashes in Tucson's special enforcement zones increased by ten percent, but the number of crashes with aggressive driving PCFs increased by less than one percent. More important, the proportion of all crashes with target PCFs decreased by eight percent. That is, crash incidence increased overall in Tucson's zones, but the proportion of those crashes with aggressive driving PCFs declined.

Study results suggest that limited resources might be better spent on officer labor than on publicity, and that focusing enforcement responsibility on a small team assigned full-time to the special enforcement patrols might be more effective than sharing the responsibility among a large number of officers as occasional overtime duty.

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AGGRESSIVE DRIVING ENFORCEMENT:

EVALUATIONS OF TWO DEMONSTRATION PROGRAMS

EXECUTIVE SUMMARY

This report presents the results of a study conducted for the National Highway Traffic Safety Administration (NHTSA) to assess the effects of two enforcement programs that were implemented to reduce the incidence of aggressive driving. The programs were conducted by the Marion County Traffic Safety Partnership (a consortium of agencies in the vicinity of Indianapolis, Indiana), and The Tucson, Arizona, Police Department. The programs each received grants of $200,000 from NHTSA to support the special enforcement and public information and education (PI&E) components. Program managers were required, as conditions of the grant, to 1) focus their enforcement efforts on key aggressive driving infractions in carefully-selected zones within their communities; 2) develop and implement PI&E campaigns to publicize the special enforcement efforts; and, 3) provide the data and other information necessary to prepare this evaluation. The programs shared additional features, but program managers were encouraged to consider innovative approaches to both special enforcement and publicity.

Both the Marion County Traffic Safety Partnership and the Tucson Police Department developed vigorous PI&E programs. The Marion County program featured professionally-produced television and radio PI&E messages and an emphasis on paid and donated advertising. The centerpiece of the Tucson PI&E program was an aggressive driving hotline, supported by billboards and printed materials, that generated public interest and considerable free publicity. The special enforcement efforts of both programs involved both marked and unmarked vehicles and a focus on drivers who exhibited any of the moving violations that frequently are associated with aggressive driving, including speeding, failure to obey traffic controls / devices, failure to yield, improper or unsafe lane changes, and following too closely.

Samples of vehicle speed, collected unobtrusively in the special enforcement zones, and crash incidence served as the primary measure of program effect. Average speeds declined slightly in Marion County and to a greater degree in Tucson. The total number of crashes in the Marion County special enforcement zones increased by 32 percent, compared to the same six-month period one year earlier, and the number of those crashes with primary collision factors (PCFs) associated with aggressive driving increased by 41 percent. That is, the total number of crashes increased, but the crashes with aggressive driving PCFs increased at a greater rate. The change in proportion of crashes with the target PCFs provides a better overall measure than crash frequency because it eliminates the effects of changes in traffic volume and other factors that might have contributed to the overall increase in crash incidence. In this regard, the Marion County zones experienced a six percent increase in the proportion of all crashes with aggressive driving PCFs, despite the extensive publicity and special enforcement efforts of the Marion County Traffic Safety Partnership. The number of crashes in Tucson's special enforcement zones increased by ten percent, but the number of crashes with aggressive driving PCFs increased by less than one percent. More important, the proportion of all crashes with target PCFs decreased by eight percent. That is, crash

incidence increased overall in Tucson's zones, but the proportion of those crashes with aggressive driving PCFs declined.

Study results suggest that limited resources might be better spent on officer labor than on publicity, and that focusing enforcement responsibility on a small team assigned full-time to the special enforcement patrols might be more effective than sharing the responsibility among a large number of officers as occasional overtime duty. The study also shows that crashes caused by aggressive driving can be deterred by a combination of PI&E and enforcement.

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INTRODUCTION

This report presents the results of a study conducted for the National Highway Traffic Safety Administration (NHTSA) to assess the effects of two programs that were implemented to reduce the incidence of aggressive driving. This brief introduction discusses the reasons for conducting the study. Subsequent sections of the report are devoted to descriptions of the countermeasure programs, the results of the programs, and the implications of study results.

BACKGROUND

The words, "aggressive driving," emerged during the 1990s as a label for a category of dangerous on-the-road behaviors. The category comprises following too closely, driving at excessive speeds, weaving through traffic, and running stop lights and signs, among other acts. Aggressive driving occasionally escalates to gesturing in anger or yelling at another motorist, confrontation, physical assault, and even murder; "Road Rage" is the label that emerged to describe the angry and violent behaviors at the extreme of the aggressive driving continuum. NHTSA defines aggressive driving as, "The operation of a motor vehicle in a manner that endangers or is likely to endanger persons or property." An important distinction is that aggressive driving is a traffic violation, while road rage, aside from the yelling and gesticulating, is a criminal offense.

People have reported the occasional on-the-road behavior that we now describe as aggressive driving since the advent of motorized transport, and quite possibly, since the beginning of vehicular travel. Anyone who has spent more than a few hours in an automobile has experienced the rudeness of other drivers. Until the final decade of the Twentieth Century, most motorists were comforted by knowing that aggressive driving behavior was infrequent and atypical, and that extreme, confrontational acts were quite rare. However, beginning in the 1990s, an unrelenting series of news reports captured the public's attention and elevated to a national problem what previously had been considered to be, simply, rude and occasionally bizarre human behavior.[1]

The shocking reports of road rage incidents appeared to many observers to coincide with a noticeable increase in aggressive driving, in general, and a sharp decline in civility and respect for other motorists and traffic laws. The AAA Foundation for Traffic Safety studied more than 10,000 reported cases of road rage and found a 51 percent increase in serious incidents between 1990 and 1996 (Mizell, 1997). A national survey found that 60 percent of motorists believe that unsafe driving by others is a major personal threat to them and their families; 75 percent of the respondents consider it to be "very important" to do something about unsafe driving (NHTSA, 1999).

[1] For example, following separate disputes in traffic: a Massachusetts bookkeeper murders another motorist with a single shot from a crossbow; a soccer mom runs another woman off the road, and to her death, in Mississippi; two Virginia men crash into oncoming traffic, killing three drivers, as the final act of an angry, on-the-road duel; a Maryland lawyer punches a pregnant woman after a minor fender-bender; in California, a famous actor uses a golf club to repeatedly smash the window and roof of a vehicle that cut him off in traffic; a driving instructor in North Carolina tells his student to chase a vehicle that cut them off and subsequently punches the offending driver; a high-school athlete is shot to death over a stop sign right-of-way dispute in New Mexico, and the incident is quickly followed by two more local fatalities attributed to "road rage."

It is reasonable to question the claims of dramatic increases in aggressive driving and road rage. For example, Mizell's estimate of a 51 percent increase in extreme cases was based on news reports, but the amount of reporting on a topic in a particular year is influenced by journalists' interest in an issue, not necessarily the actual incidence of the phenomenon in question. Even accepting Mizell's estimate of 10,000 cases of road rage during the first six years of the 1990s, the incidence is really quite low compared to the numbers of injuries and fatalities that occur on our nation's roads and highways. During the same six year period studied by Mizell, more than 22.7 million people were injured in motor vehicle crashes in the U.S., and more than 290,000 people were killed (FARS, 2000). That is, the number of cases of road rage was only .04 percent of the total number of people injured or killed in traffic (i.e., four one-hundredths of a percent), or one case of road rage for every 2,300 injuries and fatalities. The relative size of the road rage problem is further revealed by comparisons to subsets of traffic crash data. For example, 33,521 pedestrians and 4,782 bicyclists were killed, and 531,000 pedestrians and 385,000 bicyclists were injured during the six year period in which Mizell counted 10,000 cases of road rage with various outcomes (FARS, 2000).

The crash data suggest that road rage is a relatively small traffic safety problem, despite the volume of news accounts and the general salience of the issue. It is important to consider the issues objectively because programmatic and enforcement efforts designed to reduce the incidence of road rage might detract attention and divert resources from other, objectively more serious traffic safety problems. Although cases of road rage are relatively rare, the incidence of aggressive driving is much more frequent and a measurable contributing factor to traffic crashes.

The perceived increase in aggressive driving is largely explained by demographic changes. In particular, the population of the United States increased by nearly 100 million people between 1960 and the year 2000, and by 35 percent since 1970, the year that NHTSA was created with the mission of improving traffic safety. Traffic safety has improved significantly, with fatality rates declining from 5.5 per million miles traveled during the mid-1960s to 1.5 fatalities per million miles traveled in the year 2000. Figure 1 illustrates the change in fatality rate since 1966 (FARS, 2000).

The numbers presented in Table 1 show that the final decade of the Twentieth Century was a period of rapid population growth, with even greater increases in individual mobility and improvements in the ultimate measure of traffic safety. The table shows that the population of the U.S. increased by 22 million people between 1991 and the year 2000, an increase of nine percent. However, the number of licensed drivers increased by 21 million during the same period (an increase of 13 percent), and there were 30 million additional vehicles (an increase of 16 percent) and nearly 600 *billion* additional miles traveled in the year 2000 than in 1991 (an increase of 27 percent). That is, the number of miles traveled in a year increased at a rate that is three times the rate of population growth. The table also shows that despite the 27 percent *increase* in miles traveled between 1991 and the year 2000, a driver was 21 percent *less* likely to die in a motor vehicle crash at the end of the decade than at the beginning. In other words, it is safer to drive on our nations roads and highways now than ever before, despite the increases in population, miles traveled, and aggressive driving. How is this possible?

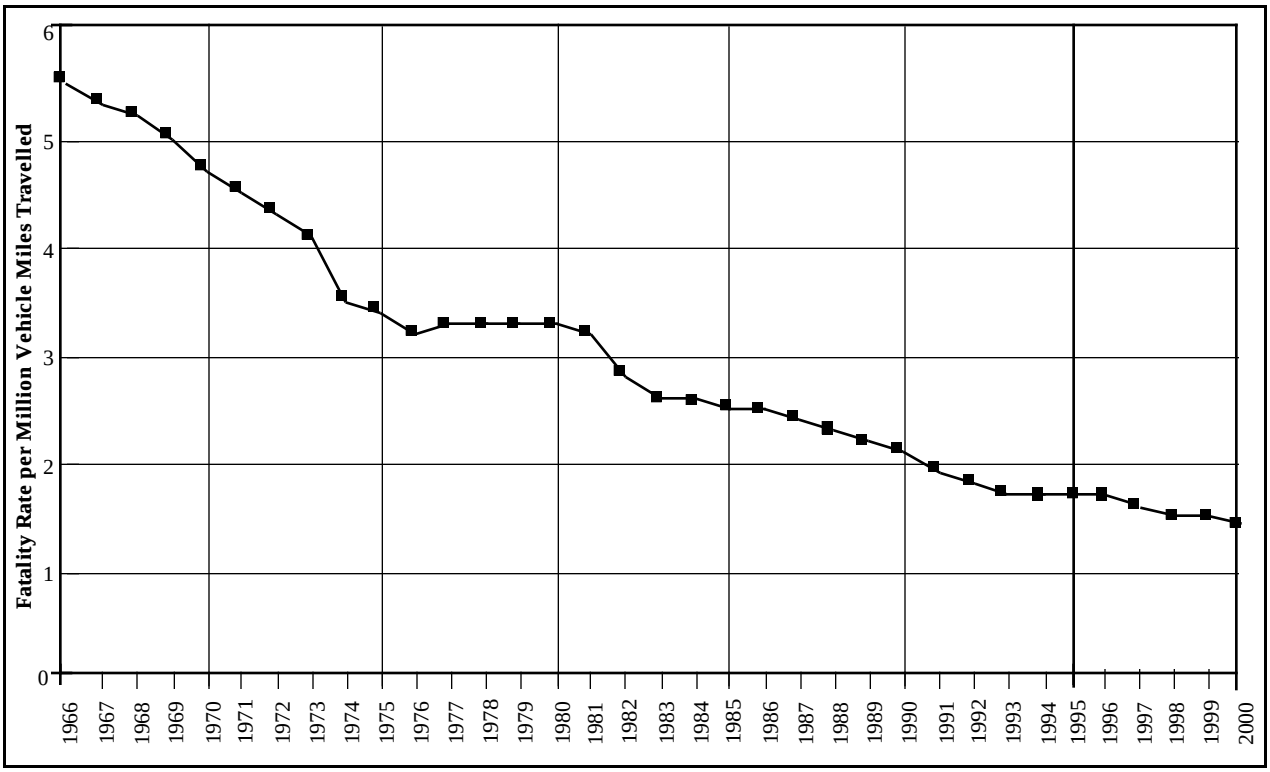


Figure 1. Fatality rates per 100 million miles traveled in the U.S.

