Washington State Target Zero Teams Project

U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA
www.nhtsa.gov

DISCLAIMER

This publication is distributed by the U.S. Department of Transportation, National Highway Traffic Safety Administration, in the interest of information exchange. The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the Department of Transportation or the National Highway Traffic Safety Administration. The United States Government assumes no liability for its contents or use thereof. If trade or manufacturers' names or products are mentioned, it is because they are considered essential to the object of the publication and should not be construed as an endorsement. The United States Government does not endorse products or manufacturers.

Suggested APA Format Citation:

Thomas, F. D., Blomberg, R. D., Masten, S. V., Cicchino, J., Tippets, A. S., Korbelak, K. T., Fell, J. C., & Lacey, J. H. (2015, January). *Evaluation of Washington State Target Zero Teams project*. (DOT HS 812 097). Washington, DC: National Highway Traffic Safety Administration.

Technical Report Documentation Page

1. Report No. DOT HS 812 097	2. Government Accession No.	3. Recipient's Catalog No.
4. Title and Subject Evaluation of Washington State Target Zero Teams Project		5. Report Date January 2015 6. Performing Organization Code 251
7. Authors F. Dennis Thomas, Richard D. Blomberg, Scott Masten,[1] Jessica Cicchino,[2] Scott Tippetts, Kristopher T. Korbelak, James Fell,[3] and John Lacey[3]		8. Performing Organization Report No. 251-2
9. Performing Organization Name and Address Dunlap and Associates, Inc. 110 Lenox Avenue Stamford, CT 06906		10. Work Unit No. (TRAIS) 11. Contract or Grant No. DTNH22-09-D-00138, Task Order 1
12. Sponsoring Agency Name and Address National Highway Traffic Safety Administration Office of Behavioral Safety Research, NTI-131 1200 New Jersey Avenue SE. Washington, DC 20590		13. Type of Report and Period Covered Final Report 5/4/10– 7/3/13 14. Sponsoring Agency Code

15. Supplementary Notes
Scott Masten[1] is with Compass Statistical Consulting. Jessica Cicchino is with the Insurance Institute of Highway Safety (formerly with NHTSA).[2] James Fell and John Lacey[3] are with PIRE. Dereece Smither was the NHTSA Project Manager.

16. Abstract
As part of its "Target Zero" strategic highway safety plan that has the goal to reduce traffic fatalities in Washington to zero by the year 2030, the State of Washington established three detachments of Washington State Patrol (WSP) troopers to focus on nighttime impaired-driving offenses. These detachments stationed in King, Pierce, and Snohomish counties were named Target Zero Teams (TZT). Each included one sergeant and six troopers funded by the Washington Traffic Safety Commission (WTSC). It is important to note that Snohomish also served as the pilot site for the successful Night Emphasis Enforcement Team (NEET) project that began in late 2006 and was the model for the TZT program. In addition to the WSP detachments, the TZT program also involved local law enforcement on overtime funded by WTSC. Researchers chose 3 other counties in Washington (Clark, Spokane, and Yakima) to serve as comparison sites since they did not have any formal, WTSC-funded TZT activities taking place. Overall, during the TZT period, there were notable countywide net increases in the number of DUI arrests by troopers in the TZT counties with Pierce increasing 47.21 percent, King 13.63 percent, and Snohomish 13.28 percent. The Snohomish increase is noteworthy since it represents a net gain above and beyond that achieved by the NEET program. The TZT detachments in King, Pierce, and Snohomish showed significantly higher percentages of trooper contacts resulting in DUI arrests (15.38%, 10.83%, and 9.78% respectively) than the non-TZT troopers in those counties (1.75%, 2.02, and 1.61%), and WSP troopers in the comparison counties (2.56%, 1.98%, and 1.91%) and the rest of the State (1.22%). The study results suggested that TZT led to reduced non-fatal crashes of all types in Pierce County, reduced crashes of some types in King County, but limited crash reductions in Snohomish County where the NEET program had already achieved significant reductions as reported previously by WTSC. Results showed that relative to the comparison counties the TZT counties had a reduction of 24.8 percent in driver alcohol involvement (BAC $\geq$ .01) in fatal crashes and a relative reduction of 22.4 percent for high driver BAC (BAC $\geq$ .15) involvement in fatal crashes. Using conservative assumptions, researchers compared projected driver alcohol-involved fatality data with observed fatality data to estimate that TZT saved 11 lives that would have been lost in driver alcohol-involved crashes in the TZT counties if TZT had not been in operation. Based on these fatalities avoided alone, TZT was highly cost-effective. Overall, the study results suggest the TZT approach markedly increased the DUI enforcement productivity of the law enforcement agencies in the intervention counties which led to safety gains in these counties during the study time period.

17. Key Words		18. Distribution Statement
Target Zero Teams	TZT	Document is available to the public from the National Technical Information Service www.ntis.gov
DUI	DWI	
Drunk Driving	Crashes	
Enforcement	Driving Under the Influence	

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	67	

Form DOT F 1700.7 (8-72)

ACKNOWLEDGEMENTS

The authors acknowledge the extensive support received from the Washington Traffic Safety Commission (WTSC) and the various agencies in Washington State who provided evaluation data. This study would not have been possible without their cooperation and hard work.

The opinions, findings, and conclusions expressed in this publication are those of the authors and do not necessarily reflect the views of the National Highway Traffic Safety Administration or the above listed contributors.

Table of Contents

Executive Summary vi
Background 1
The Target Zero Teams Program 2
  The NEET Program 3
  Expansion of NEET Program to TZT 3
  Geo-Mapping Crashes and Arrests to Guide Enforcement 5
Objective 7
Methods, Analyses, and Results 7
  Citation/Law Enforcement Activity Data 7
    TZT trooper activity data 7
    Local law enforcement activities 13
    AOC data 14
    Special prosecution staff 20
  Media Activities 20
    Paid media 22
    Earned media 23
  Statewide Crash Data 24
    Crude crash rates 25
    Total crashes 25
    Nighttime crashes 25
    Daytime crashes 26
    Injury crashes 26
    Single-vehicle crashes 26
    Multi-vehicle crashes 26
    Single-vehicle nighttime crashes 26
    Summary of crash findings 26
  Driver BACs 28
  Driver Alcohol Involvement in Fatal Crashes 31
    Driver BACs ≥ .01 in fatal crashes 32
    Driver BACs ≥ .15 in fatal crashes 33
    Driver alcohol-involved fatalities avoided 34
    Summary of driver alcohol involvement in fatal crashes 34
  Public Awareness and Self-Reported Behavior 35
  Cost/Benefit to State 41
Discussion 43
References 46
Appendix 48

List of Tables

Table 1. County Characteristics 4
Table 2. WSP DUI Arrests by County for TZT and Non-TZT Troopers 9
Table 3. Net Change in Number of WSP DUI Arrests During TZT by County 10
Table 4. WSP Warnings by County for TZT and Non-TZT Troopers 11
Table 5. WSP Speeding Citations by County for TZT and Non-TZT Troopers 12
Table 6. Local Law Enforcement Hours Worked on TZT 13
Table 7. Local Law Enforcement Contacts, Citations, and Arrests 14
Table 8. WTSC Paid DUI Media Campaigns During TZT 22
Table 9. Earned Media by Type 23
Table 10. ARIMA Results Comparing Crash Rates per 100,000 Population Before and After Target Zero Team Implementation 27
Table 11. Crude Monthly BAC Tests Administered and Mean BACs in TZT and Comparison Counties, January 2006–June 2012 29
Table 12. ARIMA Results Comparing Monthly BAC Tests Administered and Mean BACs Before and After Target Zero Team Implementation 30
Table 13. Modeling Approach for Driver Alcohol Involvement in Fatal Crashes 32
Table 14. Individual Models Where BAC ≥ .01 32
Table 15. BAC ≥ .01, Contrasts Between TZT Counties and Other Groups 32
Table 16. Covariate Model Where BAC ≥ .01 33
Table 17. Individual Models Where BAC ≥ .15 33
Table 18. BAC ≥ .15, Contrasts Between TZT Counties and Other Groups 33
Table 19. Covariate Model for BAC ≥ .15 34
Table 20. Number Of Surveys Collected 37
Table 21. In The Last 30 Days, Have You Noticed Increased Police Traffic Enforcement In This Area? 38
Table 22. Percentage Who Heard or Saw Message by Media Type 39
Table 23. Percentage Who Knew Slogan 40
Table 24. TZT Total Cost and Major Cost Components 42
Table 25. Dollars Saved by TZT and Benefit to Cost Ratios 42

List of Figures

Figure 1. TZT Counties and Comparison Counties 4
Figure 2. Example of Hot Spot Mapping 6
Figure 3. Average Number of DUI Citations by County 16
Figure 4. Average Number of Days From Citation to Court Filing by County 17
Figure 5. Average Number of Superior Court DUI Cases by County 18
Figure 6. Average Number of Days From Citation to Court Filing by County 19
Figure 7. Screenshot of TZT Mention in *Choose Your Ride* Campaign 21
Figure 8. DOL Awareness Questions 36

Executive Summary

Background and Objectives

According to the National Highway Traffic Safety Administration, 9,878 people were killed during 2011 in crashes in which at least one driver had a blood alcohol concentration (BAC) of .08 grams per deciliter (g/dL) (NHTSA, 2012) . This represented 31 percent of the total motor vehicle traffic fatalities in the United States during that year, a decrease of 2.5 percent from 2010 when there were 10,136 fatalities in these alcohol-impaired crashes. The alcohol-impaired-driving fatality rate per 100 million vehicle miles traveled (VMT) remained the same from 2010 to 2011 at 0.34 (NHTSA, 2012). Despite a downward trend for several years in the raw number of fatalities, the above numbers show alcohol-impaired driving is still a major problem. As such, there have been numerous attempts across the country to reduce alcohol-impaired driving. Fell, McKnight, and Auld-Owens (2013) provide a review of the activities undertaken by communities at various levels to reduce alcohol-impaired driving. Many of the most successful programs relied on high visibility enforcement (HVE) and the use of checkpoints. Such programs attempt to increase deterrence by elevating the driving public's perceived risk of apprehension and sanctioning. Some States, however, cannot conduct sobriety checkpoints due to State statutes, court decisions, or other impediments. The State of Washington is banned from using checkpoints. As a result, law enforcement agencies in Washington make widespread use of saturation and roving patrols rather than sobriety checkpoints for enforcing impaired-driving laws.

In late 2006, the Washington State Patrol (WSP) assembled a full-time, high-visibility saturation patrol called the Night Emphasis Enforcement Team (NEET). This pilot program, funded by the Washington Traffic Safety Commission (WTSC), included a four-trooper and one-sergeant detachment stationed primarily in Snohomish County, a suburb of Seattle that includes the City of Everett. The NEET detachment troopers focused their efforts almost exclusively on the enforcement of impaired driving and related traffic offenses (e.g., nonuse of seat belts and speed) on weekend nights and were relieved of their other routine duties while assigned to NEET. The NEET troopers were specially selected based upon their training, experience, and motivation in enforcing impaired driving laws. A NHTSA Research Note (Cicchino, 2012) indicated that traffic fatalities decreased by 40.3 percent in Snohomish County from 2005 (the year before the NEET program began) to 2008. In contrast, traffic fatalities in the same period decreased by only 17.7 percent in the remaining counties in Washington that did not have NEET patrols.

Washington expanded upon the NEET program by establishing three detachments of WSP troopers to focus on nighttime impaired-driving offenses. WTSC and the Washington State Patrol named these detachments *Target Zero Teams* (TZT) since they supported Washington's "Target Zero" strategic highway safety plan that includes the goal to reduce traffic fatalities in Washington to zero by the year 2030. For this new TZT project, Washington deployed three detachments consisting of one sergeant and six troopers in each of the three largest counties in the State—King, Pierce, and Snohomish. In addition to the WSP detachments, the TZT program also involved local law enforcement funded by WTSC. These agencies received grant funding to conduct overtime enforcement focused on driving under the influence (DUI) offenses. For research purposes, researchers chose three counties (Clark, Spokane, and Yakima) to serve as comparison sites since they did not have any formal WTSC-funded TZT activities taking place.

