

Saving Lives with Traffic Safety

Cincinnati, Ohio Police Department

Summary

SCANNING: In 2005, the City of Cincinnati, Ohio experienced their highest year for fatal traffic accidents in a decade with 36 fatal accidents and 37 people killed. In addition to the fatal accidents, Cincinnati had a total of 18,519 traffic accidents for the year.

ANALYSIS: Preliminary analysis revealed Cincinnati traffic accidents and fatalities were occurring as a result of speed/aggressive driving, operating a vehicle while impaired (OVI), and failing to wear a seatbelt where one was available. Critically, the Cincinnati Police Department lacked a comprehensive strategy to proactively address either traffic related problem causes or locations.

RESPONSE: Starting in 2006, the Cincinnati Police Department for the first time identified traffic safety as a core patrol strategy and developed a traffic safety business plan to guide traffic safety efforts across the Department. While the impetus for initial plan development was the theory of Problem-Oriented Policing, various other theories including: Situational Crime Prevention and Intelligence-Led Policing contributed to both its development and implementation throughout the Department.

The crime prevention strategies were applied to three newly identified traffic safety focus areas: high visibility patrol; consistent enforcement; and analysis of hot spots. Specific interventions were developed for and implemented in each focus area. The interventions included: partnership with the Ohio State Highway Patrol; the use of airspeed enforcement on all Interstate highways; operating a vehicle under the influence (OVI) checkpoints; analysis of traffic data to determine

high traffic accident locations, times and causative factors; and the micro grinding of precise Cincinnati street and Interstate highway locations.

The goal of the interventions was to achieve both a short and long term reduction in fatal, serious injury, and the overall number of traffic accidents within the city of Cincinnati corporate limits.

It was theorized that by having Cincinnati Police Department Officers patrol along the busiest high traffic accident locations, during peak periods, that a reduction in the number of traffic accidents would occur in all three categories.

ASSESSMENT: Since the incremental roll out of the traffic safety interventions, the Cincinnati Police Department has achieved significant reductions in the number of fatal, serious injury and overall traffic accidents. Time series analysis demonstrated roughly a 15% statistically significant decline in overall traffic accidents between the pre-and post intervention periods; additional analyses demonstrate that the reduction in Cincinnati was greater than the reductions experienced in the remainder of the county, state and country during the same time period.

DESCRIPTION

SCANNING

Nationally, fatal traffic accidents are an enormous problem. National Highway Transportation Safety Administration statistics show that every year in the United States, more people die in traffic accidents than from any other non-illness related cause. Traffic accidents are the leading cause of death at every age between the ages of three to thirty-four. In the United States, traffic accident deaths occur at twice the rates of death from homicidal violence. In the past five years, an average of 39,676 people per year died in traffic accidents, compared to an annual average of 16,558 people who died yearly from homicidal violence. (www.NHTSA.gov)

In 2008, the 5,811,000 reported traffic accidents nationwide had an estimated economic cost of \$230.6 billion dollars. (www.NHTSA.gov) Across the United States, public safety resources are being slashed to close budget deficits. The resource reductions are primarily in the areas of personnel and equipment. Agencies are being asked to do more with fewer available resources. Economic and resource costs to the public safety agencies required to respond to traffic accidents are substantial.

In 2005, the City of Cincinnati, Ohio experienced their worst year for fatal traffic accidents, in over a decade, with 36 fatal accidents and 37 people killed. For the year, Cincinnati had an overall total of 18,519 traffic accidents.

Even removing the obvious human costs associated with loss of life and serious injury from traffic accidents, the Cincinnati Police Department was spending an increased amount of personnel resources and time to investigate an ever growing number of them.

Cincinnati Police Department Traffic Unit Officers spend an average of twenty two hours of investigative time, on each serious injury and fatal traffic accident, including time at the accident scene and in the office using reconstruction software. In addition, district patrol officers are required to maintain stationary traffic posts closing the roadways around each serious injury and fatal traffic accident scene to allow traffic officers to reconstruct the accident safely. All of these investigative and support functions remove officers from the street duty to which they are assigned. Likewise, long road closures, especially at peak travel periods, generate numerous citizen complaint calls.

The combined loss of life and negative impact on Department operations meant a more efficient and effective traffic safety strategy would have to be developed.