TABLE 1
CHANGES IN POPULATION, FATALITY RATE, AND THE NUMBERS OF DRIVERS, VEHICLES, AND MILES TRAVELED IN THE UNITED STATES, BETWEEN 1991 AND THE YEAR 2000

Year	United States Population (millions)	Licensed Drivers (millions)	Registered Vehicles (millions)	Vehicle Miles Traveled (billions)	Fatalities Per 100 Million Miles
1991	252.1	169.0	186.4	2,172	1.9
2000	274.6	190.6	217.0	2,750	1.5
Change	+9%	+13%	+16%	+27%	-21%

Sources: FARS 2000, US Census

Improved safety features of vehicles and highways, and a general aging of the population, have contributed incrementally to the steady decline in the traffic fatality rate. However, since 1980, the greatest contributions to the improved conditions have come from law enforcement efforts, in particular, a focus on detecting and removing impaired drivers from the road and the development of general deterrence and effective public information and education (PI&E) programs. Largely in response to the enforcement and programmatic efforts, the proportion of all crashes in which alcohol was involved declined by 25 percent during the 1990s; there were 3,200 fewer alcohol-related traffic fatalities in the year 2000 than in 1991, even though the numbers of drivers, vehicles, and miles traveled all increased substantially. Law enforcement and traffic safety experts believe that some of the methods that helped reduce the incidence of alcohol-involved crashes also might be useful for reducing the number of crashes caused by aggressive driving.

CONTRIBUTING FACTORS TO AGGRESSIVE DRIVING

A definitive explanation for aggressive driving is beyond the scope of the current study. However, a brief discussion of contributing factors might be useful to understanding study results. Experts have suggested many reasons for the apparent increases in aggressive driving and road rage. Sociologists point to the fragmentation of society and the disintegration of shared values and sense of community as the cause of these and other acts of incivility. Many psychologists blame the intoxicating combination of power and anonymity provided by motor vehicles. Traffic engineers tend to ignore the human component, recognizing that crashes can occur when a vehicle that is traveling at the design speed of a roadway encounters a slower moving vehicle. The engineering solution is to encourage all drivers to travel at uniformly fast speeds to avoid the potentially dangerous encounters, but this approach disregards different perceptions of conditions and differences in motorists' destinations, intentions, and capabilities.

Many law enforcement officers have learned from their operations-level experiences with dangerous drivers that several factors can contribute to a single example of aggressive driving. Further, it is important to understand that not all instances of the behaviors that are categorized as aggressive driving are volitional. For example, errors in judging turning headway can result in right of way violations, and driver inattention can result in failures to obey traffic signals and signs. Also, driving in excess of a speed limit does not always endanger persons or property, nor does it necessarily involve an aggressive intent. That is, an unknown portion of all such driving acts is caused by human error, rather than conscious decisions to take risks and drive aggressively. Figure 2 illustrates the most salient factors, excluding human error, that are believed to contribute to the apparent increase in the incidence of aggressive driving behavior. The factors are summarized in the following paragraphs.

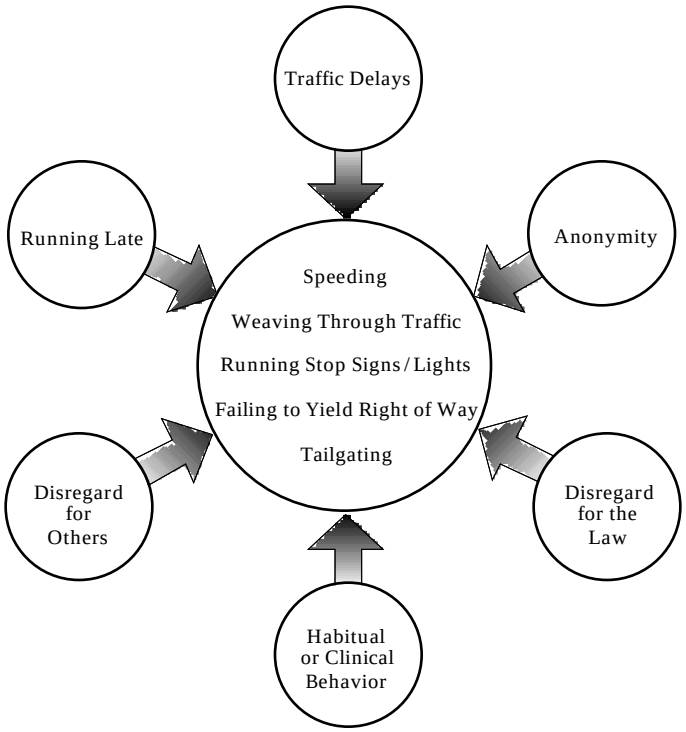


Figure 2. Salient factors that contribute to the incidence aggressive driving.

TRAFFIC DELAYS

Traffic congestion is one of the most frequently mentioned contributing factors to aggressive driving. On-the-road delays, whether caused by highway maintenance, a collision, or high traffic volumes, are frustrating for all drivers, but intolerably so for some. Drivers with low tolerances for traffic delays might respond by following too closely, changing lanes frequently, or becoming angry at anyone who impedes their progress. A 1998 survey found that 33 percent of drivers reported that they become impatient while waiting at stoplights and for parking spaces; 25 percent reported impatience while waiting for passengers to enter their vehicle; and, 22 percent said that they feel anger when a multi-lane highway narrows (Ferguson, 1998).

The survey results concerning driver impatience and anger are particularly revealing when considered in the context provided by Table 1, and one additional statistic. That is, while the number of miles traveled increased by 27 percent during the 1990s, the number of miles of roadway in the United States increased by only one percent. Together, these measures confirm and quantify most drivers' subjective perceptions; traffic congestion has, indeed, increased.

RUNNING LATE

Some people drive aggressively because they have too much to do and are "running late" for work, school, their next meeting, lesson, soccer game, or other appointment. There does, indeed, appear to be more to do with each passing year. It is reported that the average mother now spends more than an hour making five trips and driving 29 miles during a typical day. Many of the stops are to drop off or pick up children or elderly parents who cannot drive themselves (STPP, 2002). The endless series of errands and obligations of modern life weighs more heavily and/or more frequently on some individuals than on others, and can contribute to a pattern of aggressive driving. The effects of busy schedules on driving were evident when several police departments in the Washington, DC, area conducted a special enforcement program that targeted aggressive drivers. Officers issued approximately 60,000 citations during a 28 day period in 1997 for offenses ranging from following too closely to passing on the right. The most frequent excuse offered by the violators was, "I'm late" (Ferguson, 1998).

ANONYMITY

Driving involves a unique combination of public and private behavior. A motor vehicle insulates the driver from the world while, at the same time, traveling through it. Shielded from the hostile outside environment by tinted windows and a micro-climate that defies the seasons, a driver can develop a sense of anonymity and detachment, as if an observer of the surroundings, rather than a participant. The anonymity provided by this insulation can erode the inhibitions to antisocial behavior that normally shape interpersonal relations. That is, some people feel less constrained in their behavior when they cannot be seen by others and/or when it is unlikely that they will ever again see the witnesses to their behavior. When emboldened by the seemingly invincible power of a motor vehicle, a driver's feeling of anonymity can result in extreme rudeness and even transform an otherwise nice person into a dangerous, raging individual.[2]

[2] Perhaps the elevated perspective from the driver's seat of a sport utility vehicle (SUV) contributes to feelings of both anonymity *and* invincibility, a hypothesis worthy of testing. Further, many sport utility vehicles seem to be designed more for war than civilian transportation. In this regard, the term "urban assault vehicle," frequently used to describe SUVs, is strangely appropriate, particularly in the context of the familiar metaphors, "fighting traffic" and "it is a jungle out there."

Ellison et al. (1995) tested the hypothesis that vehicle-induced anonymity contributes to aggressive behavior, wisely limiting the dependent variables to measures of relatively harmless horn honking. Convertibles and jeep-like vehicles were delayed at controlled intersections by an automobile, operated by a confederate of the experimenters, that failed to proceed when the light changed to green. The confederate recorded whether the top on the delayed convertible (immediately behind the confederate's vehicle) was up (the anonymous condition) or down (the exposed or identifiable condition). Several additional variables were recorded, including the gender and age of the driver, the number of passengers, and the type of vehicle. The confederate also recorded the time interval between the change to the green light and the first sounding of the convertible's horn, the number of honks, and the duration of the honking. As predicted, the experimenters found that drivers in the anonymous condition (convertible tops up) honked significantly sooner, more frequently, and for longer durations than the drivers in the exposed condition (tops down).

Gulledge (1996) modified the research design by using a convertible as the impeding vehicle at intersections, with the convertible's top up for half of the trials and the top down for the other half. Only the time interval between the light change and the first honk by the delayed driver (any passenger vehicle located immediately behind the experimenter's convertible) was recorded. Analysis of the data found significantly longer intervals between the light change and the first use of the horn when the top on the delaying convertible was down, exposing the experimenter and driver to view. The results of this study suggest that greater visibility of the intended target also inhibits horn honking, and that mutual anonymity is a factor in at least some aggressive driving behaviors.

DISREGARD FOR OTHERS AND DISREGARD FOR THE LAW

Human behavior is clearly shaped by the external forces collectively known as Culture. The external source of the influence and degree to which norms can change are illustrated by the music, clothing, or salutation that seemed so "stylish" or appropriate in 1970, and so odd or inappropriate now. All forms of human behavior, including driving style, are similarly influenced by external forces that define what is appropriate and what is not, and the definitions change over time.

Feature films and television programming can be extremely influential in defining current style and appropriate or desirable behavior. The extent of media influence on popular culture and behavior is not fully understood. In particular, it is unknown if depictions of car chases influence motorists to drive aggressively by gradually altering individual conceptions of acceptability, or more immediately, by providing vivid images of aggressive behavior for motorists to model. Children predictably exhibit the aggressive behavior observed previously in a cartoon; it is likely that some adults and adolescents of driving age are similarly influenced by the driving observed in films and on television.[3] Learning to drive from a parent or friend who is an aggressive driver, or associating with aggressive drivers, also can shape the behavior. In this regard, Parker et al. (1998) found that drivers who had committed large numbers of aggressive driving violations were more likely to believe that people important to them would approve of the behavior, than drivers with few violations.

[3] Composing this sentence evokes memories of revving engines and squealing tires as vehicles exited the parking lot following showings of the films, *Grand Prix*, in 1966, and *Bullit*, in 1968. Do modern films have this effect on young drivers?

Much has been written about the erosion of shared values and respect for authority, variously attributed to the fragmentation of the extended family, increased individual mobility, media influence, and other characteristics of modern society. It does appear that civility and respect for authority have diminished, the trend epitomized by the phrase, "I'm just looking out for number one."

HABITUAL OR CLINICAL BEHAVIOR

Most motorists rarely drive aggressively, and some never at all. For others, episodes of aggressive driving are frequent, and for a small proportion of motorists it is their usual driving behavior. Occasional episodes of aggressive driving might occur in response to specific situations, such as speeding and changing lanes abruptly when late for an important appointment, when it is not the driver's normal behavior. Among the chronic aggressive drivers there are those who learned the driving style and consider it appropriate, and others who may have learned to drive properly, but for whom the behavior is an expression of illness. Clearly, it is a matter of degree and not all anger is uncontrolled, or even inappropriate; that is, it is not the anger, but what a person does about it that matters (e.g., anger that motivates a person to call the police when encountered on the road by an obviously impaired or dangerously aggressive driver). However, chronic anger, habitual or persistent aggressive driving, and especially a pattern of confrontation on the road, must be considered manifestations of pathology, in addition to violations of the law.[4]

The less extreme forms of aggressive driving are better understood, but are we really experiencing *increases* in road rage and aggressive driving? The answer is "yes," and for the same reason that traffic congestion has increased, as described previously in the Introduction to this report and summarized in Table 1. That is, even if the proportions of predisposed and provoked drivers have remained unchanged during the past decade, 26 percent increases in both road rage and aggressive driving should be expected from the increase in miles traveled during that period (i.e., a 27 percent increase in miles traveled minus a one percent increase in new roadway); rate and incidence of the phenomena are separate measures. If it seems that there are more cases of rude and outrageous behavior on the road now than in the past, the observation is correct, if for no other reason than there are more drivers driving more miles on the same roads than ever before.