NHTSA funded this evaluation effort independent from the TZT enforcement program. The evaluation focused on the program's effectiveness in increasing DUI enforcement and whether TZT resulted in decreased alcohol-involved driving, crashes, and fatalities in the intervention counties in relation to the chosen comparison counties and statewide. The research objectives were to:

1. Evaluate the effectiveness of Washington State's TZT project in King, Pierce, and Snohomish counties;
2. Assess public awareness and media coverage of the project;
3. Examine the degree of cooperation between TZT troopers and local law enforcement in TZT counties; and
4. Calculate the cost/benefit of the project to the State of Washington.

Method

The study effort was impact and outcome-focused. For the evaluation, researchers gathered information and data on:

- Citation and law enforcement activities (e.g., contacts, arrests, hours worked) from
  - The WSP Trooper Time and Activity System (TAS),
  - Local law enforcement grant reports, and
  - Administrative Office of the Courts (AOC) records;
- Number of BAC tests conducted by WSP,
- Special prosecution activities,
- Earned and paid media,
- The timing of WTSC efforts to develop and implement the TZT program,
- Likely cost/benefit to the State,
- Crash data,
- Driver BAC data,
- Driver alcohol involvement in fatal crashes, and
- Public awareness.

Results

WSP DUI Arrests. During the TZT period the TZT detachments in King, Pierce, and Snohomish showed significantly higher percentages of trooper contacts resulting in DUI arrests (15.38%, 10.83%, and 9.78% respectively) than the non-TZT troopers in those same counties (1.75%, 2.02, and 1.61%), troopers in the comparison counties (2.56%, 1.98%, and 1.91%) and troopers in the rest of the State (1.22%). Overall, during the TZT period there were notable countywide net increases in the number of DUI arrests by troopers in the TZT counties with Pierce increasing 47.21 percent, King 13.63 percent, and Snohomish 13.28 percent (even after the foundation provided by the NEET project).

Local Law Enforcement Activities. The agencies receiving grants from WTSC to participate in TZT reported their efforts to WTSC through activity logs. These logs revealed that local agencies in King, Pierce, and Snohomish counties logged 12,554.9 overtime hours and another 608.8 regular hours as part of TZT efforts. King County agencies reported making 525

DUI/Alcohol Arrests (0.10 per duty hour), Pierce County 521 (0.14 per duty hour), and Snohomish County 296 (0.07 per duty hour) across the 2-year TZT period.

Administrative Office of the Courts Records of DUI Citations/Arrests. Administrative Office of the Courts (AOC) provided data on DUI citations/arrests for both the Courts of Limited Jurisdiction (CLJ) and Superior Courts in the entire State. Most notably for the CLJ data, King and Pierce counties showed an overall increase in citation activity when TZT efforts began while Snohomish stayed relatively stable compared to the 2-year period before when citations levels already had been elevated by the NEET efforts. The increases in King and Pierce tended to drop off slightly over time. This could be an artifact of the lag from the issuance of a citation to entry in AOC's database or a possible decrease in impaired driving due to deterrence created by TZT. The comparison counties showed virtually no change in citation activity after TZT began.

Earned and Paid Media. WTSC's first year media plan did not include any paid radio or television advertisements, although it did include some billboard and bus advertising purchases. In the second year they integrated some TZT mentions into paid media activities, but the activities primarily utilized variations of national messages. TZT most frequently generated newspaper coverage as well as significant television news coverage. TZT also generated social media coverage. The great majority of the earned media coverage appears to have taken place during the first year of the project while the paid campaigns were spread across the entire two years of the project.

Special Prosecution Staff. As part of the TZT program, WTSC funded additional prosecution staff in King and Snohomish counties. In Snohomish, an additional prosecutor was hired while multiple support staff members were added in King County. Reports documenting the numbers of TZT DUI arrests coming through the prosecutors' offices were consistent with the data from the TAS system regarding trooper DUI arrest activities and AOC records. The reports suggest that many cases were pending and that charges were often reduced to negligent or reckless driving.

Public Awareness and Self-reported Behaviors. The Washington Department of Licensing (DOL) conducted an awareness survey of its customers. Many of the WTSC/DOL public awareness measures showed very little change. However, the intervention sites also showed a small, but significant increase in recognition of "Target Zero Teams," but the highest rate achieved was 5.1 percent during July 2012. One item on the DOL survey suggests respondents in the TZT counties may have reduced their driving while intoxicated. The item asked, "*About how many times in the past 30 days did you drive when you thought you HAD TOO MUCH TO DRINK?*" The percentage saying "0" increased from 92.9 percent at baseline, to 96.5 percent in July 2010, 96.4 percent in July 2011, and 96.7 percent in July 2012 at the intervention sites. The comparison sites did not show a similar increase.

Driver BACs. WSP's Toxicology Division maintained a database of the measured BAC of all drivers who were required to complete a breath test. This includes all of the breath alcohol tests conducted in the State by both WSP and by local agencies since all breath tests must be processed on instruments owned and calibrated by WSP. The results of the analyses indicated that 14.4 percent more drivers were BAC tested in King County and 23.5 percent more in Pierce County after the program was implemented. The number of drivers BAC tested was not reliably different before-and-after the TZT program was implemented in Snohomish County despite the

increase in DUI arrests in the county. The results also indicated the mean BAC was lower in all three of the TZT counties after the program was implemented. Specifically, the mean BAC of tested drivers was 1.1 percent lower in King County (.135 to .133), 3.0 percent lower in Pierce County (.138 to .135), and 1.6 percent lower in Snohomish County (.134 to .132) while the mean BAC increased in the comparison counties by 0.7 percent (.142 to .143).

Crash Data. The Washington Department of Transportation (WDOT) provided the study with statewide crash data for the period from January 1, 2002, to May 30, 2012. The types of crashes examined from this data set included total, daytime, nighttime, single-vehicle, multivehicle, injury, and single-vehicle at night. Driver-alcohol-involved fatal crashes were examined separately using data provided by WTSC. For all crash types examined, there were significant downward trends present before the start of TZT that the statistical analyses took into account. For total crashes the results indicated that after TZT began, and accounting for the decline already underway, total crashes decreased 7.1 percent in King County, 7.0 percent in Pierce County, and 3.8 percent across the TZT counties combined ($p < .05$). Total crashes did not reliably change in Snohomish County after TZT ($p > .05$). The results also indicated that after TZT began, nighttime crashes decreased 3.8 percent in King County, 8.7 percent in Pierce County, and 6.0 percent across the TZT counties combined (ps $< .05$). Nighttime crashes did not reliably change in Snohomish County after TZT ($p > .05$). Analyses indicated that after TZT began, single-vehicle nighttime crashes decreased 8.7 percent in Pierce County ($p < .05$), but did not reliably change in King and Snohomish counties, or across the TZT counties combined ($p > .05$). Overall, the findings supported a conclusion that the deployment of Target Zero Teams in King and Pierce counties was associated with reduced crashes. The failure to find a relationship between the TZT implementation and a crash reduction in Snohomish County may have been because the NEET program had already reduced crash rates for several years before the start of TZT.

Driver Alcohol Involvement in Fatal Crashes. Researchers examined the ratio of alcohol-involved drivers in fatal crashes to non-alcohol-involved drivers in fatal crashes in the TZT and comparison counties. For the TZT counties, there was virtually no change in the ratio of fatal crash involved drivers with any BAC greater than or equal to .01 while the rate in the comparison counties and the rest of the State increased. This represented a relative reduction of 24.8 percent for driver alcohol involvement (BAC $\geq$.01) in fatal crashes for the TZT counties. Results showed the ratio of fatal crash involved drivers with high BACs (BAC $\geq$ .15) to drivers with a zero BAC increased in the TZT counties after TZT began, but at a rate less than that of the comparison counties and the rest of the State. This represented a 22.4 percent relative reduction in high-BAC driver alcohol involvement in fatal crashes. Both results suggest that while TZT does not appear to be associated with absolute reductions in the ratios of alcohol-involved drivers in fatal crashes, it was associated with relative reductions since the comparison counties and the rest of the State were showing greater increases during the same time period.

Driver Alcohol Involved Fatalities Avoided. Analyses compared the projected number of alcohol-involved fatal crashes based on the period before TZT with the actual data for the TZT operational period in the intervention counties using the comparison counties as a covariate. Using conservative assumptions, the analyses estimated that TZT saved 11 lives that would have been lost in driver alcohol-involved fatal crashes in King, Pierce, and Snohomish counties if TZT had not been in operation.

Cost/Benefit to State. Various studies (e.g., FHWA, 1994, National Safety Council, n.d., Cambridge Systematics, 2011) suggested the cost to society of a fatality is $2.6 million to $6 million. Using the National Safety Council's intermediate estimate of $4,459,000 as the cost of a fatality, the avoidance of the 11 fatals in the TZT counties saved $49,049,000. WTSC reported direct expenditures of $6,038,362.55 on TZT. Thus, based on just savings in fatalities alone, TZT had a benefit:cost ratio of 8.12:1.

Summary and Discussion

The data show the TZT program led to increased DUI enforcement activities by the WSP and participating local agencies in the TZT counties. Analyses of WSP's TAS and BAC databases, local agency grant logs, and AOC's citation/arrest records showed increases in traffic stops for DUI, and subsequent increases in BAC testing. The TAS data also revealed the TZT troopers had substantially higher percentages of contacts resulting in DUI arrests than did their non-TZT counterparts in the same and other counties. Therefore, from a process standpoint, TZT achieved one of its goals—increasing DUI enforcement. This increase also likely heightened the visibility of enforcement and, hence, the potential for creating increased general deterrence to drinking and driving.

The results of the crash analyses suggested that TZT was related to reductions of non-fatal crashes of all types in Pierce County and certain types of crashes in King County. Most notably, the time series analyses indicated that after TZT began, total crashes decreased 7.1 percent in King County, 7.0 percent in Pierce County, and 3.8 percent across the three TZT counties combined, as compared to comparison counties. Nighttime crashes decreased 3.8 percent in King County, 8.7 percent in Pierce County, and 6.0 percent across the three TZT counties combined. Analyses also showed single-vehicle nighttime crashes (a widely used alcohol-involved crash surrogate measure) decreased 8.7 percent in Pierce County, but did not reliably change in King County or Snohomish County.

The TZT counties showed virtually no change in the ratio of drivers in fatal crashes with positive BACs (> .01), but the rate in the comparison counties and the rest of the State increased. This represented a relative reduction of 24.8 percent for driver alcohol involvement (BAC ≥ .01) in fatal crashes for the TZT counties. The ratio of driver alcohol-involved crashes with high BACs (> .15) increased in the TZT counties, but at a rate less than that of the comparison counties and the rest of the State. This represented a 22.4 percent relative reduction in high-BAC driver alcohol involvement in fatal crashes. Both results suggest that while TZT does not appear to be associated with absolute reductions in the ratios of alcohol-involved drivers in fatal crashes, it was associated with relative reductions since the comparison counties and the rest of the State were showing greater increases during the same time period. While the relative reductions in alcohol-involvement in fatal crashes appeared to be fairly substantial, the small number of fatalities in the TZT counties likely prevented the reductions from being statistically significant. The projections of fatalities avoided used in the cost/benefit analysis suggest a substantial benefit to the State even though the calculations were very conservative.