ANALYSIS

Limited scientific research has been conducted on the area of traffic safety, especially in the United States. While individual areas of traffic safety, such as operating a vehicle while under the influence (OVI), have been studied, research to determine the precise causal factors of traffic accidents and their severity is lacking. Ayuso et al. (2010) found “to our knowledge, there is no empirical analysis of the impact of traffic violations on the severity of an accident” (Ayuso et al., 2010, p. 710) despite the primary cause and effect relationship between traffic violations and traffic accidents.

Prior to 2006, the Cincinnati Police Department lacked the ability to precisely target their enforcement actions in the area of traffic safety. Traffic Unit officers concentrated their efforts on the Interstate highways and on serious injury and fatal traffic accident investigations. Traffic safety efforts on the remaining city streets were tasked as the responsibility of the five patrol

districts. District level enforcement efforts were haphazard. Resources were deployed at the discretion of individual shift commanders and deployment decisions were based on their personal experiences. Patrol officers assigned on every District shift could identify specific locations where they responded daily for traffic accidents but this information was never compiled in a meaningful way and no attempt at data analysis or problem-solving was attempted at the district level. Responding to traffic accidents was seen as a routine part of every daily shift and no prevention efforts were initiated.

At the Department level, no systematic analysis of citywide traffic patterns or traffic accidents had ever been undertaken in Cincinnati. There had been no systematic attempts to determine the underlying causes of traffic accidents in the city or initiate targeted deployment.

Annually, the three primary causative factors of fatal traffic accidents throughout the United States include: speed/aggressive driving; operating a vehicle while impaired by alcohol and/or drugs of abuse; and failure to wear a seatbelt when one is available (www.NHTSA.gov).

Analysis of Cincinnati's traffic fatalities for 2005 showed that these were the principal causes of traffic fatalities within Cincinnati as well. However, there was no set strategy in place to address these causative factors.

RESPONSE

Though 2005 was the worst year for traffic accident fatalities in over a decade in Cincinnati, five years later, Cincinnati had the fewest traffic fatalities in 15 years and fewer than any large city in the State of Ohio. This transformation did not occur by accident.

Beginning in 2006 and continuing today, the Cincinnati Police Department incorporated a problem-oriented approach to traffic safety and used strategies from Situational Crime

Prevention and Intelligence-Led Policing. The strategies of the crime prevention theories were applied to various traffic safety interventions and implemented on Cincinnati streets and highways. It was hypothesized that if traffic safety interventions could decrease opportunities for traffic accidents by increasing violator risk and effort, and guardianship could be increased in high traffic accident locations, then fatal and non-fatal accidents would decline.

The strategy of the traffic safety interventions included deployment of Cincinnati Police Department Officers to patrol along the busiest, high traffic locations during peak periods in order to reduce fatal, serious injury and overall traffic accidents. Specific interventions were designed and applied to three traffic safety focus areas: high visibility patrol; consistent enforcement; and analysis of hot spots.

High Visibility Patrol

An individual's "risk of involvement in a traffic accident depends not only on the activities themselves in which the individual takes part, but also on their location, timing and the attributes of the trip undertaken to participate in these activities" (Elias et al., 2010). In other words, the routines of drivers matter and police are part of those routines. When one lives in, works, or travels through an area daily, the local police are an expected part of the landscape. As people go about their daily routine activities, local police fade into the background, similar to buildings and landscaping - present but often unnoticed.

To increase law enforcement visibility and citizen awareness, in March 2006, the Cincinnati Police Department partnered with the Ohio State Highway Patrol to conduct joint patrols that focused combined enforcement efforts on all three of the primary causative factors of traffic fatalities.

Speed Violations/Aggressive Driving

A two-part strategy was implemented that both targeted speed/aggressive driving violations by motorists for law enforcement action, and educated the public on roadway safety. Early enforcement action focused on the state routes that serve as the main traffic arteries in the city, and was later expanded to the Interstate highways.