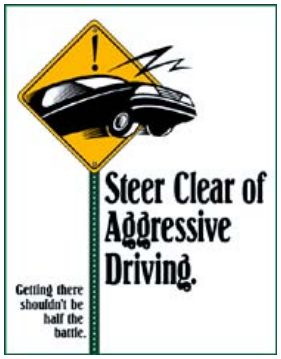
SUMMARY OF CONTRIBUTING FACTORS

The preceding discussion addressed only the most salient of the many factors that might contribute to the incidence of road rage and aggressive driving. Sociologists, psychologists, psychiatrists, journalists, traffic safety experts, and law enforcement personnel, among others, all have offered opinions concerning the causes of road rage and aggressive driving. Some of the suggested causes are more likely to help explain the behavior than others.

Scott (2002) assembled an inventory of diverse contributing factors to aggressive driving, ranging from violent video games to increased commuting distances and durations. We have added to Scott's inventory of contributing factors, based on the current research, and present the modified list in Appendix A of this report. The large

[4] Perhaps road rage, air rage, and office rage (i.e., "going postal") are just different versions of the same phenomenon.

number and diversity of possible causes of aggressive driving implies that the behaviors are complex and could be influenced by many different predisposing and provoking factors.



THE PROGRAMS

In the Spring of the year 2000, the National Highway Traffic Safety Administration selected two proposals for funding from a large number of offers to develop and conduct programs intended to reduce the incidence of aggressive driving. The selected proposals were submitted by the Marion County Traffic Safety Partnership (a consortium of agencies in the vicinity of Indianapolis, Indiana), and The Tucson, Arizona, Police Department. The programs each received grants of $200,000 from NHTSA to support the special enforcement and public information and education (PI&E) components. Program managers were required, as conditions of the grant, to 1) focus their enforcement efforts on moving violations that are associated with aggressive driving in four carefully-selected zones within their communities; 2) develop and implement PI&E campaigns to publicize the special enforcement efforts; and, 3) provide the data and other information necessary to prepare this evaluation. Although the programs shared additional features, program managers were encouraged to consider innovative approaches to both special enforcement and publicity. The two programs are summarized in the following pages.

THE MARION COUNTY TRAFFIC SAFETY PARTNERSHIP

The City of Indianapolis is the capital of Indiana, the largest city in the state, and the twelfth largest city in the United States of America. The City of Indianapolis expanded its borders in 1970 to encompass all 402 square miles of Marion County, with the exception of several small communities that chose to remain independent. The U.S. Census Bureau estimates that 857,000 people lived in Marion County in the year 2001, representing a population increase of 7.5 percent since 1990. Census data show that the population is composed of 70 percent White, 24 percent African American, 4 percent Hispanic, and one percent each of residents who reported Asian and Native American ancestry. Marion County's median household income in 2001 was $45,548 and the median home price was $116,900.

The Marion County Traffic Safety Partnership was formed in 1994 to identify traffic safety problems and implement mitigating programs for the entire county. The organization has a small, full-time staff, including a motivated and capable professional director, and an advisory board composed of concerned citizens, health care professionals, city council members, insurance managers, the county prosecutor, and representatives from the Marion County Sheriff's Office, the Indianapolis Police Department, and the departments of the several small communities within Marion County that are surrounded by the City of Indianapolis. The Marion County Traffic Safety Partnership had conducted large-scale impaired driver and safety restraint awareness programs, among other activities, prior to being selected by NHTSA to develop and implement an aggressive driving program.

RUB OUT AGGRESSIVE DRIVING: THE R.O.A.D. TEAM

The Marion County Traffic Safety Partnership selected "Rub Out Aggressive Driving" as the name for their program and referred to the participating officers in publicity materials as the "ROAD Team." As required by their agreement with NHTSA, the Marion County aggressive driving program comprised both special enforcement and public information and education.

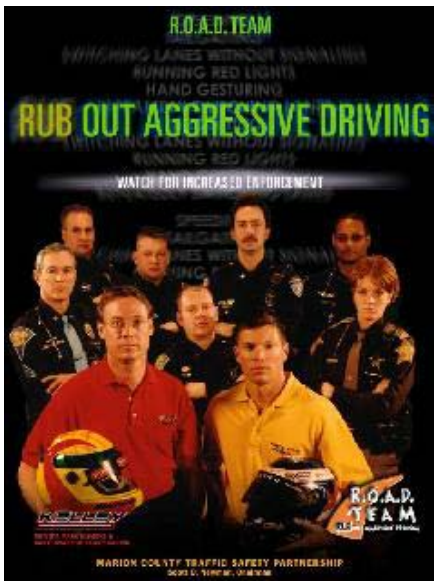
ENFORCEMENT

The special enforcement component of the program involved deployment of marked and unmarked police vehicles in areas characterized by the disproportionate incidence of aggressive driving. A review of crash records led to the identification of five roadway segments in Indianapolis that would become the special enforcement zones during the six-month program period.[5] The special enforcement effort focused on drivers who exhibited two or more of the moving violations that frequently are associated with aggressive driving, including speeding, failure to obey traffic controls / devices, failure to yield, improper or unsafe lane changes, and following too closely. Squads of five officers and a supervisor were assembled from the participating agencies and deployed during morning and evening drive times on 61 days during the six month program period.

The special enforcement effort of the Rub Out Aggressive Driving program was conducted as overtime activity by a total of 42 officers from six law enforcement agencies, which included the police departments of Indianapolis, Cumberland, Lawrence, and Beech Grove, the Marion County Sheriff's Department, and the Indiana State Police. The participating officers worked an average of 33 overtime hours each during the six-month period, with individual participation ranging from four to 76 hours. The Marion County Traffic Safety Partnership's program devoted a total of 1,400 officer-hours to the special patrols.

PUBLIC INFORMATION AND EDUCATION (PI&E)

The Marion County aggressive driving program implemented an extensive Public Information and Education (PI&E) component, which included a website, brochures, 20 billboards announcing the program, and frequent paid advertising on radio and television stations. The radio and television "spots" that were developed for the program were extremely high quality and featured racing celebrities familiar to residents of the Indianapolis area. Program managers spent half of their total budget on publicity, but purchasing air time encouraged station managers to donate considerable public service time to the Marion County program, resulting in extensive publicity by broadcast media. In particular, the program paid a local television station to broadcast a 30-second PI&E message on 50 occasions during the first five months of the program period, but records show that the message was broadcast a total of 125 times. Similarly, the purchase of two hundred radio spots resulted in additional free air time, and the aggressive driving program served as a topic of discussion on drive-time radio "talk shows."



[5] The Marion County program abandoned two of its special enforcement zones at about the mid-point of the six-month study period.

The Marion County Traffic Safety Partnership issued press releases regularly to remind the public of the aggressive driving program by announcing the dates and locations of the special enforcement patrols. Several articles concerning the program were published in *The Indianapolis Star* during the study period. The articles were supportive of the program and usually included tallies of the citations issued. News coverage also stimulated the publication of letters to the editor, mostly opposed to the special enforcement effort.

The Marion County aggressive driving program received additional, yet unfortunate, publicity when a fatal crash occurred during a high speed pursuit by an officer assigned to the aggressive driving patrol. The duration of the pursuit was fewer than 30 seconds, but during that brief time the fleeing driver exited highway I-90 into downtown Indianapolis rush hour traffic, then ran a red light, crashing broadside into another vehicle; the driver of that vehicle died six days later. The incident generated controversy and received extensive news coverage because the officer, from a neighboring community, crossed the jurisdictional boundary into Indianapolis during the pursuit. Although he announced that the motorist was evading the enforcement stop, the radio frequency that he used was monitored only by other officers assigned to the aggressive driving patrol. The circumstances and sad outcome of the incident focused unwanted attention on the Marion County special enforcement program.[6]

Program managers in Marion County worked closely with local prosecutors during the planning and implementation phases of their enforcement program. A Commissioner of the Traffic Court in Marion County supported the efforts of the Traffic Safety Partnership by excluding violators from the Safe Driver Program who officers designated as aggressive drivers; the diversion program typically is available to drivers who receive a ticket for a moving violation and have had no prior convictions during the previous two years. The traffic commissioner also regularly imposed a supplemental fine of $25 when designated aggressive drivers contested their citations.

THE TUCSON POLICE DEPARTMENT

With 487,000 residents in 2001, the City of Tucson is the second largest city in Arizona, and the center of government for Pima County. The U.S. Census Bureau estimates that 863,000 people lived in Pima County in the year 2001, representing a population increase of 29 percent since 1990. Census data show that the population is composed of 62 percent White, 29 percent Hispanic, 3 percent each of African American and Native American, and 2 percent who reported Asian ancestry. Pima County's median household income in 2001 was $45,100 and the median home price was $124,500.

[6] Because of the short duration of the pursuit, it is unlikely that notifying the Indianapolis Police Department's dispatcher could have affected the outcome. The driver who evaded the enforcement stop was operating his vehicle on a suspended license and would have gone to jail on that charge. He fled the scene of the crash on foot and was chased and apprehended by the officer and his K-9 partner moments later; the officer called for an ambulance for the critically injured motorist during the brief foot chase. Agency policies concerning high-speed pursuits were scrutinized following the incident.

The Tucson Police Department was formed in 1871, when the community was part of the Arizona Territories. The department has expanded during recent years to a force of 1,000 sworn officers who are responsible for patrolling the 200 square miles encompassed by the City of Tucson. The Traffic Section of the Tucson PD is referred to as the "flagship of the department" because of its high visibility and interaction with the community. Through education, enforcement and engineering, the Traffic Section is dedicated to fostering a safe environment for all individuals traveling within the City of Tucson. The Tucson Police Department had conducted large-scale impaired driver and safety restraint awareness programs, among other activities, prior to being selected by NHTSA to develop and implement an aggressive driving program.

WE'VE GOT YOUR NUMBER

The Tucson Police Department selected "We've Got Your Number" as the name for their program, a reference to the telephone number that could be used to report incidents of aggressive driving to the police department; the "hotline" was the central component of the Tucson PD's public information and education program. As required by their agreement with NHTSA, the Tucson Police Department's aggressive driving program comprised both special enforcement and public information and education.

ENFORCEMENT

As in Marion County, the special enforcement component of Tucson's program involved deployment of marked and unmarked police vehicles in areas characterized by the disproportionate incidence of aggressive driving. A review of crash records led to the identification of four roadway segments within the City of Tucson that would become the special enforcement zones during the six-month program period. The special enforcement effort focused on drivers who exhibited any of the moving violations that frequently are associated with aggressive driving, including speeding, failure to obey traffic controls/devices, failure to yield, improper or unsafe lane changes, and following too closely.

Two officers patrolled the special enforcement zones in unmarked police vehicles, with motorcycle backup nearby, nearly every day throughout the six-month program; two additional officers each patrolled the special enforcement zones in unmarked vehicles one day per week. That is, the special enforcement effort of the We've Got Your Number program was conducted as the primary assignment of their regular-duty shifts by the same two officers for the duration of the program. Also, the same two officers augmented the primary patrols one day each week throughout the program. The four participating officers devoted a total of 2,400 officer-hours to the special enforcement effort, on 168 days, during the six-month program period.

PUBLIC INFORMATION AND EDUCATION (PI&E)

The Tucson PD officers who conducted the special enforcement also developed and implemented the PI&E component prior to beginning the enforcement period. With the assistance of department staff, the officers developed brochures, key chains, pens, and pencils, bumper stickers, 40,000 inserts that accompanied all citations issued, and 20,000 flyers that were attached to Domino's pizza boxes. Officers distributed materials and displayed their unmarked, aggressive driving enforcement vehicles at several special events, such as Public Safety Appreciation Night at the Tucson Sidewinders' baseball stadium. Also, an outdoor advertising company donated ten billboards located throughout the city to announce the program's aggressive driving hotline. And, Alltel Corporation, a mobile telephone provider, donated the service and answering machine to record reports of aggressive driving.

The Tucson PI&E program did not include paid radio and television advertising. Rather, officers discussed the aggressive driving program on public-access cable stations, and invited reporters to ride with them during special patrols. The ride-alongs resulted in several news stories by local television stations and frequent discussion during drive-time radio talk shows. The radio hosts continued to announce the hotline telephone number throughout the six-month program period.