Finally, many of the WTSC/DOL public awareness measures showed very little change. However, the intervention and comparison sites both showed statistically significant increases in recognition of "Over the Limit; Under Arrest" by July 2012. The intervention sites also showed a significant increase in recognition of "Target Zero Teams," but the highest rate achieved was only 5.1 percent. This may have been due to the design of TZT, which did not include the

extensive media efforts characteristic of traditional high visibility enforcement programs. The results also provided an encouraging suggestion of a reduction in self-reported drinking and driving behaviors in the TZT counties after the start of the TZT program.

Overall, the study results suggest the TZT approach markedly increased the DUI enforcement productivity of the law enforcement agencies in the intervention counties that led to safety gains in at least two of the three TZT counties during the study time period. For Snohomish, the operation of the NEET program in the prior years may have mitigated the impact of TZT. The TZT process clearly produced operational gains in parameters that should relate to improved and lasting safety as general deterrence builds. Given that WTSC plans to continue the TZT program in the three counties, future research may wish to conduct follow-up efforts to see if the benefits achieved in the TZT counties continue to increase, plateau, or recede.

Background

This report summarizes the methods and results of impact and process evaluations of the Target Zero Teams high-visibility enforcement program conducted by the State of Washington. Dunlap and Associates, Inc., and the Pacific Institute for Research and Evaluation performed the evaluation. The study included multiple data collection activities encompassing examinations of citation data, crash data, fatalities, driver BACs, law enforcement activities across the State, media activity, public awareness, program implementation and processes, and an analysis of cost/benefit to the State. This report describes each data collection activity and available results.

According to the National Highway Traffic Safety Administration (2012), there were 9,878 people killed in alcohol-impaired-driving crashes (defined as at least one driver having a BAC of .08 g/dL) during 2011, which represented 31 percent of the total motor vehicle traffic fatalities in the United States during that year. This was a decrease of 2.5 percent from 2010 when there were 10,136 fatalities for alcohol-impaired crashes. The alcohol-impaired-driving fatality rate per 100 million VMT remained the same from 2010 to 2011 at 0.34 (NHTSA, 2012). NHTSA (2012) also found substantial differences in alcohol impairment based on time of day of a crash and day of the week. Most notably, the rate of alcohol impairment among drivers involved in fatal crashes in 2011 was much higher at night (36% of drivers in crashes) than during the day (8% of drivers in crashes). In addition, 31 percent of all drivers involved in fatal crashes on weekends exhibited alcohol impairment compared to 15 percent of drivers during the week. In 2011, 48 percent of drivers in single-vehicle nighttime crashes were impaired compared to 17 percent for single-vehicle daytime crashes.

Data from the Washington Traffic Safety Commission (2011) also showed a decrease in Washington for the number of impaired driving fatalities in 2010 with 230 (out 460 total fatalities or 50.0%) compared to 265 (out of 495 total fatalities or 53.5%) in 2009. The rate of impaired driving crashes per 100 million VMT decreased from 0.47 in 2009 to 0.40 in 2010. Similar to the national data, Washington showed an overrepresentation of alcohol-impaired crash fatalities on the weekends and at night. Serious injury crashes showed similar trends for the same time period.

Despite the downward trends in Washington and the United States as a whole, the residual numbers indicate alcohol-impaired driving is still a major problem. As such, there have been numerous attempts across the country at the Federal, State, and local levels to reduce alcohol-impaired driving. Fell, McKnight, and Auld-Owens (2013) provide a review of the activities undertaken by communities at various levels to reduce alcohol-impaired driving. Many of the most successful programs relied on HVE and the use of checkpoints. Such programs increase general deterrence because they increase the driving public's perceived risk of apprehension and sanctioning. Not all States, however, have the ability to conduct sobriety checkpoints due to prohibitive State statutes, court decisions, or other impediments. In Washington, the legislative ban on checkpoints is particularly strong, and safety officials therefore shy away from any enforcement activity that might even be construed as a checkpoint.

Those localities that cannot use checkpoints tend to employ saturation and roving patrols as an alternative for enforcing impaired-driving laws. These strategies involve sending more officers than normal to patrol areas where alcohol related crashes frequently occur and/or areas where there have been a high number of arrests for driving under the influence (DUI). Saturation patrols appear to be effective in reducing impaired driving if they are highly publicized (Stuster & Blowers, 1995). For example, Michigan, which like Washington does not permit checkpoints, achieved a significant reduction in drinking driver fatal crashes through the use of weekly high-visibility saturation patrols and highly publicized mobilizations (Fell, Tippetts, & Levy, 2008).

The Target Zero Teams Program

The TZT program concept emerged from one of Washington State's global highway safety objectives and a pilot project called the Night Emphasis Enforcement Team (NEET) program in a single county. The major milestones leading to the implementation of the TZT program included:

- 2000 – Washington State conceives Target Zero as a global State objective
    - Plan aims to reduce traffic fatalities in Washington to 0 by 2030,
    - Reducing alcohol-involved crashes is a top priority;
- November 2006 – NEET pilot project started in Snohomish County;
- January 2009 – Based on success of NEET project, WTSC begins developing TZT concept to expand into other counties. WTSC asks NHTSA to sponsor an independent evaluation of TZT;
- May 2010 – Evaluation contract awarded to Dunlap and Associates and PIRE;
- July 2010 – TZT launches in King, Pierce, and Snohomish counties with funding for two years of operation; and
- July 2012 – TZT receives additional State funding to continue and expands to include Yakima and Spokane counties..

In addition to these milestone events, the WTSC TZT management team provided a more detailed timeline that documents the steps in the conceptualization, project design, implementation, and project management activities conducted from February 2009 to the program start in July 2010 (see Appendix).

This timeline summarizes the hours worked by management and the nature of the efforts undertaken as an example of the steps and associated levels of effort required to develop a program of this scale to the point at which it is operational and potentially effective.

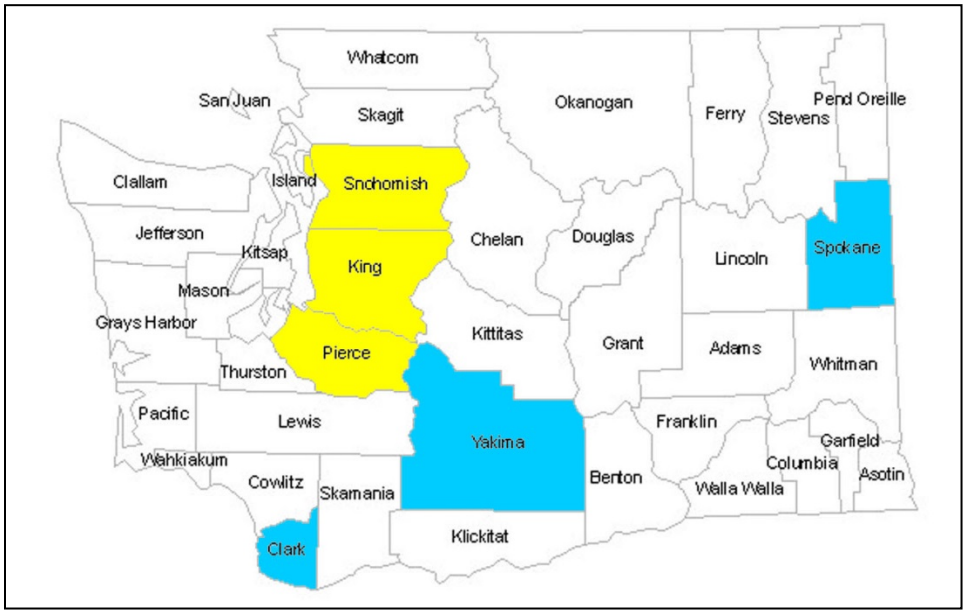
The NEET Program

The Washington State Patrol has primary responsibility for enforcing traffic safety regulations, including DUI, on the State's highways. In late 2006, WSP assembled a full-time, high-visibility saturation patrol they called NEET. This pilot program, funded by WTSC, supported a dedicated detachment of four troopers and a sergeant stationed primarily in Snohomish County, a suburb of Seattle that includes the City of Everett. The NEET detachment troopers focused their efforts primarily on the enforcement of impaired driving and related traffic offenses (e.g., nonuse of seat belts and speed) on weekend nights and were relieved of their other routine duties as WSP troopers during this time. The NEET troopers were specially selected based upon their training, experience, and motivation in enforcing impaired driving laws. A NHTSA Research Note (Cicchino, 2012) indicated that the raw count of traffic fatalities decreased by 40.3 percent in Snohomish County from 2005 (the year before the NEET program began) to 2008. In contrast, traffic fatalities in the same period decreased by only 17.7 percent in the remaining counties in Washington that did not have NEET patrols.

Expansion of NEET Program to TZT

Washington expanded the NEET pilot project concept by establishing three detachments of WSP troopers to focus on nighttime impaired-driving offenses. They named these detachments *Target Zero Teams* in support of Washington's strategic highway safety plan that included the goal to reduce traffic fatalities in Washington to zero by the year 2030. A top priority area in the overall "Target Zero" approach involved reducing impaired driving. The program deployed a TZT detachment of a sergeant and six troopers in each of the counties of King (Seattle area), Pierce (Tacoma area), and Snohomish (Everett area north of Seattle). The detachments came from WSP Districts 2, 1, and 7, respectively. Researchers chose Clark, Spokane, and Yakima counties to serve as comparison sites since they did not have any formal WTSC-funded TZT activities taking place. It must be noted, however, that King, Pierce, and Snohomish are the three largest counties in the State. Therefore, even though Clark, Spokane, and Yakima represented large counties, they did not match the TZT counties well with respect to population. Researchers also used the rest of the State, which largely consists of small, more rural counties, as a second comparison when statewide data were available.

Figure 1 contains a map of Washington with the intervention and selected comparison counties highlighted. Table 1 presents the basic characteristics of the 3 intervention and 3 comparison counties.



Note: The map indicates TZT intervention counties in yellow and comparison counties in blue.

Figure 1. **TZT Counties and Comparison Counties**

Table 1. **County Characteristics**

County	Population	Land Area (mi^2)	Population Density ($persons/mi^2$)
	INTERVENTION		
King	1,931,249	2,126	908.4
Pierce	795,225	1,679	473.7
Snohomish	713,335	2,089	341.5
	COMPARISON		
Clark	425,363	628	677.1
Spokane	471,221	1,764	267.2
Yakima	243,231	4,296	56.6
	STATE TOTAL		
State Total	6,724,540	66,544	101.1

Note: All data retrieved from 2010 US Census

Similar to the pilot NEET program, WSP relieved TZT troopers of their regular duties and assigned them to focus their efforts primarily on enforcement of alcohol-involved driving. Since Washington prohibits checkpoints, the patrols had to use a roving patrol approach to target specific areas selected based on arrest and crash data as detailed in the next section. The WSP strategy included backfilling the positions of the TZT troopers with new hires or transfers to ensure the maintenance of previous levels of effort on normal WSP activities.

In addition to the WSP detachments, the TZT program also involved local law enforcement in the three intervention counties. These agencies received grant funding from WTSC to conduct overtime enforcement focused on DUIs. In general, the local law enforcement agencies acted independently of the WSP detachments and focused on locales within their jurisdictions known to be associated with DUIs (e.g., local bars). WSP shared historical data on areas of high DUI activity with the local agencies who provided activity reports to WTSC. The results section includes a summary of their activities.

Geo-mapping Crashes and Arrests to Guide Enforcement

From the beginning of the program, TZT relied heavily on the use of geo-mapping to target areas with high concentrations of crashes and arrests related to alcohol-involved driving. Geo-mapping displays data such as crashes or DUI arrests on a map of the location at which they occurred. Geo-maps indicate clusters of events using vivid colors or dense spots often called "hot spots." WSP data analysts used geo-mapping techniques to identify hot spots of impaired driving activities as the program progressed. As shown in Figure 2, the hot spots changed over time as new information on crashes and arrests became available. The TZT teams received this dynamic information via monthly meetings with their sergeants and other TZT stakeholders. The sergeants then used the information at their own discretion to direct their teams to areas where they might be most productive in catching impaired drivers and preventing alcohol-related crashes.