Initial enforcement action was conducted using Cincinnati Police Traffic Unit Officers and Ohio State Highway Patrol Troopers patrolling jointly on state route locations that analysis revealed as historical hot spots for speed related traffic accidents. This was the first time the two agencies had ever formally partnered on a traffic safety initiative. The joint patrols were purposefully deployed in a high profile manner to raise the awareness level of both the public and the media about the importance of roadway safety. For the first time, motorists saw Cincinnati Police Department Officers and Ohio State Highway Patrol Troopers side by side on major traffic arteries during peak travel periods. Accident hot spot patrols were specifically tailored to both reduce the opportunity for violations and to increase capable guardianship in the targeted areas, which theoretically would lead to a reduction in traffic accidents.

Following the implementation of this strategy on state routes, the approach was expanded to Interstate highways. Segments of Interstate highways I-75, I-71, I-74, I-275, and I-471, all run through the city of Cincinnati. In the six years prior to the implementation of the initial traffic safety plan, the city of Cincinnati averaged nearly six fatal traffic accidents per year on these Interstates. Cincinnati Police Department Officers assigned to the Traffic Unit had primary responsibility for patrol of these highways but lacked a systematic deployment strategy.

An analysis of historical Interstate highway fatal accident data was conducted-(another first),- and revealed excessive speed and OVI as the primary causative factors for Interstate traffic accident fatalities. Analysis also showed the accidents were randomly distributed across all five Interstates with no discernible pattern. If excessive speed increased the severity of traffic accidents, it was hypothesized that a reduction in vehicle speed would reduce accident severity.

To reduce Interstate highway speeds, increased enforcement was initiated using Ohio State Highway Patrol aircraft to monitor vehicle speed from the air and relay violator information to road officers and troopers strategically positioned after the speed measurement area. The road officers and troopers would then stop violators and issue a citation for the speed violation and also a seatbelt citation if the driver or passengers were not wearing one when stopped.

Simultaneous to the initiation of airspeed patrols, the Traffic Unit began a community based public education campaign that focused on speed reduction and seatbelt usage. The campaign used both the television and print media, along with donated billboard space near high traffic accident Interstate highway locations, in an effort to remind the driving public to slow down and to buckle their seatbelts as it could save their lives in the event of a traffic accident.

OVI Checkpoints

The next intervention involved dramatic changes in the Cincinnati Police Department's method of OVI enforcement. In 2005, 47% of those drivers involved in a fatal traffic accident in the City of Cincinnati were operating a vehicle while under the influence of alcohol and/or drugs of abuse. (Cincinnati Police Department Traffic Unit Statistics)

Traditionally, the Cincinnati Police Department was reactive in its approach to locating and apprehending OVI drivers. Other than some limited Federal grant funding allocated specifically

for OVI detection around the Memorial Day and Labor Day holidays, OVI drivers were primarily apprehended when they were noticed in the course of regular random patrol or when an officer received a call to a traffic accident and upon arrival discovered an OVI driver.

The Cincinnati Police Department took a proactive approach to both deter impaired drivers, and increase awareness of the harm caused by those who operate a vehicle while impaired. In September 2006, OVI checkpoints were implemented for the first time. The exact checkpoint locations were determined after an extensive analysis of both traffic patterns and accident rates throughout the city.

OVI checkpoints consist of twenty to forty Cincinnati Police Department Traffic Officers and Ohio State Highway Patrol Troopers jointly manning fixed posts for a two-hour to four-hour period and briefly stopping each vehicle that drives through the area. Once stopped, the driver is engaged in a brief conversation that explains the purpose of the checkpoint while the officer looks for visible signs of alcohol and or drug impairment. Additional marked patrol units, not assigned to the actual checkpoint posts, patrol the surrounding side streets looking for those persons who may be driving while impaired and attempting to avoid the checkpoint area.

Prior to their implementation, informational presentations about OVI checkpoint were made to judges, prosecutors, various neighborhood community councils and the media. The presentations explained the purpose of the checkpoints, the statistical analysis supporting the locations selected and what the citizens could expect if stopped at a checkpoint or a checkpoint was initiated in their neighborhood.

Consistent Enforcement/Analysis of Hot Spots

Braga theorized that in order to maximize effectiveness, “police should focus their actions on the places, times, and people who pose the highest risks to public safety rather than dilute their crime prevention potency by spreading them thinly across the urban landscape.” (Braga, 2001, p. 105)

Although separate concepts, consistent enforcement and analysis of hot spots have a mutually beneficial relationship. Consistent enforcement cannot be achieved without analysis to determine the peak locations and times that targeted events are occurring. Analysis to determine hot spots and underlying causative factors without follow up action to remove the cause is wasted time.