The Tucson PD's program received considerable free publicity because of the Aggressive Driving Hotline. Officers announced the hotline and discussed the reasons for conducting the enforcement program on local radio and television talk shows and news programs. The report line telephone number was printed on the brochures, bumper stickers, and other items that were distributed, and it was prominently displayed on billboards throughout the city. Motorists were encouraged to call the telephone number to describe serious incidents of aggressive driving and report the license plate numbers of the vehicles involved. The lieutenant in charge of the program personally responded to each report of aggressive driving with letters to the caller and to the registered owner of the offending vehicle. Letters of appreciation were sent to callers, while owners of offending vehicles received letters that described the incident and warned that further reports could result in enforcement action. The response to the hotline was tremendous.

The Aggressive Driving hotline received 87 calls during the first month of operation and averaged 64 calls per month during the six-month program period. Lieutenant Martín Moreno, the Tucson PD lieutenant responsible for the program, reported that many of the people who received warning letters called him to complain, however, defending their driving behavior usually caused them to realize that they had acted inappropriately while driving, and in some cases, dangerously. Most of the

conversations ended with a sincere apology and promise to drive with more consideration in the future. The officers involved in the program were gratified by these individual responses and consider them to be among the most important outcomes of their program.

Program managers in Tucson met with their local prosecutors and Municipal Court Magistrates early in the planning phase of their project to advise court personnel about the dangers of aggressive driving and to discuss Arizona's new aggressive driving statute. Collaboration between law enforcement and the courts resulted in a standardized plea agreement that ensured uniform prosecution of aggressive drivers, beginning at implementation of the Tucson police Department's special enforcement program.

SUMMARY OF THE PROGRAMS

The overall level of special enforcement effort can be measured by the numbers of patrol hours, days on which patrols were conducted, and officers deployed. The agencies participating in the Marion County Traffic Safety Partnership's program devoted a total of 1,400 hours to the special patrols, compared to 2,400 officer hours by the Tucson Police Department. The scheduling and staffing of the special enforcement patrols also differed. The Marion County program limited deployment of special patrols to 61 days during the six month program period, compared to 168 days of special enforcement in the Tucson Police Department's program. Also, 42 officers from six law enforcement agencies conducted the Marion County special enforcement patrols, compared to the same four officers from a single agency in the Tucson program. The Marion County officers worked an average of 33 overtime hours each during the six-month period (with individual participation ranging from four to 76 hours). In contrast, two officers of the Tucson Police Department worked full-time on their program, with two additional officers devoting one day each week to the special enforcement effort. In other words, the Marion County approach was to deploy several officers at a time, distributing the hours among 42 officers from six participating agencies, and to limit the frequency of the patrols to one day in three. The Tucson approach was to assign the same four officers to the special detail and to conduct the special enforcement patrols nearly every day of the six month program period.

Other differences between the two programs are revealed by the proportions of grant funds devoted to the three primary categories of expenditures. In particular, the Marion County program spent half of its budget on publicity, including frequent paid advertising on radio and television stations. Purchasing air time encouraged station managers to donate considerable public service time to the Marion County program, in addition to the paid spots, resulting in extensive publicity by broadcast media. In contrast, the Tucson program spent only 11 percent of its budget on publicity, relying on inexpensive flyers, donated billboards, volunteer efforts, and free news coverage of their program, rather than paying for advertising. The Tucson program spent 40 percent more of its budget on officer labor than did the Marion County program, in order to support the two full-time officers and schedule of more frequent special enforcement patrols. Further, the Tucson program spent 22 percent of its budget on equipment, compared to about two percent in Marion County. The Tucson program purchased an unmarked patrol car, motorcycle, laser speed gun, and two in-vehicle video systems with grant funds, while the Marion County program purchased only two in-vehicle video cameras. Figure 3 illustrates a comparison of program expenditures.

Figure 3. Comparison of Program Costs

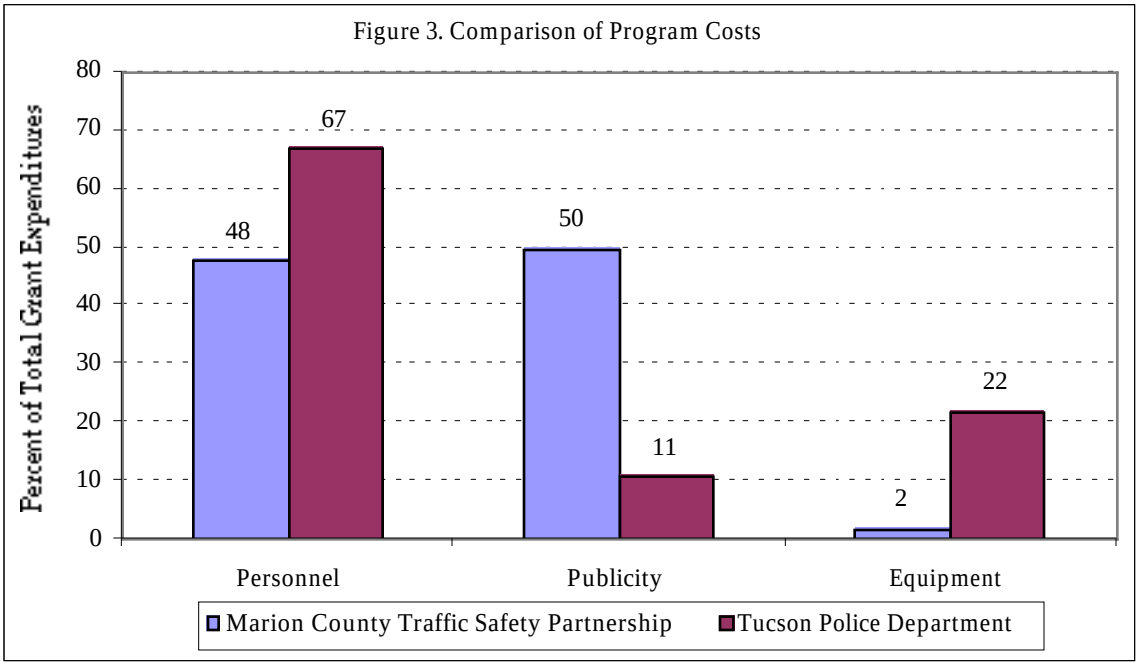


Table 2 presents a summary of the enforcement effort in both aggressive driving programs. The table lists the numbers of enforcement stops and citations for offenses associated with aggressive driving (separately) and other offenses (combined) that were issued by officers in each program. The table shows that the Marion County officers stopped 1,334 motorists and cited 2,215 offenses, for an average of 1.7 offenses per enforcement stop. Officers of the Tucson program made 1,907 enforcement stops and cited 2,383 offenses, for an average of 1.3 offenses per stop. The difference in average number of offenses per stop reflects the Marion County program's emphasis on citing motorists who exhibited two or more offenses that are associated with aggressive driving.

TABLE 2
SUMMARY OF ENFORCEMENT EFFORT BY THE TWO AGGRESSIVE DRIVING PROGRAMS

Offense	Marion County Traffic Safety Partnership	Tucson Police Department
Aggressive Driving	568*	56**
Speeding	916	1,343
Following Too Closely	244	97
Unsafe Lane Change	173	57
Failure to Yield Right of Way	22	32
Other	745	742
Total Violations Cited	2,215	2,383
Total Number of Stops	1,334	1,907

*The 568 offenses are not included in the Marion County total because Aggressive Driving is a designation made by officers to represent the severity of an infraction (usually two or more infractions).
**The 56 aggressive driving offenses listed for Tucson are included in the Tucson total because aggressive driving is a separate offense in Arizona.

The key elements of the two aggressive driving programs and maps indicating the locations of the special enforcement zones are presented below.

Marion County Traffic Safety Partnership "R.O.A.D. Team Program"

Enforcement

3 special enforcement zones;

6 local law enforcement agencies;

1,394 officer-hours devoted to the special patrols;

Special enforcement conducted on 61 days during the 6 month program period.

Tactics: Squads of five officers deployed to the special enforcement zones during morning and evening commuting periods on selected days to focus on vehicles exhibiting two or more aggressive driving violations. Experimented with police helicopters but ground units could not reach offenders.

Publicity

Press releases
Posters
Brochures
Outdoor display advertising
Corporate Campaign (links to companies)
Television and radio paid advertising
Television and radio public service announcements
Several articles in the *Indianapolis Star*

Tucson Police Department "We've Got Your Number Program"

Enforcement

4 special enforcement zones;

1 law enforcement agency;

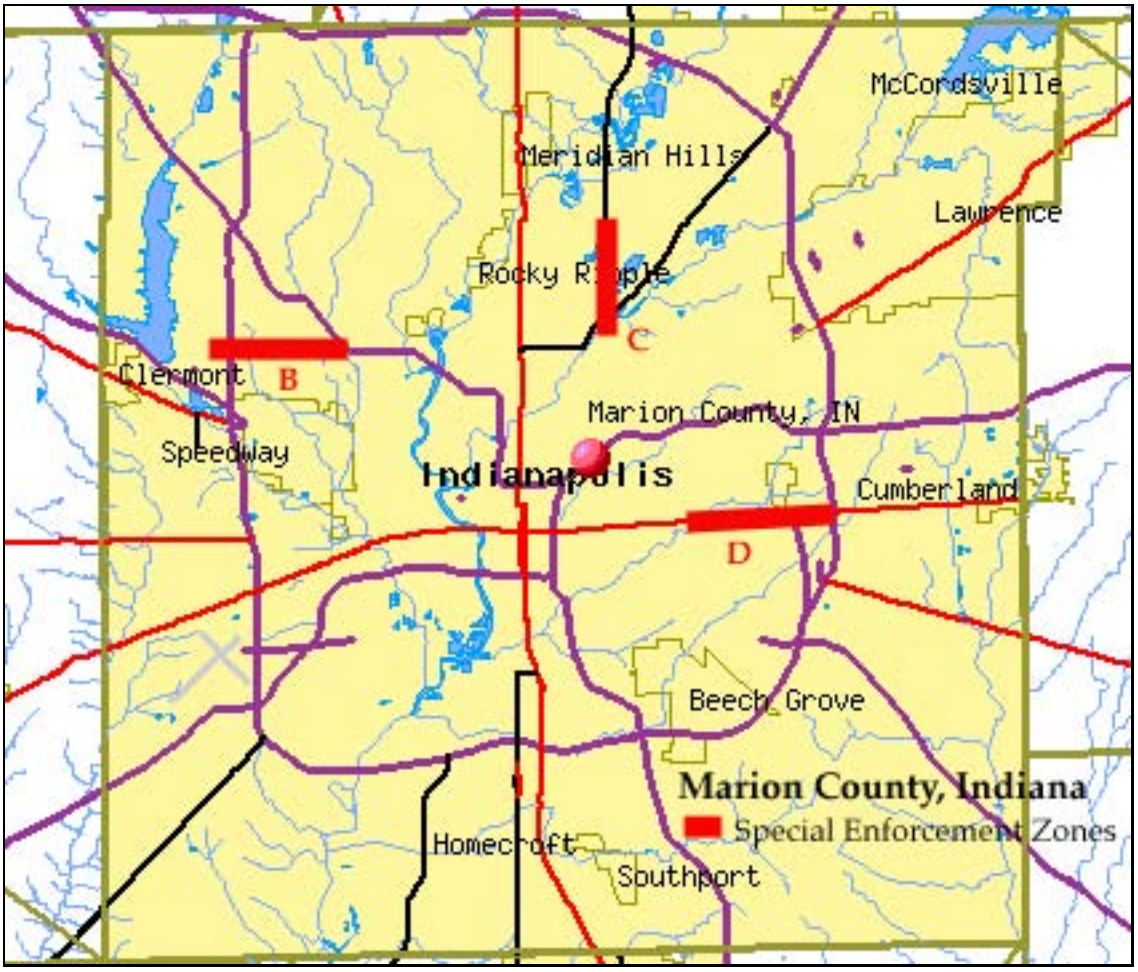
2,400 officer-hours devoted to the special patrols;

Special enforcement conducted on 168 days during the 6 month program period.

Tactics: Two officers were assigned full-time responsibility to patrol the special enforcement zones in unmarked police vehicles (with motorcycle backup nearby) nearly every day throughout the program; two additional officers each deployed in unmarked vehicles one day per week.