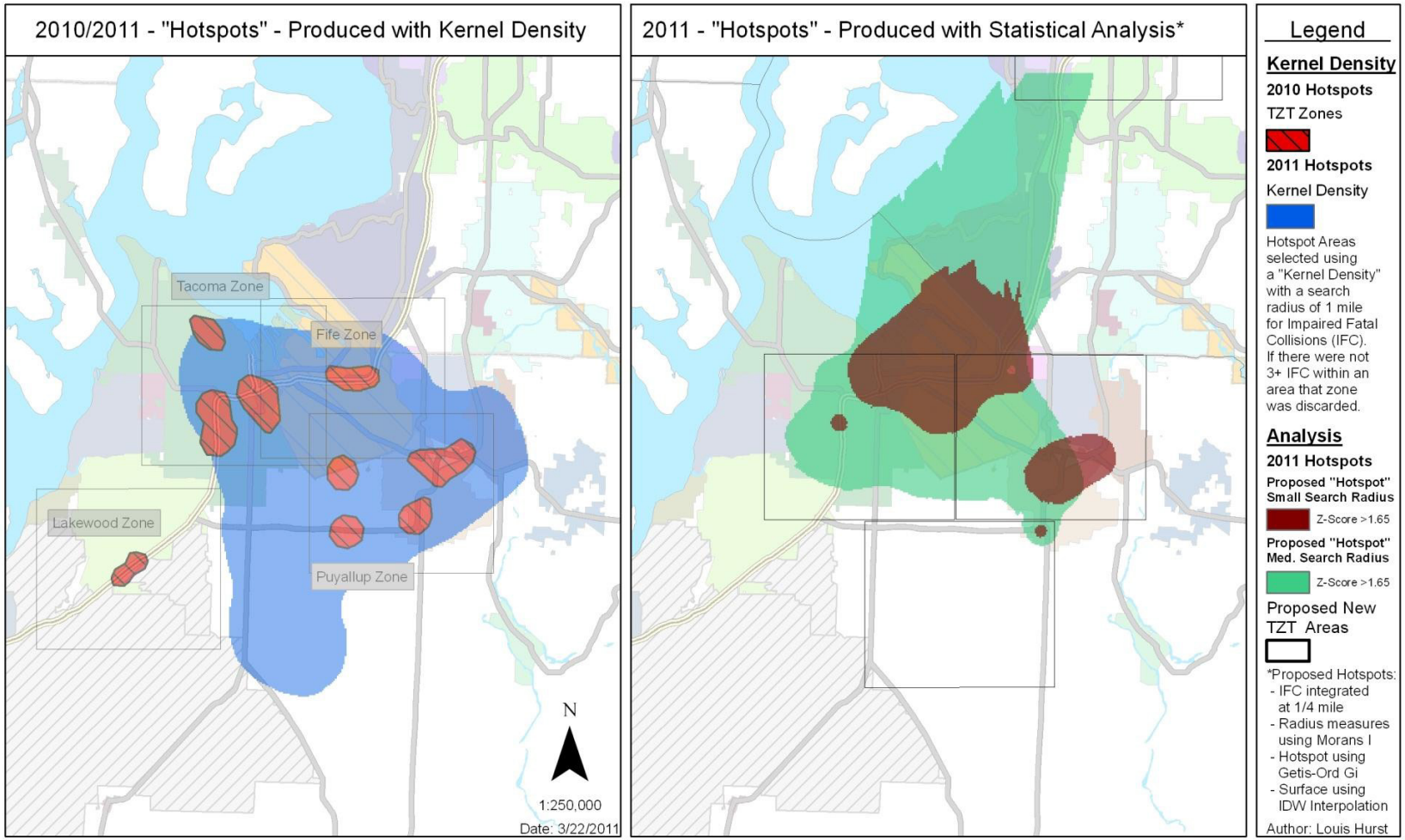


Figure 2. **Example of Hot Spot Mapping**

Objective

The evaluation effort was independent from the TZT enforcement program. The evaluation focused on the program's effectiveness in increasing DUI enforcement and whether TZT resulted in decreased alcohol-involved driving, crashes, and fatalities in the intervention counties in relation to the chosen comparison counties and statewide. The research objectives included:

1. Evaluate the effectiveness of Washington State's TZT project in King, Pierce, and Snohomish counties;
2. Assess public awareness and media coverage of the project;
3. Determine the degree of cooperation between TZT troopers and local law enforcement in TZT counties; and
4. Calculate the cost/benefit of the project to the State of Washington.

Methods, Analyses, and Results

The sections below describe the methods for each data collection activity, the data analysis approach, and any noteworthy results. All data collection efforts were initiated by Washington State; the data analyses were performed by the authors. The discussion in each section also highlights any problems experienced during the data collection efforts.

Citation/Law Enforcement Activity Data

The evaluation examined changes in citations/arrests, particularly alcohol-related traffic citations, in the three intervention counties versus the three comparison counties and the remainder of the State. Without a notable increase in alcohol-related citations/arrests, it would be difficult to attribute any changes in crashes or fatalities to the TZT program. The current project acquired citation and arrest data from four separate sources. These included WSP's trooper activity database, WTSC's database of local law enforcement grant activities, the files of the Washington Administrative Office of the Courts, and activity reports from prosecutors' offices to WTSC.

TZT trooper activity data. WSP maintains a detailed "Time and Activity System" (TAS) consisting of Time and Activity Reports (TARs) completed by WSP troopers for every activity in which they engaged while on duty. WSP provided TAS data for 2 years prior to the start of TZT (July 1, 2008, to June 30, 2010) and for the 2-year TZT program period (July 1, 2010, to June 30, 2012). TAS data included the identity of the detachment to which a trooper was assigned when a particular activity took place. In order to identify Trooper activities engaged in by the TZT detachments, WSP created new detachment codes for the TZT special DUI enforcement units. As troopers moved in and out of the TZT detachments, the system changed their detachment codes so that TZT-related actions could be identified. Due to the structure of the database and the movement of troopers in and out of the TZT detachments, the actions of

individual troopers could not be followed. Researchers could therefore not calculate measures of arrests/citations rates per hour or shift. In place of these measures, researchers used counts of the overall number of contacts made and an assessment of what percentage of those contacts resulted in various types of arrests, citations, or warnings for the TZT detachments versus troopers on regular duty.

Table 2 presents the number of DUI arrests made during the 2-year periods before and after the start of TZT by county and whether the arresting troopers were TZT (or NEET) members. The table also shows what percentage of the overall contacts these DUI arrests represented within each county by TZT membership category. Table 2 shows that during the TZT period the TZT detachments in King, Pierce, and Snohomish showed significantly higher percentages of contacts resulting in DUI arrests (15.38%, 10.83%, and 9.78% respectively) than did the non-TZT troopers in those counties (1.75%, 2.02, and 1.61%) and the troopers in the comparison counties (2.56%, 1.98%, and 1.91%) and the rest of the State (1.22%), χ^2 (9, N = 2,333,895) = 32,399.69, $p < 0.001$.[1] In addition, column proportions Z-tests showed the King County TZT detachment's DUI arrest rate was significantly higher ($p < 0.05$) than that of Pierce and Snohomish, but it should be noted TZT Troopers in King County had fewer stops overall, compared to the other two TZT counties.

[1] When sample sizes are as large as those found here, the chi square statistic will almost always indicate significant differences. The actual differences in counts and proportions should be examined to determine the operational meaningfulness of the significant differences observed.

Table 2. **WSP DUI Arrests by County for TZT and Non-TZT Troopers**

County	Count % of All Contacts	Non-NEET Troopers 2 Years Pre-TZT	NEET Troopers 2 Years Pre-TZT	Non-TZT Troopers During TZT	TZT Troopers During TZT
King	Count	7,682	N/A	6,761	1,990
	% of All Contacts	2.06%	N/A	1.75%	15.38%
Pierce	Count	4,289	N/A	4,211	2,110
	% of All Contacts	2.51%	N/A	2.02%	10.83%
Snohomish	Count	3,749	1,287	3,839	1,868
	% of All Contacts	1.75%	13.34%	1.61%	9.78%
Clark	Count	2,046	N/A	2,143	N/A
	% of All Contacts	2.49%	N/A	2.56%	N/A
Spokane	Count	2,550	N/A	2,442	N/A
	% of All Contacts	2.12%	N/A	1.98%	N/A
Yakima	Count	1,809	N/A	2,186	N/A
	% of All Contacts	1.89%	N/A	1.91%	N/A
Rest of State	Count	15,893	N/A	13,799	N/A
	% of All Contacts	1.41%	N/A	1.22%	N/A

Table 3 shows that during the TZT period, the intervention counties exhibited notable net increases in the number of countywide DUI arrests as compared to the control counties and the rest of State. Pierce had a particularly large increase (47.21%) while King County showed a smaller net increase of 13.63%. The pattern of data in King County suggests the non-TZT troopers in King County may have actually decreased their arrest rates during the program. For Snohomish, there was an increase of 13.28 percent during the TZT period which is notable because the successful NEET program had been in operation prior to the start of TZT. Of the three comparison counties, only Yakima (20.84% increase) showed a notable net increase for DUI arrests, while the rest of the State showed a fairly substantial decrease of 13.18 percent during the TZT timeframe. Analysis showed that each of the TZT counties (and Yakima) accounted for a greater percentage of the DUI arrests across the entire State during the TZT period than they did before the TZT period, $\chi^2(6, N = 80{,}654) = 637.06$, $p < 0.001$. Anecdotal reports indicated that Yakima had independently mounted some TZT-like activities to increase their DUI enforcement. These may have accounted for the observed data pattern.

Table 3. **Net Change in Number of WSP DUI Arrests During TZT by County**

County	All Troopers 2 Years Pre-TZT	All Troopers During TZT	Net Change During TZT	
King	7,682	8,729	1,047	(13.63%)
Pierce	4,289	6,314	2,025	(47.21%)
Snohomish	5,036*	5,707	669	(13.28%)
Clark	2,046	2,143	97	(4.74%)
Spokane	2,550	2,442	-108	(-4.24%)
Yakima	1,809	2,186	377	(20.84%)
Rest of State	15,893	13,799	-2,094	(-13.18%)

*Includes DUI arrests made by NEET Troopers

WSP officers could issue official warnings to drivers for a variety of reasons when a traffic stop was made. When a trooper issued a warning, he or she also generated a TAS entry. Table 4 displays the number of warnings of any type issued during the 2-year periods by county and TZT (or NEET) detachment membership. The table also shows what percentage of the overall contacts these warnings represented within each county by TZT involvement. Table 4 shows that during the TZT period, there were notable differences in warning rates with the TZT detachments in King, Pierce, and Snohomish showing significantly higher percentages of contacts resulting in warnings (80.12%, 70.97%, and 66.04%, respectively) than the non-TZT troopers in those counties (44.26%, 42.88%, and 46.01%), the troopers in comparison counties (42.94%, 45.83%, and 58.3%), and troopers in the rest of the State (50.06%), $\chi^2(9, N = 2{,}333{,}895) = 24{,}363.33$, $p < 0.001$. In addition, column proportions Z-tests showed the King County TZT detachment's warning rate was significantly higher ($p < 0.05$) than that of Pierce and Snohomish, and Pierce was significantly higher than Snohomish.