Data Analysis

In early 2006, the initial sworn officer position of Traffic Analyst was created within the Traffic Unit to analyze: citywide traffic patterns, all traffic accident data and OVI arrest data. The selection criteria for the traffic analyst position specified that applicants be experienced traffic officers and required current certification in traffic accident reconstruction. These requirements were built in to ensure the analyst was able to readily identify unusual traffic accident patterns, look for underlying causative factors, and possessed sufficient knowledge to recommend actions to remedy the causative factors on a long term basis.

Once a traffic analyst was selected, both citywide and individual patrol district traffic data for the previous 30 days was provided to each Patrol District Captain and to the Traffic Unit Commander on the first Tuesday of each month. The analyzed data included the overall number of traffic accidents, along with a precise listing of the top ten percent of accident locations; days of the week; times of the day; and primary causative factors. The new monthly traffic report was

designed to be used for traffic problem-solving and was based on the widely used Scanning Analysis Response Assessment (SARA) problem-solving model. (Eck and Spelman, 1987)

Every month, the traffic analyst *Scanned* and *Analyzed* both citywide and district-level traffic data, and provided the information in an actionable format to the district and traffic commanders who were able to quickly custom tailor a timely *Response* to their current traffic problems. An immediate *Assessment* of the effectiveness of the response was conducted which allowed for quick modification of the response plan if needed. Monthly problem-solving projects involving traffic safety were entered and tracked in the Department's problem-solving tracking system. Once entered, these projects were then available for review by other Department Commanders who may be experiencing similar traffic problems.

Micro Grinding

In 2005, three fatal traffic accidents occurred in a three block area of Montana Avenue. Montana Avenue is a main traffic feeder artery to Interstate I-74 and receives heavy morning and afternoon rush hour traffic volume. During the same time period, River Road had one fatality and two life threatening injury traffic accidents and another fatality three days into 2006. River Road is one of the primary East/West traffic arteries in the city and receives heavy traffic volume at all hours.

The Montana Avenue and River Road accident locations were the first project assigned to the traffic analyst. Analysis of the traffic accidents revealed serious injury and fatal traffic accidents were occurring at higher rates in inclement weather than at other times. It was hypothesized this was due to the sharp bends in both roadways that became slippery when the road surface was wet from rain or snow. Both roadways also had eleven-foot wide travel lanes, instead of the

currently mandated thirteen-feet, which reduced margins for driver error. The combination of wet pavement and narrow lanes caused vehicles to slide across the double yellow line and into oncoming traffic from the opposite direction. This led to an increased number of head on-collisions that resulted in fatalities and life threatening injuries at both locations. Traditionally, rumble strips like those on winding expressway ramps, or grooving of the road surface are used to keep vehicles from sliding on wet pavement. Both of these solutions are extremely noisy and cannot be used in residential neighborhoods.

Using the information developed by the analyst, the Traffic Unit convinced the City of Cincinnati Traffic Engineering Department to work with their outside paving contractors to develop a new micro-grind of the roadway surface. The micro-grind prevented vehicles from sliding on the wet roadway by roughening up the top one-quarter inch of the pavement surface to allow vehicle tires better traction in inclement weather. However, it is still quiet enough that neighborhood residents are not disturbed by noise every time a vehicle travels over the lightly ground up-roadway.

Assessment

Over the past five years, the Cincinnati Police Department implemented a variety of traffic safety interventions in an attempt to reduce fatal, serious injury and overall traffic accidents. Using 2005 traffic accident numbers as the baseline measure, the City of Cincinnati has experienced a reduction in fatal traffic accidents, life threatening injury traffic accidents and overall traffic accidents since the interventions were implemented. However, during the same period of time, Hamilton County Ohio, the State of Ohio and the United States as a whole have also experienced declines in the same areas.

City of Cincinnati, Hamilton County, State of Ohio and United States data for both fatal traffic accidents and overall accidents was compiled for the period of 2000-2009. In addition, 2010 traffic accident data, for the City of Cincinnati; Hamilton County; and the State of Ohio, was compiled for both categories. (National 2010 traffic accident data was not yet available)

The data and interventions were examined by Drs. John Eck, Robin Engel, and Nicholas Corsaro (University of Cincinnati) to determine whether the reductions in fatal and non-fatal accidents experienced in Cincinnati that temporally corresponded with the interventions were statistically significantly larger than the reductions experienced in other locations.