Publicity

Pizza boxtop flyers
Flyers distributed to motorists
Outdoor display advertising
Bumper stickers
Ride-alongs by news reporters
Television and radio coverage of the program
Special events displays
Aggressive Driver Hot Line


McCordsville
Meridian Hills
Lawrence
Rocky Ripple
C
Clermont
B
Marion County, IN
Speedway
Indianapolis
Cumberland
D
Beech Grove
Marion County, Indiana
Special Enforcement Zones
Homecroft
Southport


Tangerine Rd.
U.S.89
Thornydale
La Cholla Blvd.
La Cañada Dr.
Oracle Rd.
Coronado National Forest
I-10
Ina Rd.
Sunset
Silverbell Rd.
River Rd.
Sunrise
Saguaro National Monument
Sandario Rd.
1
4
Grant
Catalina Hwy.
Soldier Trail
Tanque Verde
3
Speedway
Shannon Rd.
Greasewood
Alvernon
Broadway
22nd St.
Kinney Rd.
Golf Links
Saguaro National Monument
2
DMAFB
Escalante Rd.
Ryan Airfield
Ajo Hwy.
Valencia Rd.
Campbell
Houghton Rd.
Mission Rd.
I-19
Tucson Int'l Airport
Wilmot
I-10
Hughes Access
Tucson, Arizona
Special Enforcement Zones
U.S.89

PROGRAM RESULTS

The primary measures of program effects for this evaluation of aggressive driving countermeasures are, 1) samples of vehicle speeds, and 2) the incidence of crashes in the special enforcement zones. Program results are presented in these two categories in the following paragraphs.

SPEED SAMPLES

One-hour samples of vehicle speed were taken unobtrusively at the same locations, beginning at least one month prior to program implementation. Speed samples were obtained by use of lidar devices at the same locations, during the same weeks of the month, and for each location, on the same day of the week and the same hour of the day (to maximize comparability). Data collectors were instructed to postpone sampling one week if it appeared that rain at a scheduled sampling time would affect vehicle speeds. Program personnel in Marion County and Tucson interpreted the speed sample requirement differently, resulting in non-uniform baseline periods and slightly different sampling schedules. However, data collectors for both programs followed the same sampling procedures and used identical data collection forms.

MARION COUNTY SPEED SAMPLE RESULTS

The Marion County special enforcement program was conducted from March 1 through August 31, 2001. Program personnel collected speed samples at five locations, beginning approximately three months prior to the start of the program and continuing throughout the six-month program period. Samples consisted of 105 vehicle speeds for each location and date. Data collection forms were sent to Anacapa Sciences, Inc., for data entry and analysis. The following three figures, collectively labeled as Figure 4, illustrate the results of the analysis, presenting the average vehicle speed and the highest speed recorded on each sampling date; the shaded areas indicate the baseline period (i.e., samples taken prior to program implementation). Each figure represents a separate sampling location. Marion County began with five special enforcement zones, but program managers abandoned locations A and E mid-way through the program.

Table 3 summarizes the speed sample results illustrated in the figures. The table shows that average speeds during the program period were slightly lower than during the baseline periods at two of the sites, and slightly higher at the third sites. The average of the averages shows a one percent decline in speed, overall. However, this calculation could be misleading if the different posted speed limits at the locations differentially influence drivers' responses to the special enforcement program; although this does not appear to be the case, averages of averages could obscure program effects.[7] For this reason, an alternative measure is to sum the percent change values for the three sampling sites that were within the program's three special enforcement zones: Site B declined by one percent, Site C declined by three percent, and Site D increased by one percent, for an overall decline in average speed of three percentage points in Marion County's special enforcement zones.

[7] The special enforcement zone with the 40 mph speed limit declined by one percent, while one of the 35 mph zones declined by three percent and the other increased by one percent.

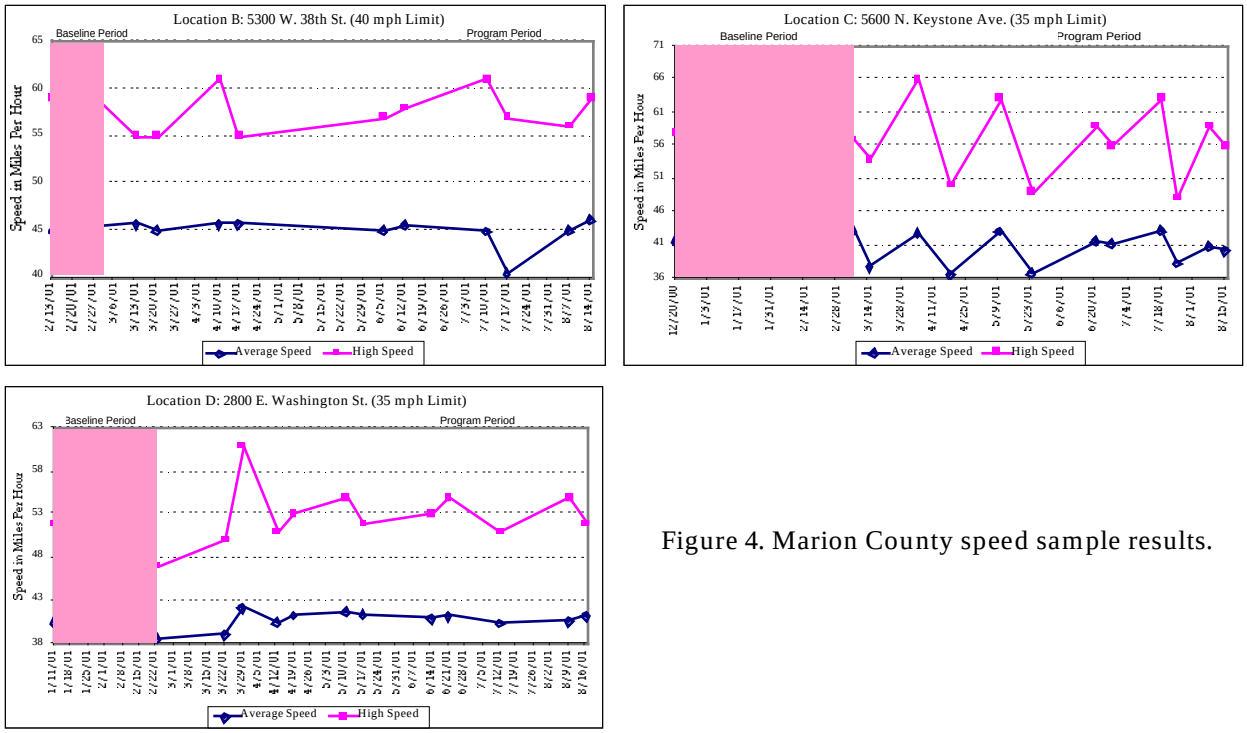


Figure 4. Marion County speed sample results.

TABLE 3
MARION COUNTY UNOBTRUSIVE SPEED SAMPLES:
COMPARISON OF AVERAGE OF BASELINE SAMPLES TO
AVERAGE OF SAMPLES DURING THE PROGRAM PERIOD, IN MILES PER HOUR

Site	Speed Limit	Average Speed Baseline Period	Average Speed Program Period	Percent Change
B	40	45.68	45.03	-1%
C	35	41.67	40.62	-3%
D	35	40.50	41.02	+1%
Average of All 3 Sites		42.62	42.22	-1%
Sum of Change Values				-3%

TUCSON SPEED SAMPLE RESULTS

The Tucson special enforcement program was conducted from July 1 through December 31, 2001. Program personnel collected speed samples at four locations, beginning in January and continuing throughout the six-month program period. Samples consisted of between 686 and 1,274 vehicle speeds for each location and date. Data were entered by program personnel and sent to Anacapa Sciences, Inc., for analysis. The following four figures, collectively labeled as Figure 5, illustrate the results of the analysis, presenting the average vehicle speed and the highest speed recorded on each sampling date; the shaded areas indicate the baseline period (i.e., samples taken prior to program implementation). Each figure represents a separate sampling location. Each location was within one of the four zones on which the Tucson Police Department focused its special enforcement efforts.

Table 4 summarizes the speed sample results illustrated in the figures. The table shows that average speeds during the program period were slightly higher than during the baseline periods at one of the sites, slightly lower at two of the sites, and substantially lower at one of the sites. The average of the averages shows a three percent decline in speed, overall. But, as before, calculating the averages of averages could obscure program effects. Summing the percent change values for the four sampling sites, all of which were within the program's four special enforcement zones, again provides a more appropriate measure: Site 1 declined by nine percent, Site 2 declined by three percent, Site 3 increased by one percent, and Site 4 declined by two percent, for an overall decline in average speed of 13 percentage points in Tucson's special enforcement zones.

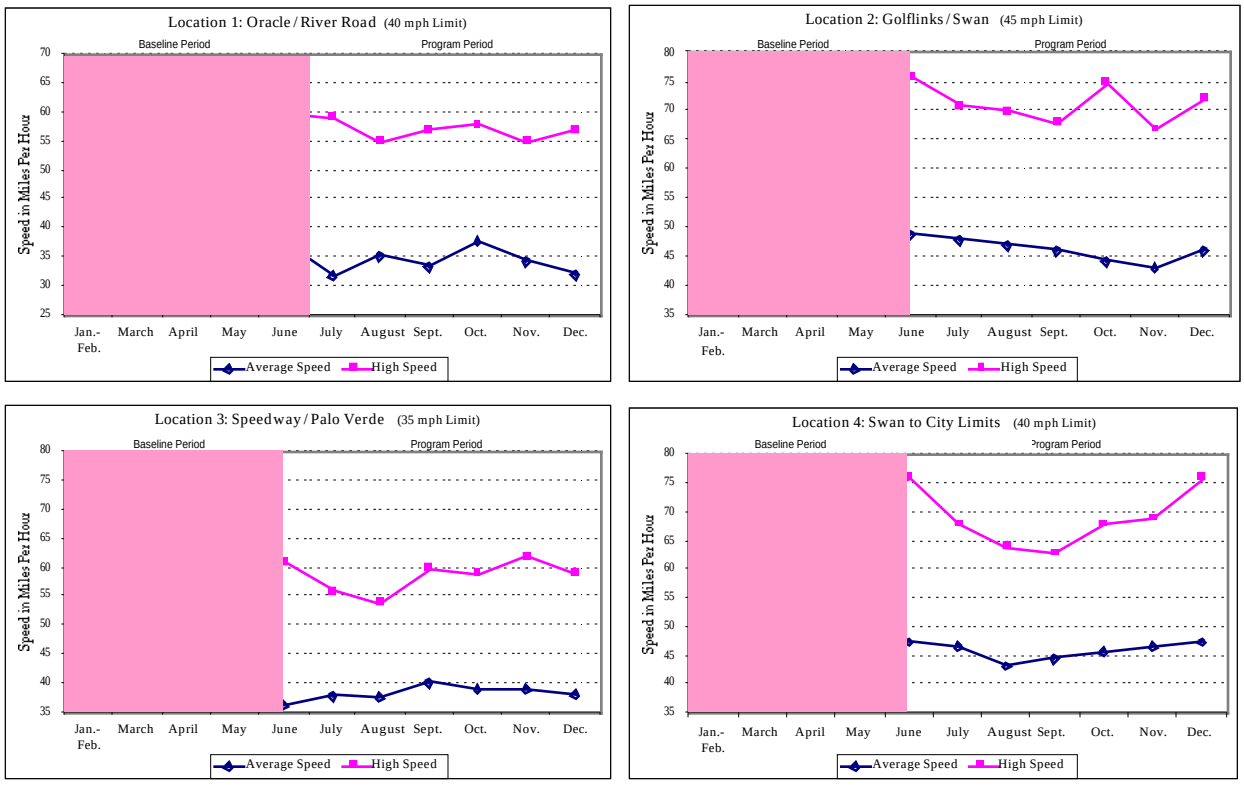


Figure 5. Tucson speed sample results.