Table 4. **WSP Warnings by County for TZT and Non-TZT Troopers**

County	Count % of All Contacts	Non-NEET Troopers 2 Years Pre-TZT	NEET Troopers 2 Years Pre-TZT	Non-TZT Troopers During TZT	TZT Troopers During TZT
King	Count	154,917	N/A	170,900	10,364
	% of All Contacts	41.64%	N/A	44.26%	80.12%
Pierce	Count	70,292	N/A	89,410	13,825
	% of All Contacts	41.21%	N/A	42.88%	70.97%
Snohomish	Count	94,533	7,036	109,515	12,617
	% of All Contacts	44.23%	72.93%	46.01%	66.04%
Clark	Count	39,077	N/A	35,936	N/A
	% of All Contacts	47.48%	N/A	42.94%	N/A
Spokane	Count	54,828	N/A	56,529	N/A
	% of All Contacts	45.60%	N/A	45.83%	N/A
Yakima	Count	54,574	N/A	66,813	N/A
	% of All Contacts	57.07%	N/A	58.30%	N/A
Rest of State	Count	568,061	N/A	564,669	N/A
	% of All Contacts	50.36%	N/A	50.06%	N/A

Table 5 shows significant variations in rates of speeding citation issuance, $\chi^2(9, N = 2{,}333{,}895) = 34{,}738.38$, $p < 0.001$, with column proportions Z-tests showing that King and Pierce counties had smaller percentages of contacts made by TZT troopers resulting in speeding citations, compared to their non-TZT counterparts within their respective counties and the troopers working in the other studied counties during the TZT time period. TZT trooper contacts in Snohomish resulted in similar rates of speeding citation issuance, compared to their non-TZT counterparts in the county and the rest of the State. Counts of other violations (e.g., failure to wear a seat belt), were too small relative to the overall number of contacts to show any meaningful changes over time.

Table 5. **WSP Speeding Citations by County for TZT and Non-TZT Troopers**

County	Count % of All Contacts	Non-NEET Troopers 2 Years Pre-TZT	NEET Troopers 2 Years Pre-TZT	Non-TZT Troopers During TZT	TZT Troopers During TZT
King	Count	63,026	N/A	62,117	1,637
	% of All Contacts	16.94%	N/A	16.09%	12.93 %
Pierce	Count	29,367	N/A	40,344	1,658
	% of All Contacts	17.22%	N/A	19.35%	8.51%
Snohomish	Count	60,989	1,918	65,107	5,139
	% of All Contacts	28.53%	19.88%	27.35%	26.90%
Clark	Count	12,563	N/A	16,164	N/A
	% of All Contacts	15.26%	N/A	19.31%	N/A
Spokane	Count	30,866	N/A	27,395	N/A
	% of All Contacts	25.67%	N/A	22.21%	N/A
Yakima	Count	19,202	N/A	22,788	N/A
	% of All Contacts	20.08%	N/A	19.88%	N/A
Rest of State	Count	328,435	N/A	320,126	N/A
	% of All Contacts	29.12%	N/A	28.38%	N/A

Local law enforcement activities. In addition to the enforcement activities of the WSP troopers, local Police and sheriff's departments participated in overtime DUI enforcement efforts funded by WTSC as part of TZT. The agencies receiving grants from WTSC to participate in TZT reported their efforts to WTSC through periodic activity logs. The logs included number of hours worked (paid overtime and regular time donated by the agencies) and all activities conducted during those hours such as the number of traffic stops, citations issued, or arrests made. Participating agencies only completed the logs for times when they funded their operations with grant funds provided by WTSC. Thus, researchers had no baseline enforcement data for these agencies similar to the information on WSP troopers derived from TAS. Table 6 displays the overtime and regular hours worked by county on TZT. As shown in the table, the great majority of hours came from the paid overtime purchased by WTSC.

Table 6. **Local Law Enforcement Hours Worked on TZT**

	King (12 agencies)	Pierce (9 agencies)	Snohomish (15 agencies)	Total
Overtime	4,931.6	3,668.8	3,954.5	12,554.9
Regular	348.0	8.0	252.8	608.8
Total	5,279.6	3,676.8	4,207.3	13,163.7

Table 7 provides the reported tallies of the contacts made by local law enforcement agencies in each county and counts of selected citations issued and arrests made as a result of those contacts during the paid overtime efforts. Overall, the counties displayed similar rates of contacts made per hour, with King at 1.89 contacts per hour worked, Pierce at 1.81, and Snohomish at 2.1. Of most interest for this project, local agencies in King County reported making 525 DUI/alcohol arrests (0.10 per hour worked), 521 in Pierce County (0.14 per hour worked), and 296 in Snohomish County (0.07 per hour worked) across the 2-year TZT period. Other common infractions included speeding, financial responsibility (e.g., no insurance), equipment violations, failure to wear a seat belt (or use a child restraint), and driving while suspended/revoked. In addition to the citations and arrests, officers and deputies issued a substantial number of warnings in each TZT intervention county, with 6,533 in King, 3,546 in Pierce, and 5,597 in Snohomish. The law enforcement officers did not document the reasons for issuing the warnings. Again, these data represent only the most frequent violation types addressed during the overtime activities paid by WTSC under the TZT program.

Table 7. **Local Law Enforcement Contacts, Citations, and Arrests**

	King	Pierce	Snohomish	Total
Total Contacts	9,966	6,655	8,830	25,451
Per hour worked	1.89	1.81	2.1	1.93
DUI/Alcohol Arrests	525	521	296	1,342
Per hour worked	0.10	0.14	0.07	0.10
Speeding Citations	1,081	1,014	678	2,773
Per hour worked	0.20	0.28	0.16	0.21
Seat Belt Citations	124	39	88	251
Per hour worked	0.02	0.01	0.02	0.02
No Insurance Citations	696	899	711	2,306
Per hour worked	0.13	0.24	0.17	0.18
Equipment Citations	416	427	373	1,216
Per hour worked	0.08	0.12	0.09	0.09
Drive Susp/Rev Citations	330	405	281	1,016
Per hour worked	0.06	0.11	0.07	0.08
Total Warnings	6,533	3,546	5,597	15,676
Per hour worked	1.24	0.96	1.33	1.19

AOC data. The AOC provided the project with alcohol-related citation/charge data for the entire State for both the Courts of Limited Jurisdiction (CLJ) and the Superior Courts. These data supported an examination of the alcohol citations/charges filed in the TZT counties, the comparison counties, and the rest of the State over time. However, some issues arose that limited the utility of the data. First, AOC indicated they purge many records from the CLJ database 3 years after a case is closed. The database also failed to include many newer cases due to a lag from initial infraction to entry into AOC files. After examining data for January 1, 2002 through June 30, 2012, researchers determined that only the period from January 1, 2008 through December 31, 2011 had sufficiently complete data to warrant inclusion in the analyses.

A second issue arose because, while most alcohol citations represented infractions, a significant minority of the alcohol and driving offenses constitute more serious charges adjudicated in Superior Court. AOC maintained Superior Court cases in a totally separate database that had a different structure than the CLJ database. Because of the incompatibility between the databases, researchers had to analyze the two sources separately since no basis existed for merging the files.

Third, AOC designed its databases for operational query purposes and not primarily for research. As a result, extracting data suitable for research analyses involved high workload for

the AOC staff. Therefore, researchers could not obtain possibly relevant non-alcohol infractions (e.g., speeding, seat belt) from the database. This limited the evaluation to an examination of only alcohol-related citations/charges. AOC asked the researchers to use the same list of alcohol charges of interest used by McCartt, Leaf, Farmer, & Eichelberger (2012) in a previous study in Washington to AOC to guide the data extraction and limit AOC workload.

Finally, a single citation/charge could have resulted in multiple entries in either the CLJ or Superior Court databases as local courts sent in new information regarding a citation/charge (e.g., amended charges). A single key variable linked all of these database cases, and researchers had to reduce the dataset to identify unique initial DUI citation/charge events and avoid double counting.

Given the foregoing limitations, researchers produced only descriptive results for the CLJ and Superior Court data, and the reader should interpret the following results with caution. Figure 3 displays, from the CLJ database, the average number of DUI citations per quarter in the TZT counties, comparison counties, and the rest of the State. King and Pierce counties show an increase in citation activity when TZT efforts began while Snohomish stayed relatively stable compared to the prior years when NEET had been operating and presumably had increased DUI citation activity. The increases in King and Pierce tended to drop off slightly over time, but this could simply be an artifact of the lag from the issuance of a citation to entry in AOC's database. The comparison counties showed virtually no change in citation activity after TZT began. The rest of the State had been on a downward trend since 2008 but showed a small spike after the start of TZT, which was followed by a drop in the fourth quarter of 2010.

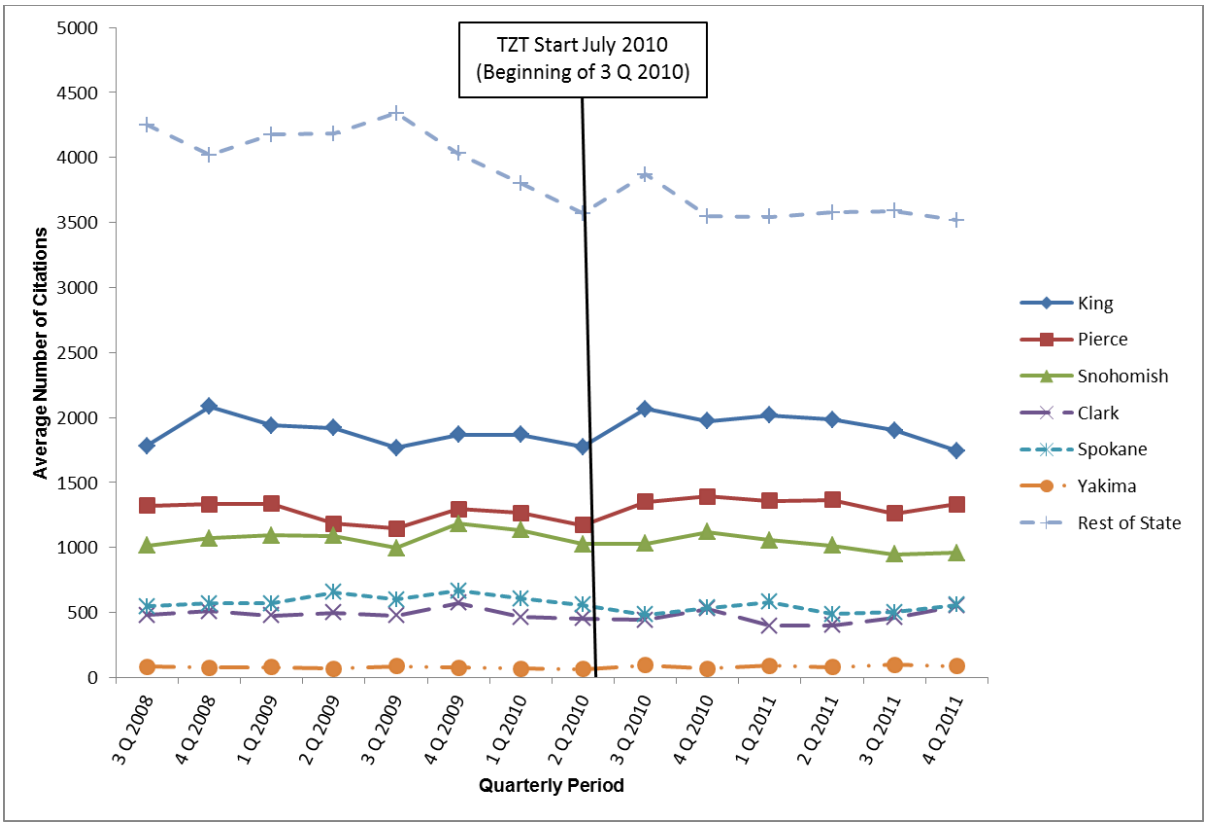


Figure 3. **Average Number of DUI Citations by County**

A potential downside to increasing DUI arrests involves added workload for the prosecutors and courts. To offset the potential increased workload for the courts, WTSC provided funding to the prosecutors' offices in King County and Snohomish County to hire additional staff. Given that TZT appeared to increase the number of DUI cases in King and Pierce counties during the first five quarters of the project, researchers decided to examine how the program impacted the time it took to process the additional cases as one measure of the TZT process impact. Figure 4 shows the average number of days from citation issuance to the date prosecutors filed that citation in court. As shown in the figure, King County had a much higher pre-TZT average than the other counties, but evidenced a downward trend in filing time the year before TZT. Once TZT began, the average number of days to filing in King initially increased, likely due to the increase in citation issuance, but the average again fell in the first quarter of 2011. This latter fall may be attributable to the increased number of prosecution staff supported by TZT.