Time series count models for all traffic accidents in Cincinnati from 2000-2009 were estimated using the precise dates of implementation for the various interventions. These same models were also applied accident data from Hamilton County, the State of Ohio and the United States. A detailed description of the methodology and results is included in Appendix A.

Empirical Results

Time Series Analysis Examining Fatal and Non-Fatal Traffic Accidents

To examine the impact of CPD's interventions, Generalized Linear modeling (GLM) Negative Binomial regression models were estimated using local, county, state and national traffic accident data. These models demonstrated that the vehicle accidents within Cincinnati that resulted in serious injuries experienced a statistically significant decline of roughly 14.5% above and beyond the fluctuations due to seasonal shocks and drifts in the data between the pre-and post-intervention periods. Additional analyses demonstrate that the reduction in traffic accidents with injuries in Cincinnati was significantly greater than the reductions experienced in the remainder of the county, state and country. These analyses provide statistical support suggesting

that the reductions in accidents experienced in Cincinnati were not merely a product of random chance, but likely influenced by the set of strategies described above, which were specifically designed to reduce accidents during the time period examined.

Additional times series analyses examining only fatal accidents were unable to detect statistically significant reductions in fatal traffic accidents pre/post intervention. This result is likely due in part to the small number of fatal accidents examined. These non-significant results only suggest that we cannot eliminate the possibility that the difference in the fatal accident reductions between Cincinnati and other jurisdictions could be due to chance. The non-fatal accident analyses however, provide convincing evidence regarding the promise of CPD's interventions. The Cincinnati traffic accident reductions post-intervention were larger than those reductions experienced during the same time period in Hamilton County, the State of Ohio and the United States, none of which received the interventions implemented in Cincinnati.

Experimental Results

Precise scientific tests for each individual intervention could not be conducted. However, each intervention demonstrated positive results that were unique to the specific intervention. Overall result data were compiled by the Cincinnati Police Department Traffic Unit for: airspeed enforcement, operating a vehicle under the influence checkpoints, and the micro grinding of high traffic accident road surfaces. The effects of data analysis and data distribution for traffic problem-solving were measured for overall traffic accident numbers during the period of 2005-2010.

While there are limitations to non-experimental findings, the results are positive and important for understanding the impact of the strategy undertaken by the Cincinnati Police. In each case,

the data show that the interventions probably triggered the expected mechanisms that created the overall drop in traffic accidents.

Airspeed Enforcement

Pre intervention, between the years 2000-2005, the Interstates within the city of Cincinnati had a cumulative total of 35 fatal traffic accidents, or an average of 5.8 per year. Post intervention, between the years 2006-2010, the same roadways had a cumulative total of 21 fatal traffic accidents, or an average of 4.2 per year. Three of the fatalities in 2008 occurred on dates, times, and at locations where airspeed enforcement was scheduled but cancelled due to inclement weather. (Cincinnati Police Department Traffic Unit Statistics)

The average speed of violators on Interstate highways was reduced 7.8 miles-per-hour after the implementation of airspeed enforcement. Prior to airspeed enforcement, speeding citations on Cincinnati Interstates averaged 82 miles-per-hour or 27 miles-per-hour over the speed limit. After the implementation of airspeed enforcement, the average speeding citation on Cincinnati Interstate highways is now 74 miles-per-hour or 19 miles-per-hour over the speed limit. (Cincinnati Police Department Traffic Unit Statistics, see Appendix B)

OVI Checkpoints

In 2005, 47% of the drivers involved in a fatal traffic accident in the city of Cincinnati were found to be operating a vehicle while under the influence of alcohol and/or drugs of abuse. After the implementation of regular OVI checkpoints in September of 2006, the number of impaired drivers involved in a fatal traffic accident in the city of Cincinnati was reduced to 33% in 2010. (Cincinnati Police Department Traffic Unit Statistics)

Micro Grinding of Roadways

The Montana Avenue and River Road high traffic accident locations received micro grinding in October of 2006. Since that date, no life threatening injury or fatal traffic accidents have occurred at either location. Due to the elimination of serious injury and fatal traffic accidents in these initial locations post intervention, seven additional locations on city streets and Interstate highways have received the same intervention. No life threatening injury or fatal traffic accidents have occurred at those additional locations since the intervention.