TABLE 4
TUCSON UNOBTRUSIVE SPEED SAMPLES:
COMPARISON OF AVERAGE BASELINE SPEEDS TO
AVERAGE SPEEDS DURING THE PROGRAM PERIOD, IN MILES PER HOUR

Site	Speed Limit	Average Speed Baseline Period	Average Speed Program Period	Change
1	40	37.47	34.22	-9%
2	45	47.38	45.87	-3%
3	35	38.23	38.63	+1%
4	40	46.60	45.86	-2%
Average of All 4 Sites		42.42	41.15	-3%
Sum of Change Values				-13%

CRASH DATA

MARION COUNTY CRASH RESULTS

Crash data were provided by the City of Indianapolis for the three special enforcement zones and three comparable locations that did not receive special aggressive driving enforcement effort. Data for each location were provided, by month for the program period, the same six-month period one year earlier, and for the intervening six-month period (i.e., an 18-month series beginning one year prior to program implementation). Data were entered in configured spreadsheets and included designations of crash severity (Fatal, Injury, and Property Damage Only/PDO) and primary collision factor (PCF). The following three figures, collectively labeled as Figure 6, illustrate the crash frequencies, presenting the numbers of injury and PDO crashes in each of the Marion County special enforcement zones during the program period in 2001 and in the same six-month period of the Year 2000; the shaded areas indicate the intervening six-month period.[8]

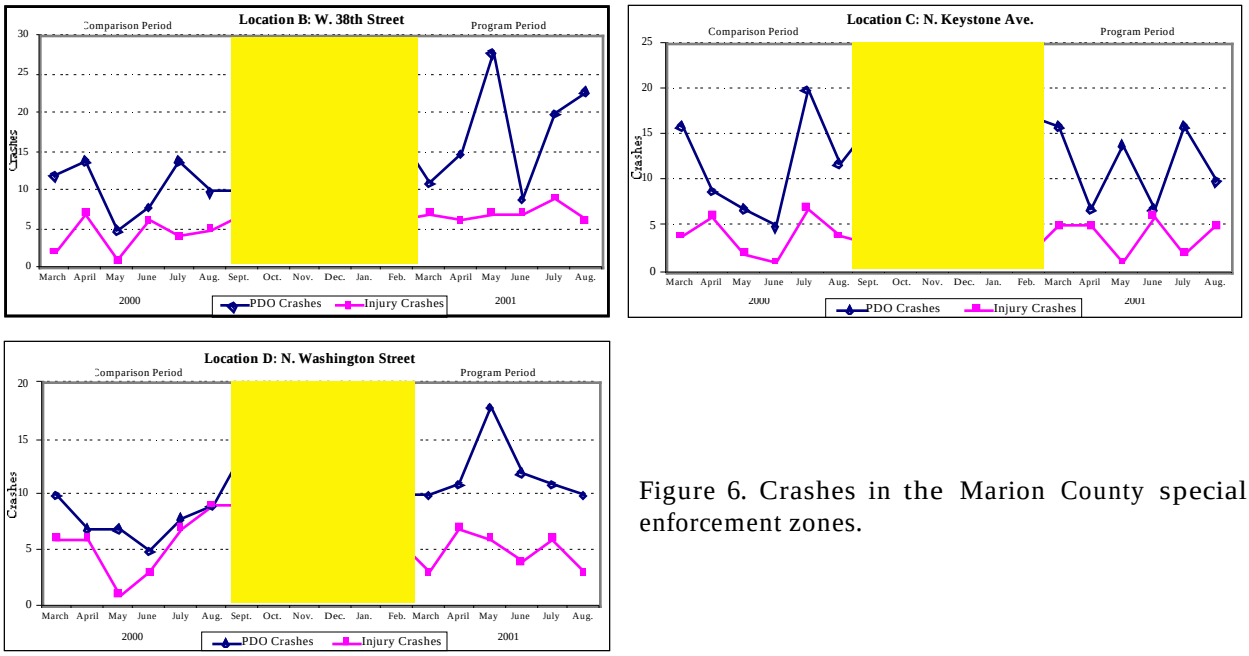


Figure 6. Crashes in the Marion County special enforcement zones.

Table 5 presents a summary of all crash data relevant to the Marion County aggressive driving program. The table shows that the three special enforcement zones and the three comparison zones experienced substantial increases in both injury and PDO crashes during the program period, compared to the same six-months of the previous year. The increases ranged from a six percent increase in injury crashes in the comparison zones to a 39 percent increase in PDO crashes in the special enforcement zones. Overall, crashes increased by 32 percent in the special enforcement zones and 24 percent in the comparison zones. The table also shows that the numbers of crashes for which a PCF associated with aggressive driving was cited increased by 21 percent in the comparison zones and by nearly twice that rate in the special enforcement zones.[9]

[8] Corresponding figures for the Marion County Comparison Zones are included in Appendix B.

[9] The Primary Collision Factors (PCFs) associated with aggressive driving are, Unsafe Speed, Failure to Yield Right-of-Way, Disregarded Signal/Sign, Left of Center, Improper Passing, Improper Turning, and Following Too Closely.

TABLE 5
SUMMARY OF ALL CRASH MEASURES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *MARION COUNTY* SPECIAL ENFORCEMENT AND COMPARISON ZONES

Measure	March-Aug. 2000 Comparison Period	March-Aug. 2001 Program Period	Percent Change
Total PDO Crashes in Enforcement Zones	178	248	+39%
Total PDO Crashes in Comparison Zones	177	238	+34%
Total Injury Crashes in Enforcement Zones	81	95	+17%
Total Injury Crashes in Comparison Zones	103	109	+6%
Total Crashes in Enforcement Zones	259	343	+32%
Total Crashes in Comparison Zones	280	347	+24%
Total Target PCFs in Enforcement Zones	160	226	+41%
Total Target PCFs in Comparison Zones	196	238	+21%
Percent of Crashes w/ a Target PCF: Enforcement	62%	66%	+6%
Percent of Crashes w/ a Target PCF: Comparison	70%	69%	-1%

The substantial increases in the numbers of crashes in the comparison zones, and even greater increases in the special enforcement zones, suggest the influence of factors that were outside the control of the quasi-experiment. For example, a disproportionate number of rainy days or increased traffic volumes during the program period might be responsible for the increase in crash incidence; these issues will be discussed in a subsequent section of this report. However, calculating the proportions of all crashes with a primary collision factor associated with aggressive driving, for the program and comparison periods, largely eliminates the effects of uncontrolled variables that might influence the incidence of crashes; that is, in the current context, comparing the proportions of aggressive driving-related crashes is more meaningful than comparing the actual numbers of crashes. The results of these calculations, presented in Table 5, show that the proportions of all crashes in the enforcement zones that were associated with aggressive driving increased by about six percent. In contrast, the overall incidence of crashes in those zones increased by 32 percent. The proportions of all crashes in the comparison zones that were associated with aggressive driving remained the same, despite a 24 percent increase in crashes, overall, in the comparison zones.

TUCSON CRASH RESULTS

Crash data were provided by the City of Tucson for the four special enforcement zones and four comparable locations that did not receive special aggressive driving enforcement effort. Data for the special enforcement zones were provided by month for the program period, the same six-month period one year earlier, and for the intervening six-month period (i.e., an 18-month series beginning one year prior to program implementation). Crash data for the comparison zones were provided for the two six-month periods, rather than by month. Data were entered in configured spreadsheets and included designations of crash severity (Fatal, Injury, and Property Damage Only/PDO) and primary collision factor (PCF). The following four figures, collectively labeled as Figure 7, illustrate the crash frequencies, presenting the numbers of injury and PDO crashes in each of the Tucson special enforcement zones during the program period in 2001 and in the same six-month period of the Year 2000; as in the previous figures, the shaded areas indicate the intervening six-month period.

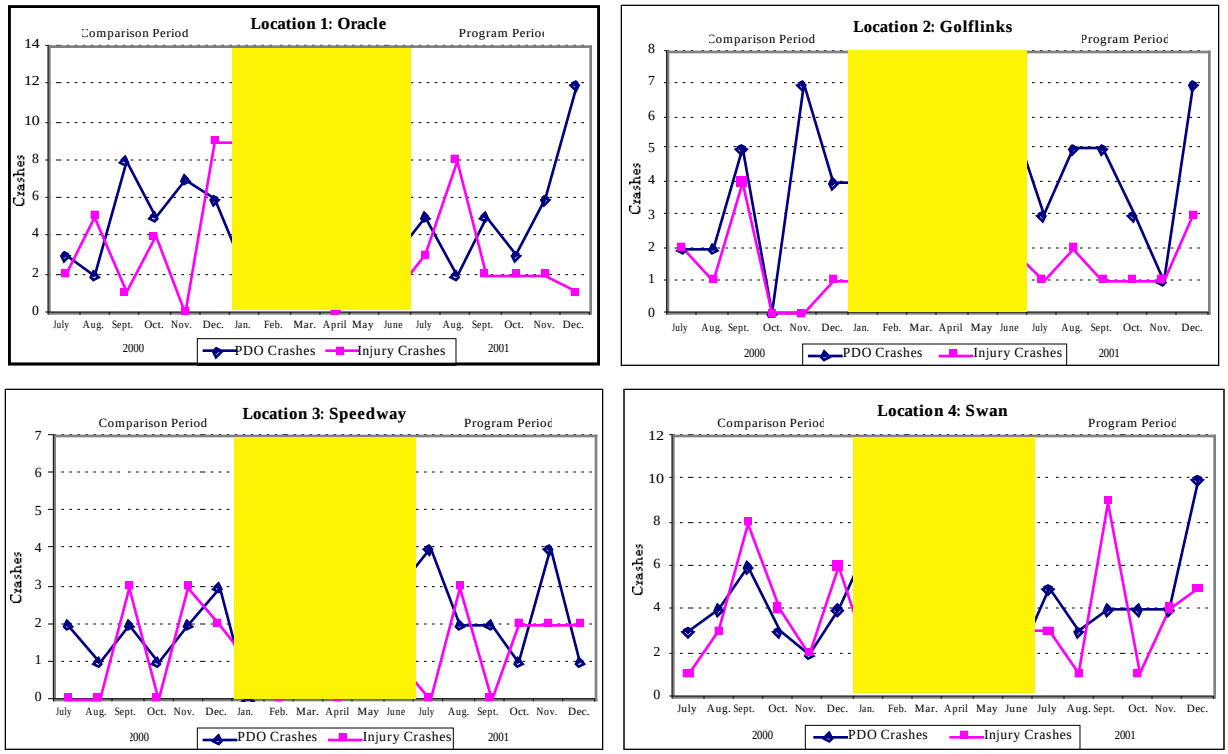


Figure 7. Crashes in the Tucson special enforcement zones.

Table 6 presents a summary of all crash data relevant to the Tucson aggressive driving program. The table shows that the four special enforcement zones and the four comparison zones experienced increases in PDO crashes and declines in injury crashes during the program period, compared to the same six-months of the previous year. The changes ranged from a 20 percent increase in PDO crashes in the enforcement zones to a 15 percent decrease in injury crashes in the comparison zones. Overall, crashes increased by 10 percent in the special enforcement zones and decreased by two percent in the comparison zones. The table also shows that the numbers of crashes for which a PCF associated with aggressive driving was cited decreased by three percent in the comparison zones and by nearly three times that rate in the special enforcement zones.

TABLE 6
SUMMARY OF ALL CRASH MEASURES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *TUCSON* SPECIAL ENFORCEMENT AND COMPARISON ZONES

Measure	July-Dec. 2000 Comparison Period	July-Dec. 2001 Program Period	Percent Change
Total PDO Crashes in Enforcement Zones	84	101	+20%
Total PDO Crashes in Comparison Zones	86	92	+7%
Total Injury Crashes in Enforcement Zones	61	59	-3%
Total Injury Crashes in Comparison Zones	62	53	-15%
Total Crashes in Enforcement Zones	145	160	+10%
Total Crashes in Comparison Zones	148	145	-2%
Total Target PCFs in Enforcement Zones	121	122	+1%
Total Target PCFs in Comparison Zones	104	98	-6%
Percent of Crashes w / a Target PCF: Enforcement	83%	76%	-8%
Percent of Crashes w / a Target PCF: Comparison	70%	68%	-3%

PROGRAM AWARENESS

The managers of both aggressive driving programs were encouraged to conduct surveys of public awareness to determine if local drivers received the programs' public information and education messages. The Tucson Police Department did not conduct a survey; rather, the officers interpreted the response to their aggressive driver hotline as evidence of substantial public awareness. In contrast, the managers of the Marion County program commissioned Purdue University's Center for the Advancement of Transportation Safety to conduct identical telephone surveys of 100 drivers each, prior to and at the conclusion of the Marion County Rub Out Aggressive Driving program. The Marion County pre- and post-program surveys contained 72 questions, the subjects of which ranged from demographic information to opinions about hypothetical changes to the Indiana vehicle code. Only two questions addressed public awareness of the aggressive driving program. The first of those questions asked, "Besides your experiences of aggressive driving while driving or as a passenger, what is your level of awareness of aggressive driving as a potential problem?" The responses to this question are presented in Table 7.