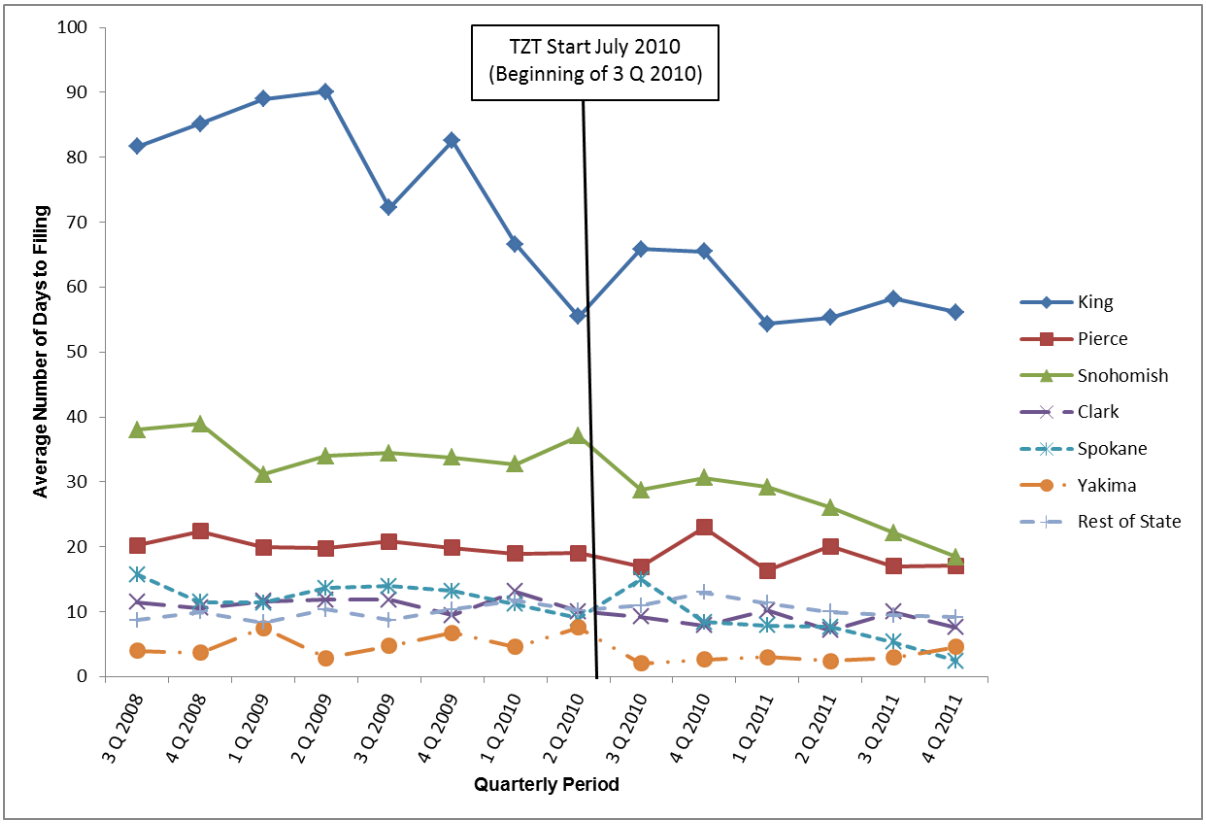


Figure 4. **Average Number of Days From from Citation to Court Filing by County**

Unlike King, Snohomish County showed a relatively flat trend before TZT, but began a gradual downward trend in average number of days to filing after the program began. Pierce County showed a slight spike in the fourth quarter of 2010, but returned to pre-TZT levels in the following quarters. The comparison counties and the rest of the state showed no major changes over time. Again, the later quarters presented in this figure should be interpreted with caution due to the lag from filing in court to actual entry into AOC's database. This lag could artificially lower the average for these later quarters if cases with longer times from citation to filing did not make it into the database by the time researchers accessed it.

The additional arrests due to TZT also may have affected the time to the final disposition of a DUI charge. Researchers could not perform an analysis of time to final disposition reliably because larger percentages of filed cases in the more recent quarters did not have final disposition information entered compared to the earlier time periods. Excluding cases without dispositions would lead to an artificially low average number of days to disposition for the more recent time periods and an analysis data set with unknown sampling properties. Similarly, researchers could not reliably explore the rates of amended charges because of the unavailable final disposition data for more recent cases. This database needs more time to mature before it can support a comparison of pre-TZT plea rates to those after TZT began. As described later, however, the reports provided by the prosecutors suggested they allowed a substantial percentage of violators to plead to lesser charges.

Figure 5 displays the average number of DUI charges in the Superior Court database by county and quarter. Superior Court cases generally involve more serious felonies and gross misdemeanors. The same limitations detailed for the CLJ data apply to this data set, and, as with the CLJ results, the reader also should interpret the results presented below with caution. In addition, the relatively small number of cases in some of the counties further limits the ability to interpret any observed trends. Examining Figure 5, King County showed a small increase in the number of charges immediately after the start of TZT followed by a drop off. Pierce County displays a slight increase in number of charges near the end of 2011. Snohomish County and the comparison counties showed very few charges at all. The rest of the State exhibited a downward trend before TZT, and showed a spike in cases during the fourth quarter of 2010, followed by a drop-off in the subsequent quarters before spiking again in the fourth quarter of 2011.

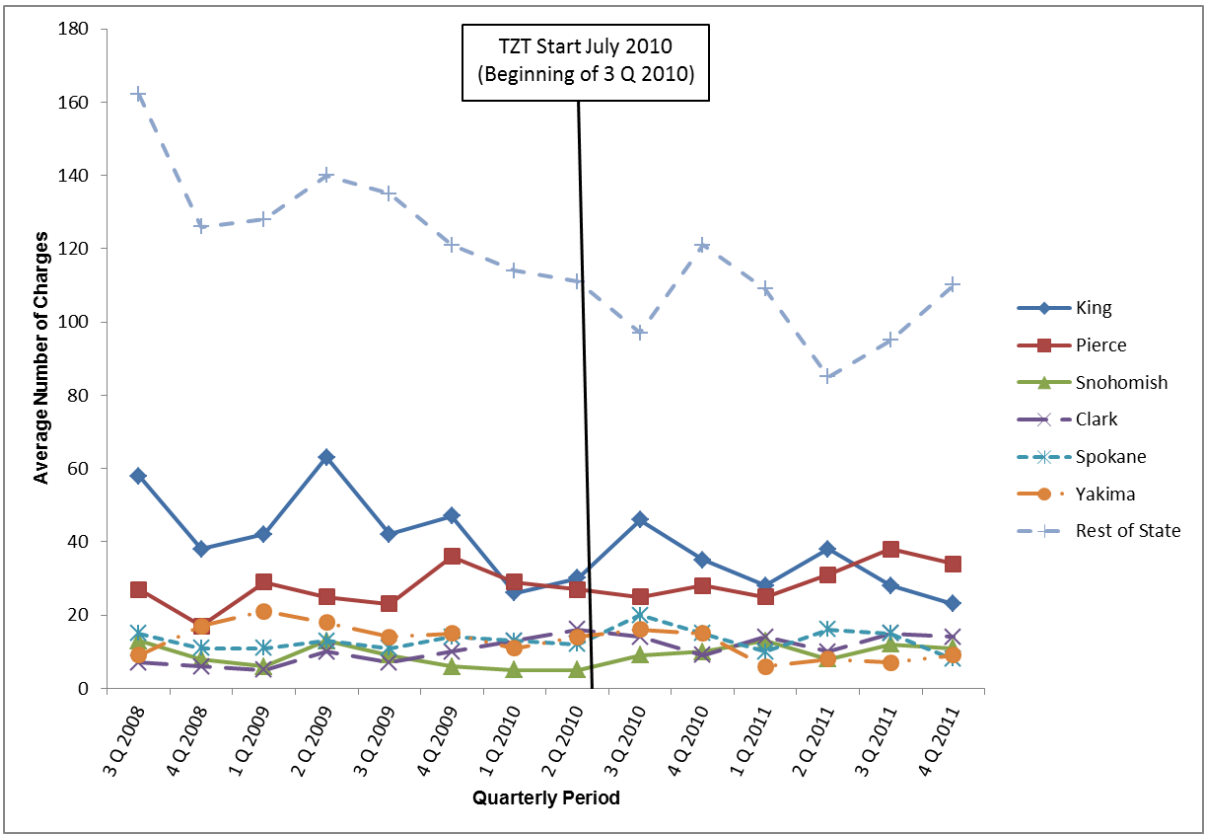


Figure 5. **Average Number of Superior Court DUI Cases by County**

Researchers next examined the average number of days from charge to filing in Superior Court (Figure 6). Due to the rather small numbers of cases for most counties, researchers aggregated data for the TZT counties for comparison to the control counties and the rest of the State. In general, the TZT counties had a higher average number of days from charge to filing in Superior Court before TZT, but were on a downward trend. After TZT began, there was a sharp increase followed by a return to the downward trend. The comparison counties and the rest of the State exhibited an upward trend before TZT. Right before TZT began, however, the comparison counties saw a large drop in the average number of days to filing, but resumed the upward trend until the first quarter of 2011, after which another drop was observed. The rest of the State saw a steady decline after TZT began. Similar to the CLJ data, the later quarters presented in this figure should be interpreted with caution due to the lag from filing in court to actual entry into AOC's database. This lag could artificially lower the average number of days from charge to filing for these later quarters if cases with longer times from charge to filing had yet to be entered into the database.