Data Analysis and Data Distribution

The overall number of traffic accidents in the City of Cincinnati has declined annually since the intervention of traffic data analysis and data distribution was implemented across the Department and used for traffic problem solving. Over the five year period the interventions have been in place, a 26% overall reduction in the number of annual traffic accidents has occurred. This is a numerical reduction of over 4800 traffic accidents annually. (see Appendix C)

Using the most conservative estimate of one hour of an officer's time for every traffic accident call for service, the Cincinnati Police Department now has an additional 4800 hours of discretionary patrol time that can be used for neighborhood problem-solving activities. Based upon a standard 40-hour work week, each of the city's five patrol districts has 24 additional weeks of discretionary patrol time for their officers. This increase in time for neighborhood problem-solving was accomplished at no additional cost to the Department.

Overall Effect on Fatal and Overall Traffic Accidents

Each Cincinnati traffic safety intervention applied demonstrated positive numerical and percentage reduction effects. The collective results of analyses examining the impact of the Cincinnati Police Department's use of crime prevention strategies to reduce accidents leads to a plausible conclusion that the interventions had their desired effect. Overall traffic accidents in the City of Cincinnati have been reduced at rates greater than comparison areas of Hamilton County, the State of Ohio and the United States that did not receive the interventions. (See Appendix D for details). No displacement effect to other areas was detected.

The CPD's development and application of precise traffic safety interventions that reduced opportunity, increased offender risk and effort, and increased guardianship on streets and highways, resulted in reductions in accidents, serious injuries and deaths while producing savings in agency resources. This work clearly demonstrates that the strategies of crime prevention can be successfully applied to increase traffic safety.

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And the 25 officers assigned to the Cincinnati Police Department Traffic Unit who implement these strategies daily on the streets of Cincinnati.

Appendix A Time Series Testing

Prepared by Dr. Nicholas Corsaro

One of the unique challenges of analyzing longitudinal data is the non-random fluctuations in the outcome variables that occur over an extended period of time (McDowall et al., 1980: p. 14). More specifically, there is often inherent bias in monthly time series data driven by seasonality as well as trends, drifts, and the potential of an overall ‘regression toward the mean’ that has the capacity to confound a researcher’s ability to assess unique program impact that takes place independent of these influencing factors. One common analytic approach that provides a more comprehensive test of an intervention effect is the use of interrupted time series models (McDowall et al., 1980). Given the structure of the outcome variables (i.e., monthly count data measuring fatal and non-fatal automobile accidents) Generalized Linear Modeling (GLM) Negative Binomial regression models (see Dobson, 1990) were used to test for a specific intervention effect associated with a post-intervention date of September 2006.¹

All models presented here control for linear and curvilinear trends as well as seasonal effects through the use monthly dummy variables (where December is the reference category). The pre-intervention period is defined as January 2000 – August 2006, while the post-intervention period is operationalized as September 2006 – December 2010. All estimates in the regression models are displayed as incident rate ratios (exponentiated coefficients).

¹

Table 1: GLM Time Series Results for Fatal Vehicle Accidents

Measure	<u>City of Cincinnati</u>		<u>Remainder of H.C.</u>		<u>Remainder of Ohio</u>	
	I.R.R.	St. Error	I.R.R.	St. Error	I.R.R.	St. Error
Post-Intervention	1.260	0.318	1.421	0.340	1.041	0.042
Controls						
Trend	1.014*	0.006	0.994	0.005	1.000	0.001
Trend Squared	0.999**	0.000	0.999	0.000	0.999**	0.000
January	0.691	0.181	0.569*	0.165	0.842**	0.040
February	0.527*	0.150	0.483*	0.148	0.719**	0.036
March	0.557*	0.156	0.911	0.232	0.816**	0.039
April	0.616	0.167	0.703	0.192	0.913	0.043
May	0.422*	0.130	0.800	0.211	0.974	0.045
June	0.565*	0.159	0.929	0.236	1.148**	0.051
July	0.994	0.239	1.029	0.255	1.177**	0.052
August	0.829	0.208	1.161	0.280	1.224**	0.054
September	0.533*	0.152	0.919	0.233	1.158**	0.052
October	0.621	0.169	0.926	0.235	1.087	0.049
November	0.709	0.186	0.838	0.219	0.970	0.045

H.C. = Hamilton County; * p < .10; ** p < .05.