TABLE 7
RESPONSES TO THE MARION COUNTY PUBLIC AWARENESS SURVEY QUESTION #1

Response	Pre-Program	Post-Program
I read or hear about it on a daily basis.	15.1%	13.0%
I read or hear about it on a weekly basis.	32.6%	27.0%
I have read or heard about it at least once in the past month.	39.5%	33.0%
I have read or heard about it at least once in the past six months.	7.0%	15.0%
I have not read or heard anything about it until this interview.	5.8%	11.0%

The table shows that, overall, fewer drivers reported awareness of aggressive driving as a problem at the conclusion of the Marion County program than before it began. Fewer drivers reported hearing about the issue on a daily or weekly basis and within the past month, despite the extensive advertising campaign implemented by the Marion County Traffic Safety Partnership. Evidence that some drivers heard or read at least something about aggressive driving can be found in the 15 percent of respondents who reported hearing about the issue at least once during the past six months, up from seven percent prior to the program period. However, 11 percent reported that they had never heard or read anything about aggressive driving until the survey interview, compared to about six percent before the PI&E program.

The other relevant question on the survey asked about the primary sources of the respondents' awareness of aggressive driving. Table 8 shows that television was the primary source of information both before and at the conclusion of the Marion County aggressive driving program. Awareness from newspapers showed the largest change, increasing as the primary source of information from 16 percent of respondents prior to the program to 31.5 percent at its conclusion. This increase probably reflects the *Indianapolis Star's* substantial coverage of the program and of the fatal crash that resulted from a high-speed pursuit by an officer on special enforcement patrol.

TABLE 8
RESPONSES TO THE MARION COUNTY PUBLIC AWARENESS SURVEY QUESTION #2

Response	Pre-Program	Post-Program
Newspapers / magazines	16.0%	31.5%
Television	42.5%	47.2%
Radio	14.2%	4.5%
Other people	27.4%	14.6%
Other sources	0	2.2%

IMPLICATIONS

The data presented in the previous section of this report show that more crashes occurred during the program periods in both Marion County and Tucson than in the same six-month periods of the previous year, when no special aggressive driving enforcement was conducted in either community. Marion County's special enforcement zones experienced 32 percent more crashes than during the same period of the Year 2000; crashes in Tucson's special enforcement zones increased by ten percent, overall. Further, in Marion County, crashes with primary collision factors associated with aggressive driving increased by 21 percent in the comparison zones and by 41 percent in the special enforcement zones. Based on increases such as these, it would be reasonable to question whether special enforcement has a stimulating, rather than an inhibiting, effect on the incidence of aggressive driving. One interpretation might be that the special enforcement and PI&E programs influenced some motorists to drive more slowly, resulting in increased opportunities for aggressive drivers, whose behavior is less likely to be influenced by the programs, to overtake the slower drivers, with the encounters leading to the increase in crashes.

The Introduction to this report discussed the apparent increase in road rage and aggressive driving, and attributed the increase in observed incidents, largely, to the 27 percent increase in vehicle miles traveled per year that occurred in the U.S. during the final decade of the Twentieth Century. With the addition of only one percent of roadway during that period, one might expect, overall, 26 percent increases in *all* traffic-related phenomena, or increases of approximately two and a half percent each year in the absence of mitigating factors. However, the relationship between traffic volume and phenomena such as crashes may not be linear, nor are increases in traffic volume uniformly distributed throughout the network of roads and highways. That is, a small increase in traffic volume from one year to the next might result in a disproportionate change in crash incidence. Further, changes in traffic volumes are of greater magnitude on some roadways than on others. Perhaps factors such as these influenced the results of the aggressive driving programs conducted by the Marion County Traffic Safety Partnership and the Tucson Police Department.

Data were obtained from the Department of Public Works of the City of Indianapolis, and the Department of Transportation of the City of Tucson, to determine if any changes in traffic volumes were measured that might help explain the increases in crashes that occurred during the program periods. Traffic counts are not performed every year nor in all locations within a community. For these reasons, in some cases extrapolation was required from 1999 data and in others from sections of roadway adjacent to a special enforcement zone. Table 7 presents the estimated changes in traffic volumes in the Marion County and Tucson special enforcement zones from the Year 2000 to 2001, based on the traffic count data provided by the cities. The table shows that Marion County's zones experienced estimated increases in traffic volumes ranging from five to ten percent, with an average estimated increase of eight percent. The estimated traffic volume increases in Tucson's zones ranged from five to 18 percent, with an average estimated increase of nine percent. The actual and estimated traffic count data show that the special enforcement zones of both aggressive driving programs experienced increases in traffic volumes substantially greater than the national average of two and a half percent between the Year 2000 and 2001.

TABLE 9
ESTIMATED CHANGES IN TRAFFIC VOLUMES
IN THE MARION COUNTY AND TUCSON SPECIAL ENFORCEMENT ZONES: YEAR 2000 TO 2001

Program / Zone	Speed Limit (in mph)	Percent Change in Traffic Volume
Marion County Special Enforcement Zones		
B	40	+5%
C	35	+8%
D	35	+10%
Average Change of Traffic Volume		+8%
Tucson Special Enforcement Zones		
1	40	+5%
2	45	+2%
3	35	+10%
4	40	+18%
Average Change of Traffic Volume		+9%

The estimated increases in traffic volumes are supported by the anecdotal accounts of officers. Officers of the Marion County program reported that traffic has been increasing steadily for several years, with a noticeable increase in traffic in the special enforcement zones during 2001. Officers attribute the increased traffic in the enforcement zones to two major highway maintenance projects that caused many motorists to take surface streets to avoid delays on the highways; the maintenance work was not anticipated by the research plan. Tucson officers also reported noticeable increases in traffic volumes during 2001. The officers attribute the increases to the recent expansion of activities at a local Air Force base, which is adjacent to one of the special enforcement zones, and the construction of several thousand new houses north of the city. The primary arterial that links the new housing to the city passes through one of the Tucson Police Department's special enforcement zones.

The estimated increases in traffic volumes between the years 2000 and 2001 provide a partial explanation for the increases in crashes in the special enforcement zones of both communities during their aggressive driving programs. The estimated nine percent increase in traffic volume in Tucson's zones was accompanied by a ten percent increase in crashes. An increase in crash incidence comparable to the increase in traffic volume is a reasonable expectation. The data from Marion County, however, are not as easily explained.

It was estimated that traffic volume increased by an average of eight percent in Marion County's special enforcement zones, while the number of crashes increased 32 percent during the aggressive driving program, compared to the number of crashes during the same six-month period one year earlier. That is, crashes increased at a rate four times the increase in traffic volume. The most likely explanation for this difference is that the estimates of traffic volume are inaccurate; in particular, the extrapolations from previous years and neighboring zones were statistical projections that did not take into account any unmeasured increases in traffic volume resulting from the highway maintenance and construction projects that were mentioned by officers as a possible explanation for the increase in crashes.

The number of crashes overall is not the primary figure of merit for evaluating the aggressive driving programs. Increases in traffic volume can result in increased crash incidence, as discussed in the previous paragraphs. More relevant measures of program effect are the numbers of crashes with primary collision factors that are associated with aggressive driving, and the calculated proportions of all crashes that were assigned those PCFs on collision reports. In this regard, the incidence of crashes with aggressive driving PCFs might increase, but to demonstrate program effect the increase cannot be greater than the increase in crashes, overall.

Table 8 presents a summary of the relevant crash data for both Marion County and Tucson. The table shows that the total number of crashes in the Marion County special enforcement zones increased by 32 percent, and the number of those crashes with aggressive driving PCFs increased by 41 percent, as reported previously. That is, the total number of crashes increased substantially, but the crashes with aggressive driving PCFs increased at a greater rate. Crashes with the target PCFs is a more relevant metric than total crashes, but change in the *proportion* of crashes with the target PCFs provides the best overall measure of program effect because it eliminates the influence of differential traffic volume and other uncontrolled factors that might contribute to an overall increase in crash incidence. In this regard, Table 8 shows that the Marion County zones experienced a six percent increase in the proportion of all crashes with aggressive driving PCFs; that is, total crashes increased by 31 percent, crashes with aggressive driving PCFs increased by 41 percent, but the *proportion* of total crashes with aggressive driving PCFs increased by six percent.

TABLE 10
SUMMARY OF KEY CRASH MEASURES DURING THE MARION COUNTY AND TUCSON PROGRAM PERIODS AND THE SAME SIX-MONTH PERIODS ONE YEAR EARLIER

Program / Measure	Year 2000 Comparison Period	Year 2001 Program Period	Percent Change
Marion County			
Total Crashes in Enforcement Zones	259	343	**+32%**
Total Crashes in Comparison Zones	280	347	+24%
Total Target PCFs in Enforcement Zones	160	226	+41%
Total Target PCFs in Comparison Zones	196	238	+21%
Percent of Crashes w / a Target PCF: Enforcement	62%	66%	**+6%**
Percent of Crashes w / a Target PCF: Comparison	70%	69%	-1%
Estimated Average Change in Traffic Volume			+8%
Tucson			
Total Crashes in Enforcement Zones	145	160	**+10%**
Total Crashes in Comparison Zones	148	145	-2%
Total Target PCFs in Enforcement Zones	121	122	+1%
Total Target PCFs in Comparison Zones	104	98	-6%
Percent of Crashes w / a Target PCF: Enforcement	83%	76%	**-8%**
Percent of Crashes w / a Target PCF: Comparison	70%	68%	-3%
Estimated Average Change in Traffic Volume			+9%

Table 8 also shows that the number of crashes in Tucson's special enforcement zones increased by ten percent, but the number of crashes with aggressive driving PCFs increased by less than one percent. Most important, the *proportion* of all crashes with target PCFs decreased by eight percent. That is, crash incidence increased overall in Tucson's zones, but the proportion of those crashes with aggressive driving PCFs declined. In the absence of a countermeasure program, it would be reasonable to expect a ten percent increase in aggressive driving PCFs, corresponding to the ten percent increase in crashes, overall, and no change in the proportion of all crashes with the target PCFs. However, the number of crashes increased in Tucson while the proportion of those crashes with the target PCFs declined, which suggests that the Tucson Police Department's program had an effect on the driving behavior of local motorists.

Greater crash incidence in the enforcement zones could be expected because those locations were selected on the basis of disproportionate aggressive driving. Enforcement and comparison zones experienced comparable numbers of crashes during the preceding year, but the locations of greatest concern to the officers in both communities were selected to be the enforcement zones. Table 8 also shows that total crashes and crashes with the target PCFs increased in the Marion County comparison zones (24 and 21 percent, respectively), but the increases were not as great as in Marion County's enforcement zones. The proportion of all crashes with the target PCFs declined by one percent in the comparison zones and increased by six percent in the zones in which Marion County's special enforcement was conducted. Tucson's comparison zones experienced two percent fewer crashes during the program, compared to the same six-month period one year earlier, while crashes in Tucson's enforcement zones increased by ten percent. However, the proportion of all crashes with the target PCFs declined by three percent in Tucson's comparison zones and by eight percent in the zones that received special enforcement.