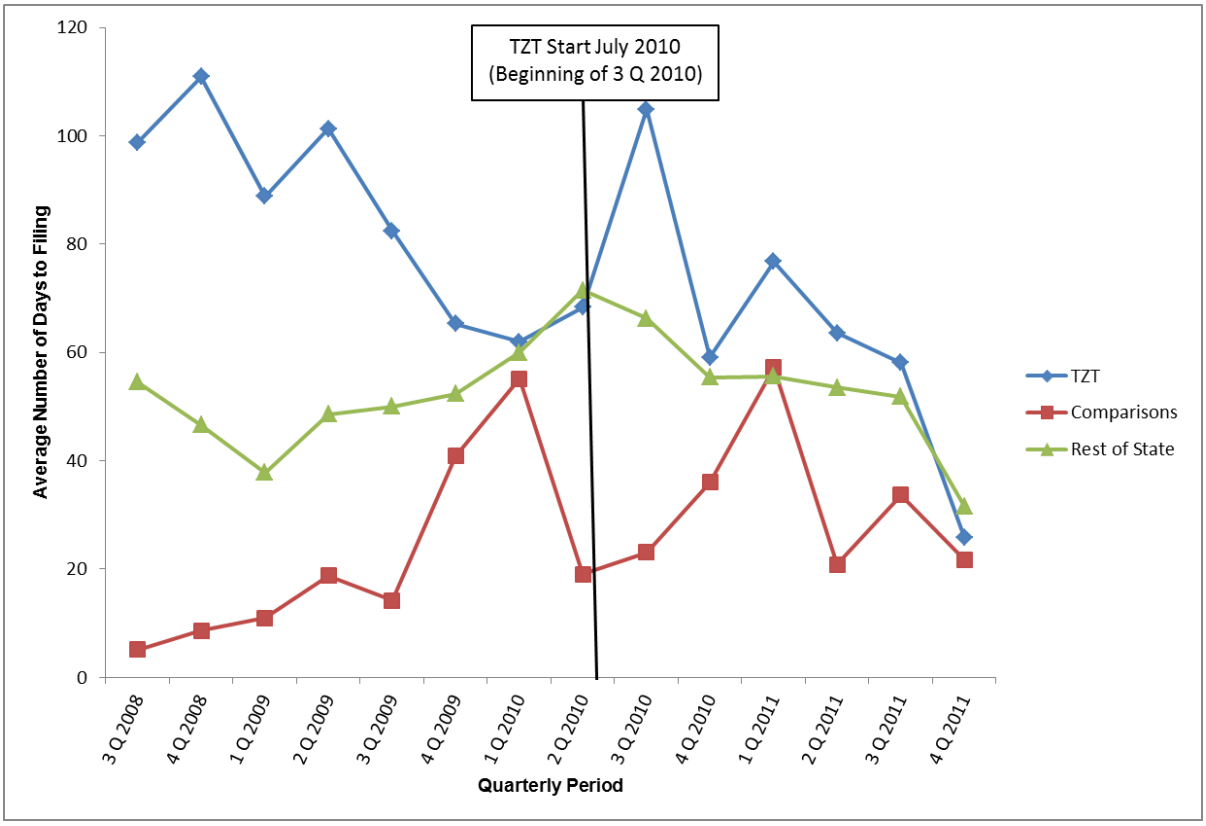


Figure 6. **Average Number of Days from Citation to Court Filing by County**

Special prosecution staff. At the start of the TZT program, WTSC funded additional prosecution staff in King and Snohomish counties for the entire 2-year period. In Snohomish, a single additional prosecutor was hired while multiple support staff members were added in King County. WTSC funded these additional staff members to assist with the prosecution of DUIs in the counties and make sure the already backlogged system did not get even further backlogged because of the elevated enforcement efforts. In addition to these duties, they were asked to keep records of all DUI related activities at the prosecutors' offices and report those to WTSC.

The types of information reported varied among the counties, and no statistical analyses could be conducted. Most notably, the information provided on numbers of DUI arrests made by TZT detachments was consistent with that found in the TAS database provided by WSP. Also, the reports confirmed the finding from the AOC data that many DUI cases had their disposition status as "pending" which meant no final disposition had taken place for the cases. For those TZT cases with a final disposition, a King County report showed that, for the period from July 2010 – September 2011, only 20 percent of the TZT cases actually resulted in a final disposition of DUI, while 2 percent were dismissed, and the rest were pled down to lesser charges such as reckless driving or negligent driving. The reports did not include the final disposition proportions for non-TZT cases. The reader should note that the availability of prosecutorial staff with a motivation to process cases may not be sufficient to produce a reduction in disposition time. For example, legal maneuvers by a cited driver's attorneys can still produce a considerable delay in disposition.

Media Activities

WTSC's first-year (July 1, 2010 – June 30, 2011) TZT media plan did not include any TZT-specific paid radio or television advertisements, although it did include some billboard and bus advertising purchases. Second year (July 1, 2011 – June 30 2012) media activities included some integration of TZT into the media messages, particularly as part of the Internet campaign (Figure 7). The main messages of the paid activities, however, were derivatives of current or former national campaigns using the "Under the Influence, Under Arrest" and "Drive Hammered, Get Nailed" tag lines for the great majority of the paid television and radio advertisements. Aside from these statewide campaigns, other media and outreach activities included:

- "We're on the Team" PSAs,
- Home Safe Bar Program,
- Target Zero Teams Facebook page,
- waTikileaks.com Web site,
- Billboards and bus ads,
- Earned media coverage by newspapers, and radio and television stations, and
- Alcohol server and seller outreach.

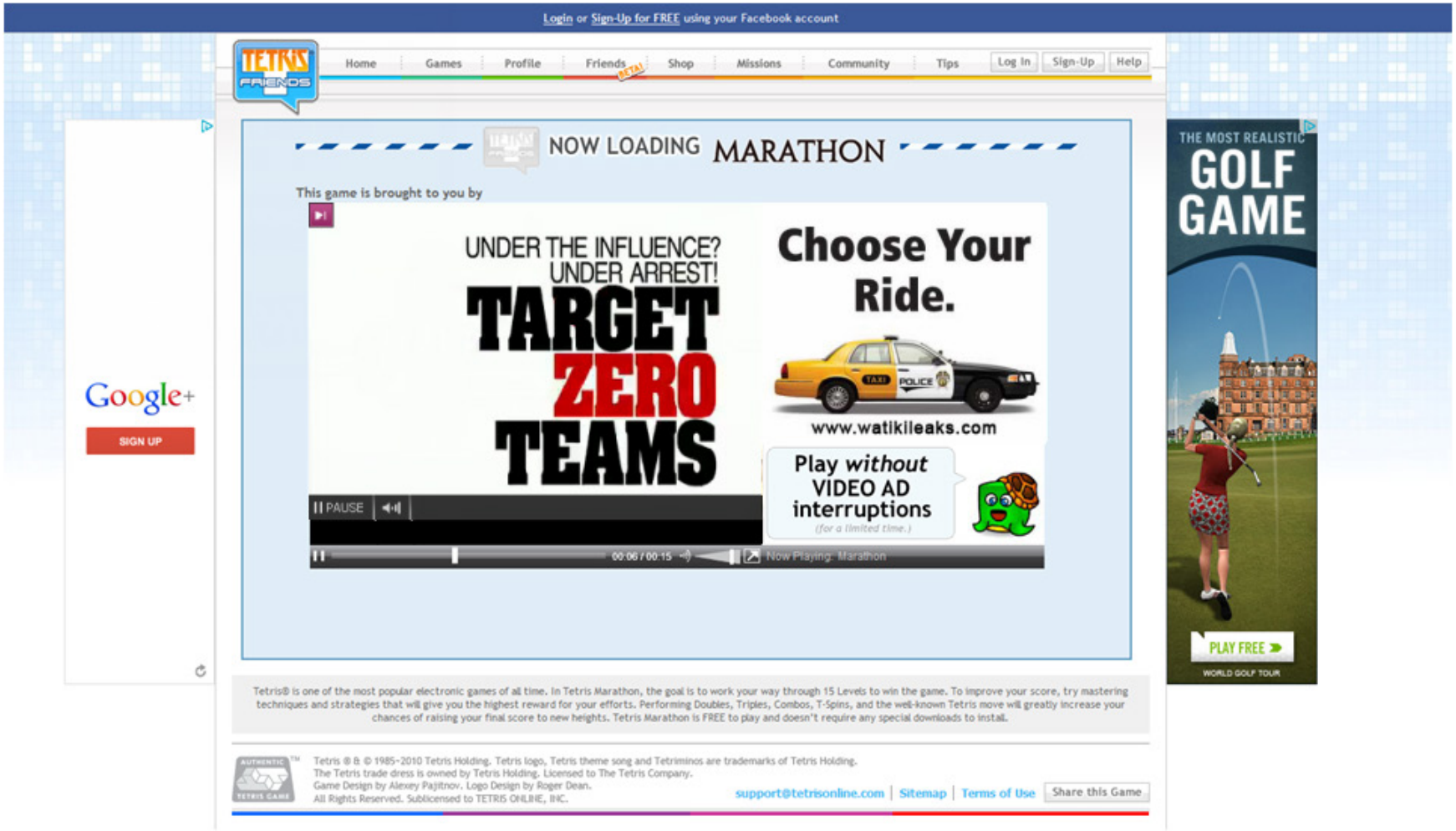


Figure 7. **Screenshot of TZT Mention in *Choose Your Ride* Campaign**

Paid media. Table 8 displays the DUI-related paid media activities conducted by WTSC during the TZT time period. As mentioned above, TZT was not generally the focus of these DUI paid media efforts, and most of the efforts covered the major population centers of the State, not just the TZT intervention counties. Therefore, the comparison counties for the current project would have received the same paid media messages as the TZT counties.

Table 8. **WTSC Paid DUI Media Campaigns During TZT**

Campaign	Dates	Medium	Target Audience	Markets	Amount Spent
Drive Hammered, Get Nailed	8/2/10-9/5/10	TV, Radio	Men 18-34	Seattle, Spokane, Yakima, Tri Cities, Olympia, Moses Lake, Aberdeen, Longview, Ellensburg, Bellingham, Centralia, Port Angeles, Walla Walla, Wenatchee	$200,200
Impaired Driving	4/11/11-7/31/11	Outdoor Posters and Bulletin	Men 18-34	Seattle/Tacoma	$14,612
Impaired Driving Holidays	11/16/11-1/1/12	TV, Radio, Outdoor Posters, Internet	Men 18-34	Seattle, Spokane, Yakima, Tri Cities, Olympia, Moses Lake, Aberdeen, Longview, Ellensburg, Bellingham, Centralia, Port Angeles, Walla Walla, Wenatchee	$262,310
Impaired Driving St. Patrick's Day Campaign	3/2/12 - 3/18/12	Radio	Men 18-34	Seattle, Spokane, Tri Cities, Yakima, Olympia, Moses Lake, Aberdeen, Longview, Ellensburg, Bellingham, Centralia, Port Angeles, Walla Walla, Wenatchee	$46,490
Impaired Driving Summer	6/18/12-7/8/12	TV, Radio, Outdoor Posters, Internet	Men 18-34	Seattle, Spokane, Yakima, Tri Cities, Olympia, Moses Lake, Aberdeen, Longview, Ellensburg, Bellingham, Centralia, Port Angeles, Walla Walla, Wenatchee	$150,346
				Total Spent	$673,959

Earned media. WTSC and WSP instituted wide monitoring to detect earned media activities and e-mailed all TZT stakeholders via a listserv when the monitored media mentioned TZT or when WTSC or WSP issued a press release. Overall, researchers reviewed 126 messages posted to the TZT communications listserv and identified 11 earned media outlets based on the content of the listserv messages. From the 126 messages, researchers identified 74 unique earned media events or unique placements and then classified them according to the earned media outlets that carried them. Table 9 lists the earned media outlets and their frequency of occurrence in the listserv.

As shown in Table 9, TZT most frequently generated both major (e.g., front or full-page story) and minor (e.g., smaller back-page story) newspaper coverage as well as television and social media coverage. Newspaper stories appeared in *The News Tribune*, *USA Today*, *The Herald*, and *The Seattle Times*. Television coverage included *King5 News* (an *NBC* affiliate), *KOMO News* (an *ABC* affiliate), *Q13* (a *FOX* affiliate), and *KIRO* (a CBS affiliate). With respect to social media, posts on the TZT listserv indicated Twitter tweets about TZT activities, YouTube video clips of troopers in training and TZT's anniversary activities, a Facebook page for TZT, and a waTikiLeaks Web site designed to generate social media buzz by "leaking" TZT activity in the target counties.

Table 9. **Earned Media by Type**

Earned Media Outlet	Frequency
Newspaper Minor	19
Social Media	13
TV	13
Press Release	10
Newspaper Major	7
Ride-Along	4
Grass Roots	3
Radio	3
Meetings	1
Other Print Media	1
Total	74

Statewide Crash Data

The Washington Department of Transportation (WDOT) provided the study with statewide crash data for the period from January 1, 2002 to May 30, 2012. The WDOT indicated there was a four to five month lag between when a crash occurs and when it is entered into the database. At the time of the data request, WDOT believed that May 30, 2012 was the latest date for which it had complete data. The types of crashes examined included:

- Total crashes,
- Daytime (6 a.m. to 5:59 p.m.),
- Nighttime (6 p.m. to 5:59 a.m.),
- Injury,
- Single-vehicle,
- Multivehicle, and
- Single-vehicle at night.