¹ Alternative intervention dates (i.e., November 2005, April 2006, and May 2006) were also incorporated into the time series regression models given different components of the strategy unfolded during these specific dates. The results of those analyses were very consistent with the results presented here, which would suggest the immediacy of the estimated impact that corresponded with the different types of strategies was less of a facilitating factor on the outcomes than the overall program. However, more detailed analyses that test the unique program components that were implemented at specific points in time are needed to provide greater clarity to this issue.

Table 1 shows that fatal vehicle accidents remained relatively stable between the pre- and post-intervention periods. More specifically, fatal vehicle accidents within the city of Cincinnati were roughly 26 percent higher in the post-intervention period relative to the pre-intervention period once seasonal and trend influences were taken into account, though this estimated rate of change was not statistically significant. Comparatively, fatal accidents in the remainder of Hamilton County (i.e., Hamilton County – Cincinnati) also remained relatively stable between these two periods in that the change was not statistically significant (I.R.R. = 1.42, p > .10). The same level of stability was seen in the remainder of Ohio (State of Ohio – Cincinnati) between January 2000 and December 2010.

Table 2: GLM Time Series Results for Non-Fatal Accidents with Injuries

Measure	<u>City of Cincinnati</u>		<u>Remainder of H.C.</u>		<u>Remainder of Ohio</u>	
	I.R.R.	St. Error	I.R.R.	St. Error	I.R.R.	St. Error
Post-Intervention	0.855**	0.030	0.926*	0.028	0.962	0.021
Controls						
Trend	1.000	0.000	0.996**	0.000	0.996**	0.000
Trend Squared	0.999**	0.000	1.000	0.000	1.000	0.000
January	0.959	0.038	0.841**	0.028	0.896**	0.023
February	0.839**	0.034	0.758**	0.026	0.812**	0.021
March	0.908*	0.036	0.779**	0.027	0.811**	0.021
April	1.050	0.041	0.895**	0.030	0.854**	0.022
May	0.113**	0.044	0.961	0.032	0.957	0.024
June	1.010	0.040	0.960	0.032	0.955	0.024
July	1.025	0.040	0.911**	0.033	0.936*	0.024
August	1.018	0.040	0.9277*	0.030	0.961	0.025
September	1.036	0.041	0.889**	0.030	0.937*	0.024
October	1.126**	0.044	1.020	0.034	0.978	0.025
November	1.059	0.042	0.944	0.031	0.934*	0.024

H.C. = Hamilton County; * $p < .10$; ** $p < .05$.

Table 2 shows that vehicle accidents within Cincinnati that resulted in injuries experienced a statistically significant decline ($p < .01$) of roughly 14.5% (exponentiated coefficient – 1.00) above and beyond fluctuations due to seasonal shocks and drifts in the data between the pre- and post-intervention periods. However, the remainder of Hamilton County also experienced a statistically significant decline ($p < .05$) of roughly 7.4% in this same outcome during this period. Comparatively, the remainder of Ohio also experienced a decline, though the change was not statistically significant (I.R.R. = 0.962, $p > .10$).

Given that the reduction in Cincinnati was twice as large as the reduction in the remainder of Hamilton County (14.5% compared with 7.4%) and the significance thresholds appeared to be more precise in the Cincinnati model as well ($p < .01$ compared with $p < .05$), it became important to examine difference coefficients tests (see Clogg et al., 1995) using the Paternoster et al. (1998) error-correction in order to determine if the reduction in automobile accidents that resulted in injuries within the city of Cincinnati declined at a significantly greater rate than the change that occurred within the rest of Hamilton County during the same period. We found that the additional 7.1% decline in automobile accidents with injuries within Cincinnati occurred at a rate that was marginally statistically significantly greater (t value = 1.73, $p < .10$) than the decline observed in the rest of Hamilton County. Thus, while it appears there may have been a ‘regression to the mean’ in automobile accidents that resulted in injuries within *all* of Hamilton County between the pre- and post-intervention periods, the decline within the city Cincinnati was significantly greater than the change experienced by the remainder of the county.