The data summarized in Table 5 showed that Marion County's 32 percent overall increase in crashes is composed of a 39 percent increase in property damage only (PDO) crashes and a 17 percent increase in injury crashes. In contrast, Tucson's ten percent overall increase in crashes is composed of a 20 percent increase in PDO crashes and a three percent decrease in injury crashes. Higher vehicle speed is a more likely contributing factor to injury crashes than to PDO crashes. Injury crashes increased in Marion County's special enforcement zones, but declined in Tucson's zones, which suggests greater effectiveness of Tucson's countermeasure program. This interpretation of the crash data is supported by the results of the speed samples presented in Tables 3 and 4. Average speeds declined slightly in Marion County, and at a greater rate in Tucson, possibly in response to special enforcement and other programmatic efforts.[10]

EXPLANATION

The original purpose of this report was to present, rather than compare, the two aggressive driving programs. However, comparisons are inevitable and the substantially different results of the two programs require an explanation. First, it is important to understand that it is impossible to control all of the variables that could influence the outcome of a study when conducting large-scale, quasi-experiments, such

[10] Baseline speeds were generally faster in Marion County than in Tucson. Average baseline speeds in 35 mph zones were 6.1 mph over the limit in Marion County, compared to 3.7 mph in Tucson; average speeds in 40 mph zones were 5.3 mph over the limit in Marion County, compared to 2 mph in Tucson. The causes and possible effects of the apparent differences in baseline speeds are unknown.

as the programs described in this report. Highway maintenance projects and large residential developments that increase traffic volumes on surface streets are examples of unexpected and uncontrolled variables that can affect dependent measures in a field study involving driver behavior. We have attempted to identify and/or control relevant variables within each program, but the research was not originally designed to support systematic comparisons between the two programs. Marion County, Indiana, and Tucson, Arizona, are different in many ways, and it is possible that some of those differences could be responsible for the differential results reported here.

Despite the differences between Marion County and Tucson, comparisons can be made if it is assumed that any unknown differences are unlikely to influence the incidence of crashes or average vehicle speed, and that known differences have been identified and controlled. For example, a hypothetical difference, such as driving style, or a known difference, such as climate, are rendered irrelevant by comparing percent changes from baseline conditions at each location, rather than comparing actual crash frequencies; this procedure permits comparisons of zones with different baseline crash frequencies within a program, and comparisons of programs. Also, we calculated the proportions of crashes with aggressive driving PCFs to facilitate comparisons by eliminating the confounding effects of increased numbers of crashes, overall. These methods provide reasonable assurance that the only relevant independent variables are the components of the two countermeasure programs.

If the assumptions concerning comparability are accepted, the data presented in this report show that Tucson's aggressive driving program achieved the intended result of reducing the incidence of aggressive driving, while the Marion County program did not. As described previously, each program received a grant of $200,000, but the managers of the Tucson program devoted considerably more of their resources to enforcement effort than the Marion County managers, and considerably less to conventional paid advertising to publicize their program. Further, the Tucson program assigned two officers full-time and two officers part-time to conduct the special enforcement patrols and deployed the officers nearly every day of the six-month program period. In contrast, special enforcement in the Marion County program was conducted as overtime duty by 42 officers from six different law enforcement agencies, with teams of five officers deploying, on average, one day in three.

This comparison of the Marion County and Tucson aggressive driving programs suggests that limited resources might be better spent on officer labor than on publicity. It also appears that focusing enforcement responsibility on a small team assigned full-time to the special enforcement patrols is probably more effective than sharing the responsibility among a large number of officers as occasional overtime duty.

WHY AREN'T THE PROGRAMS MORE EFFECTIVE?

The proportion of all crashes with aggressive driving primary collision factors increased by six percent in Marion County's special enforcement zones and decreased by eight percent in Tucson's zones. Why didn't the considerable efforts of both programs have greater inhibiting effects on driving behavior, as measured by speed samples and crashes with aggressive driving PCFs? No positive effect of the Marion County program was measured, and there was only an eight percent decline in the proportion of aggressive driving crashes in Tucson. It is possible that the programs were more effective than indicated by the data presented here, but our measures are insensitive to the change in driving behavior. Or, perhaps we expect too much.

The Introduction to this report identified the driving behaviors and primary collision factors that are associated with aggressive driving, and used in the current analysis as measures of program effect. As noted in that discussion, those driving behaviors and the associated PCFs are imperfect dependent measures because they are not always the results of conscious decisions to drive aggressively. Rather, unknown proportions of crashes assigned the "aggressive driving" PCFs clearly are attributable to inattention and errors in judgment, rather than volitional aggressive driving. For this reason, programs intended to reduce the incidence of crashes caused by these driving behaviors can be expected to influence only the portion of those crashes that results from volitional acts, rather than human error and misjudgment.

Both programs were well planned and conducted by skilled and highly-motivated professionals. It is quite likely that at least Tucson's countermeasure program achieved as much success as reasonably can be expected based on the actual, rather than the news media-inflated, magnitude of the "aggressive driving problem." Further, Tucson's eight percent decline in the proportion of crashes with aggressive driving PCFs is a considerable accomplishment. The eight percent decline represents approximately 13 fewer crashes in the special enforcement zones during the six-month program period than would have occurred had the program not been conducted (i.e., five injury crashes and eight property damage only crashes). Some portion, if not all of those prevented crashes, could be attributable to the Tucson program. Although statistical tests were not conducted, all measures are consistent with the hypothesis that a program that combines special enforcement with publicity about the enforcement can change driver behavior. Economists have calculated the overall costs resulting from crashes of different severity. The savings to society from preventing eight PDO crashes and five crashes with only moderate injuries to one person per crash greatly exceeds the cost of Tucson's aggressive driving program.

RECOMMENDATIONS

The current study used direct, unobtrusive measures of vehicle speed, and indirect, archival measures of crash incidence to assess program effects. Both of these methods produce quantifiable data that are easily obtained and linked to the behavior of interest. However, not all incidents of aggressive driving result in crashes, and not all crashes with "aggressive driving" PCFs are caused by aggressive driving. As stated previously, the methods used in this evaluation are imperfect and might be insensitive to the accurate measurement of aggressive driving.

Based on the experiences of the current study, it is recommended that observational methods also be used in future evaluations of aggressive driving countermeasure programs. In particular, trained data collectors, positioned unobtrusively at roadside or at intersections, could record observed incidents of aggressive driving on paper or electronic forms. The observers would have the advantage of actually seeing the drivers and the surrounding traffic and, thus, be able to discriminate, in most cases, whether the behavior was intentional or the result of human error or misjudgment. Observations conducted according to a systematic sampling plan, involving time of day, day of week, and location, could provide robust data sets for comparing baseline to treatment conditions. Direct observation of the behaviors in question would help interpret and allow greater confidence in study results.

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APPENDIX A

CONTRIBUTING FACTORS TO AGGRESSIVE DRIVING

CONTRIBUTING FACTORS TO AGGRESSIVE DRIVING

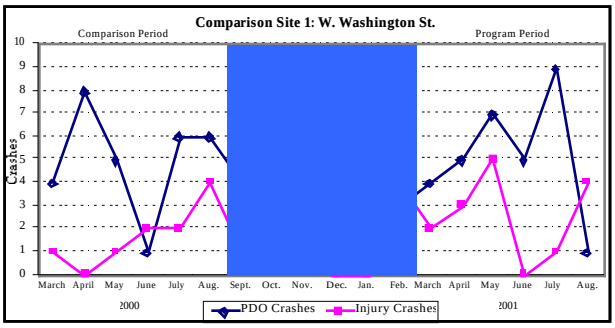
The items on the following list have been suggested in news accounts, scholarly articles, or the current research as factors that can contribute to the incidence of aggressive driving.

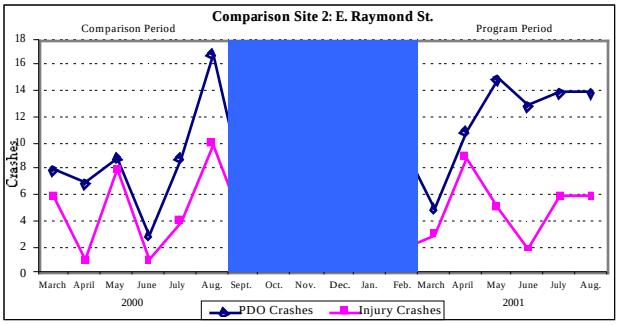
- Increased congestion on roadways;
- Running late, too many obligations;
- Anonymity provided by a closed vehicle;
- Disregard for others and the law;
- Chronic or pathological anger;
- Traffic jams caused by construction zones with little or no work going on;
- Fewer mental health services available than in the past;
- Violent video games;
- Violent films and television programs;
- Increased levels of intrapersonal and interpersonal stress, including stress associated with employment, two-career families, familial relationships, child-care issues, elder-care issues, and fundamental economic and technological changes in society;
- Loud, thumping music on the car radio while driving;
- The need to "save face" and overcome feelings of being disrespected by another driver;
- The need to assert one's identity and maintain control in a situation where one fears losing control;
- A cultural focus on "time" as a limited resource, including concerns about "saving time," "using time wisely," "being on time," and "time is money";
- A human need for "space" that causes some drivers to be territorial about infringements on their space;
- The summer heat;
- Popular culture's focus on machismo and masculinity;
- Increased immigration trends leading to a mixture of different driving styles;
- A widespread increase in interpersonal violence, including murder, domestic abuse, and street crime;
- A focus on individualism that produces a "me first" mentality;
- Oppressive social conditions that produce feelings of alienation in individuals;
- Slow drivers (especially in the "fast lane");

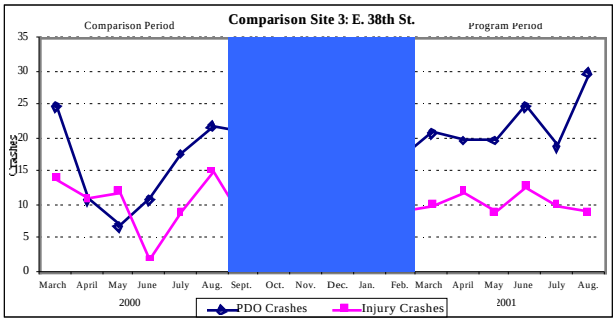
- Defensive driving habits that produce an inflated concern about the poor driving skills of others;
- A lower emotional intelligence and moral character than exhibited in past societies;
- An innate human drive to aggression;
- Decreased drivers education in schools;
- Reduced levels of traffic enforcement;
- Ignorance about the “rules of the road”;
- Dehumanization of the other;
- An attempt to attain power in an otherwise powerless existence;
- Increased commuting distances and durations;
- Fewer people relying on mass transit and more relying on cars;
- An increased sense of invincibility behind the wheel of a 3,000-pound vehicle;
- A cultural propensity to promote and reward competitive, tenacious, and aggressive behavior; and,
- An individual propensity to perceive one’s vehicle as an extension of oneself.

APPENDIX B

DATA TABLES AND FIGURES







Marion County Comparison Zone Crash Figures.

TABLE B-1
PROPERTY DAMAGE ONLY (PDO) CRASHES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *MARION COUNTY* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
B	63	106	+68%
C	69	70	+1
D	46	72	+57%
Total	178	248	+39%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	30	31	+3%
2	53	72	+36
3	94	135	+44%
Total	177	238	+34%

TABLE B-2
INJURY CRASHES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *MARION COUNTY* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
B	25	42	+68%
C	24	24	0%
D	32	29	-9%
Total	81	95	+17%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	10	15	+50%
2	30	31	+3
3	63	63	0%
Total	103	109	+7%

TABLE B-3
TARGET PCFS DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *MARION COUNTY* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
B	57	103	+81%
C	54	59	+9
D	49	64	+31%
Total	160	226	+41%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	30	28	-7%
2	67	77	+15%
3	99	133	+34%
Total	196	238	+21%

TABLE B-4
PROPERTY DAMAGE ONLY (PDO) CRASHES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *TUCSON* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
1	31	33	+7%
2	20	24	+20
3	11	14	+27
4	22	30	+36%
Total	84	101	+20%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	30	18	-40%
2	11	25	+127%
3	18	26	+44%
4	27	23	-15%
Total	86	92	+7%

TABLE B-5
INJURY CRASHES DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *TUCSON* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
1	21	18	-14%
2	8	9	+13%
3	8	9	+13
4	24	23	-4%
Total	61	59	-3%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	16	13	-19%
2	13	11	-15%
3	11	16	+45%
4	22	13	-41%
Total	62	53	-15%

TABLE B-6
TARGET PCFS DURING THE PROGRAM PERIOD AND THE SAME SIX-MONTH PERIOD ONE YEAR EARLIER: *TUCSON* SPECIAL ENFORCEMENT ZONES AND COMPARISON ZONES

Enforcement Zone	**Comparison Period**	**Program Period**	**Change**
1	45	37	-18%
2	24	27	+13%
3	18	20	+11%
4	34	38	+12%
Total	121	122	+1%
Comparison Zone	**Comparison Period**	**Program Period**	**Change**
1	33	22	-33%
2	19	23	+21%
3	20	29	+45%
4	32	24	-25%
Total	104	98	-6%

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