In summary, there did not appear to be a sizeable, significant, or substantive change in fatal accidents before and after the intervention strategy unfolded, after controlling for important non-random influences in time series data. However, the city of Cincinnati experienced a statistically significant ($p < .01$) and substantive decline of roughly 14.5% in automobile accidents with injuries. This decline was also (marginally) significantly greater ($p < .10$) than the reduction experienced by the remainder of the county indicating the change was not merely a product of random chance, thus lending additional credence to the notion that the reduction may have been influenced by a set of strategies designed to disrupt this specific type of outcome during the period of examination.

References

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Appendix B

Table 1 below depicts the average miles per hour speed reduction on Cincinnati Interstate highways and the average fatality reduction since the intervention of regular airspeed patrols.

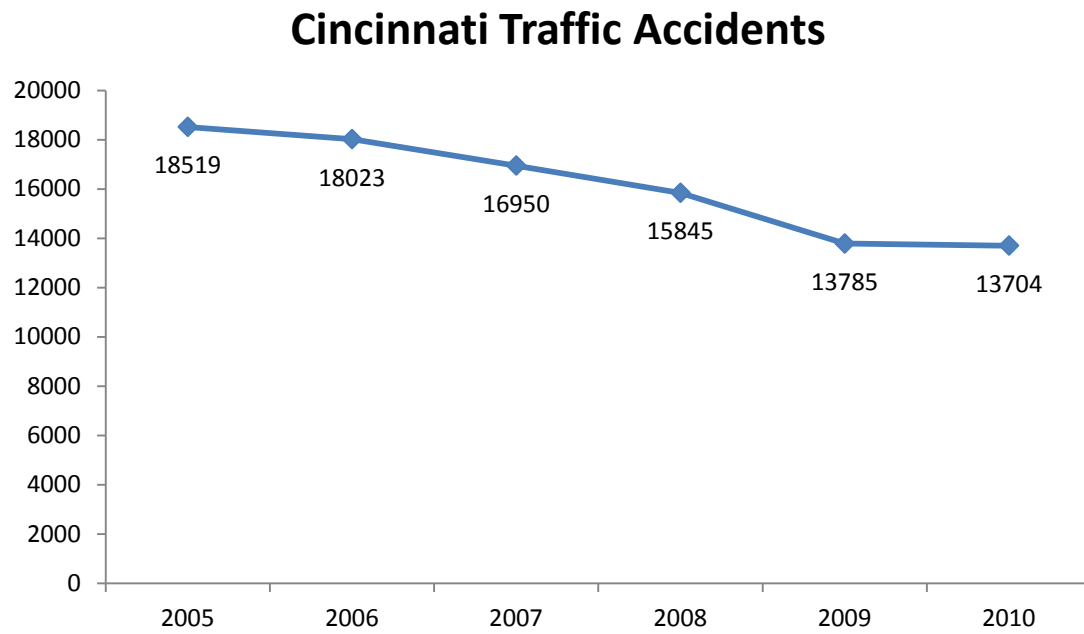
Table 1 Cincinnati Interstate highway data

	Before Airspeed Intervention	After Airspeed Intervention
Average Interstate Miles Per Hour Citations (55 MPH speed limit)	82 MPH	74 MPH
Average Fatal Interstate Traffic Accidents per Year	5.8	4.2

Appendix C

Chart 1 below illustrates the year by year traffic accident reduction in the city of Cincinnati 2005-2010. (Cincinnati Police Department Traffic Unit Statistics)

Chart 1 Cincinnati Traffic Accidents



Appendix D

Table 2 illustrates the numerical and percentage reductions for each entity for the baseline year of 2005 and the year 2009, the last year full data is available for all four entities. (Cincinnati Police Department Traffic Unit Statistics)

The reductions for Hamilton County and the State of Ohio are consistent with the national decline. Cincinnati's reduction stands out as it is nearly twice the reduction as the national decline.

Table 2 Numerical and Percentage Fatal Traffic Accident Reductions

	City of Cincinnati	Hamilton County (without Cincinnati)	State of Ohio	United States
2005 Fatal Traffic Accidents	36	57	1229	43,510
2009 Fatal Traffic Accidents	19	41	945	33,646
Reduction Percentage 2005-2009	47%	28%	23%	23%