All crash variables entered the analysis as rates per 100,000 population rather than as raw counts in order to account for the differing county sizes. Researchers obtained population estimates used for the analyses from the Washington State Office of Financial Management, Forecasting Division Web site (2013). Driver alcohol-involved fatal crashes are examined in a later section using separate fatality data made available by WTSC.

Researchers used Auto-Regressive Integrated Moving Average (ARIMA) interrupted time series analysis (Box & Jenkins, 1970; Box & Tiao, 1975) to determine whether reliable changes existed in the crash outcomes after the implementation of the TZT program. Using this analytic method, the monthly outcomes in each TZT county were first statistically adjusted for any preexisting secular trends, autocorrelation, and historical variations prior to estimating any changes associated with implementing the TZT program. Researchers used a comparison series in the ARIMA analyses to adjust for historical variation over time, such as enforcement, fuel prices, new traffic safety laws, and other unknown factors (Liu, 2006). Specifically, researchers used the outcome series for the three combined comparison counties (Clark, Spokane, and Yakima) in the analyses to adjust for historical factors that could potentially affect all Washington counties and might otherwise be mistaken for an intervention effect. The analyses included individual ARIMA models for each of the three TZT counties and also for all three TZT counties combined. Researchers ran each model with and without the comparison series. The examination of each intervention county separately as well as the combination permitted researchers to examine effects with and without Snohomish which almost certainly was affected previously by the NEET activities.

The intervention point used in each ARIMA model was the date that the TZT program was implemented (July 2010). Snohomish analyses used the same intervention point in spite of the prior NEET activities because TZT was the program of interest for the evaluation. Researchers modeled this data as a sudden-permanent intervention, which only requires one parameter (ω) to be estimated for the intervention (Yaffee, 2000). The comparison series and intervention parameters were retained in the models regardless of their level of statistical

significance because the analyses were intended to test hypotheses about the effects of the TZT program rather than build parsimonious models.

For the sake of brevity and simplicity, results do not include a presentation of the ARIMA model parameters (e.g., autoregressive terms). Most of the crash models had seasonal ARIMA structures involving both first-order and seasonal (12-month) auto-regressive terms. However, the inclusion of the comparison county crash series frequently removed the need to include seasonal parameters, so those models tended to be less complex than the models without the comparison series. All autoregressive and moving average terms in the final models were within the bounds of stationarity and invertibility, meaning that they had absolute values less than 1.0 and were mathematically stable (Yaffee, 2000). Joint estimation of model parameters and outlier effects were used during the analyses to reduce the impact of outliers and other anomalies, particularly those resulting from the United States economic downturn that began in late 2007 (Chen & Liu, 1993). The reported final models best represented the outcome series for each county as determined by the best-fitting auto-correlation and partial-auto-correlation functions of the series residuals (Liu, 2006). The results of the ARIMA analyses provided county-by-county estimates of the mean monthly change in each outcome associated with implementation of the TZT program, and also the mean monthly change in each TZT county relative to that seen in the aggregated comparison counties. Researchers also calculated percentage change estimates relative to the pre-TZT series for descriptive purposes.

Crude crash rates. Analyses first examined the crude mean monthly crash rates per 100,000 population in the TZT counties and the combined comparison counties before (January 2002–June 2010) and after (July 2010–May 2012) the implementation of the TZT program. All the crude crash rates were lower after the TZT program was implemented in each county and also in the combined comparison counties. For example, total crashes decreased 24.3 percent across the combined TZT counties and 28.7 percent across the combined comparison counties. These large decreases in crashes are likely due at least in part to the economic downturn in the United States that began in late 2007 and resulted in reduced driving (Longthorne, Subramanian, & Chen, 2010). Given this obvious bias in the crude post-TZT crash estimates, they are not discussed in more detail here. A table in the Appendix provides the data. To reduce this bias in the ARIMA analyses, researchers used automated outlier detection and modeling procedures when estimating the final crash models (Chen & Liu, 1993). Table 10 presents the detailed results, and the text below provides a brief summary of the results for each crash type.

Total crashes. For total crashes, the results of the ARIMA analyses indicated that after TZT, total crashes decreased 7.1 percent in King County, 7.0 percent in Pierce County, and 3.8 percent across the TZT counties combined ($p < .05$). Total crashes did not reliably change in Snohomish County after TZT began ($p > .05$).

Nighttime crashes. The results of the ARIMA analyses indicated that after TZT began, nighttime crashes decreased 3.8 percent in King County, 8.7 percent in Pierce County, and 6.0 percent across the TZT counties combined ($p < .05$). Nighttime crashes did not reliably change in Snohomish County after TZT began ($p > .05$).

Daytime crashes. The results of the ARIMA analyses indicated that after TZT began, daytime crashes decreased 6.4 percent in King County, 9.9 percent in Pierce County, and 5.9 percent across the TZT counties combined ($p < .05$). Daytime crashes did not reliably change in Snohomish County after TZT began ($p > .05$).

Injury crashes. ARIMA analyses indicated that after TZT began, injury crashes decreased 6.8 percent in Pierce County and 3.8 percent across the TZT counties combined ($p < .05$). However, injury crashes did not reliably change in King or Snohomish counties after TZT began ($p > .05$).

Single-vehicle crashes. For single-vehicle crashes, the ARIMA analyses indicated that after TZT began, single-vehicle crashes decreased 7.3 percent in Pierce County and 8.2 percent in Snohomish County ($p < .05$). Single-vehicle crashes did not reliably change in King County or across the TZT counties combined after TZT ($p > .05$).

Multi-vehicle crashes. The results of the ARIMA analyses indicated that after TZT began, multi-vehicle crashes decreased 7.5 percent in Pierce County ($p < .05$), but did not reliably change in King County, Snohomish County, or across the TZT counties combined ($p > .05$).

Single-vehicle nighttime crashes. ARIMA analyses indicated that after TZT began, single-vehicle nighttime crashes decreased 8.7 percent in Pierce County ($p < .05$), but did not reliably change in King County, Snohomish County, or across the TZT counties combined ($p > .05$).

Summary of crash findings. Overall, the findings were supportive of the Target Zero Teams implemented in King and Pierce counties leading to reduced crashes, but not as definitively for Snohomish County. TZT implementation was associated with lower total, nighttime, and daytime crashes in King County, and lower crashes of all types in Pierce County. Only single-vehicle crashes appear to have been lower for Snohomish after the start of TZT. These analyses took into consideration prior trends which would make it more difficult for Snohomish to show significant reductions since the successful NEET program had been operating since late 2006.

Table 10. **ARIMA Results Comparing Crash Rates per 100,000 Population Before and After Target Zero Team Implementation**

Outcome	Change vs. pre-TZT period only				Change vs. comparison counties			
County	Δ	95% CI		$\Delta_{\%}$	Δ_{adj}	95% CI		$\Delta_{\%adj}$
Total crashes								
TZT Combined	-2.2	-21.8	17.3	-1.0	-8.7*	-14.5	-3.0	-3.8
King	-3.0	-23.7	17.6	-1.2	-16.4*	-23.3	-9.4	-7.1
Pierce	-9.6	-28.2	9.0	-4.4	-15.4*	-24.9	-6.0	-7.0
Snohomish	3.1	-13.5	19.8	1.5	-1.3	-13.5	10.9	-0.6
Nighttime crashes								
TZT Combined	-1.2	-6.0	3.6	-1.7	-4.2*	-7.4	-1.0	-6.0
King	-0.6	-6.0	4.9	-0.7	-2.9*	-5.8	-0.0	-3.8
Pierce	-2.6	-6.0	0.9	-3.8	-5.8*	-9.0	-2.7	-8.7
Snohomish	-0.7	-5.8	4.3	-1.2	-1.7	-4.9	1.6	-2.7
Daytime crashes								
TZT Combined	-0.9	-7.8	6.0	-0.5	-9.5*	-15.5	-3.5	-5.9
King	-6.9	-21.9	8.0	-4.1	-10.7*	-19.0	-2.4	-6.4
Pierce	-9.0	-21.4	3.4	-5.9	-15.0*	-23.4	-6.6	-9.9
Snohomish	3.8	-2.8	10.3	2.5	1.8	-7.0	10.5	1.2
Injury crashes								
TZT Combined	-0.2	-5.5	5.1	-0.2	-2.9*	-5.4	-0.4	-3.8
King	-2.4	-8.7	3.9	-3.1	-1.8	-4.6	0.9	-2.3
Pierce	-4.7	-11.5	2.1	-5.9	-5.5*	-8.2	-2.8	-6.8
Snohomish	-2.0	-7.8	3.8	-3.0	-0.5	-3.4	2.3	-0.8
Single-vehicle crashes								
TZT Combined	0.0	-2.7	2.6	-0.1	-0.8	-2.1	0.6	-1.9
King	-0.8	-4.6	2.9	-2.1	-2.2	-4.9	0.4	-5.6
Pierce	-0.8	-3.5	1.9	-2.0	-2.9*	-4.7	-1.1	-7.3
Snohomish	1.4	-1.3	4.1	3.3	-3.5*	-5.4	-1.6	-8.2
Multi-vehicle crashes								
TZT Combined	-2.9	-20.7	15.0	-1.5	-4.9	-11.0	1.3	-2.6
King	0.3	-16.8	17.3	0.1	-3.8	-11.0	3.5	-1.9
Pierce	-1.6	-21.6	18.5	-0.9	-13.4*	-19.0	-7.9	-7.5
Snohomish	-5.5	-18.1	7.1	-3.3	2.6	-7.8	13.0	1.5
Single-vehicle nighttime crashes								
TZT Combined	-0.3	-1.6	1.0	-1.4	-0.3	-1.5	1.0	-1.5
King	-1.1	-3.1	1.0	-5.4	-1.4	-3.1	0.3	-7.3
Pierce	-0.8	-2.3	0.7	-3.8	-1.8*	-3.0	-0.6	-8.7
Snohomish	0.3	-1.2	1.7	1.3	-0.9	-2.2	0.4	-4.2

Note. All estimates are based on sudden-permanent ARIMA models. Comparison counties were Clark, Spokane, and Yakima. TZT = Target Zero Team. Δ = monthly difference subsequent to TZT implementation. 95% CI = 95% confidence interval for the difference. $\Delta_{\%}$ = percentage change relative to the pre-TZT period.

*$p < .05$, two-tailed from ARIMA model.

Driver BACs

WSP owns and controls all of the breath test devices in Washington State regardless of which law enforcement agency uses them. WSP's Toxicology Division maintains a database of the measured BACs of all drivers who were required to complete a breath test to determine BAC on the Datamaster® device universally employed in Washington State at the time of the TZT program. This includes all of the breath alcohol tests conducted in the State by both WSP and by local police since all breath tests must be processed on instruments owned and calibrated by WSP. WSP provided the entire database for January 1, 2006, to June 30, 2012. The database was designed to keep track of all operations on the breath testers, including tests, retests (each arrested driver must blow twice), calibrations, and maintenance. As such, the data required substantial manipulation to eliminate duplicate and/or incomplete data, as well as anything other than a single BAC value for each arrestee. The final dataset for the above-referenced time period included 192,602 complete BAC measurements.[2] Unfortunately, the database had no indicator of the identity of the arresting officer or any way to link specific BAC measurements to the TZT teams. As such, all analyses focused on countywide changes in BAC testing rates and test results.

Table 11 shows the mean monthly numbers of BAC tests administered and mean BAC levels of tested drivers in the TZT counties and the combined comparison counties before (January 2006–June 2010) and after (July 2010–June 2012) implementation of the TZT program. After the start of TZT, the total number of BAC tests administered increased 19.6 percent in Pierce County, decreased 13.2 percent in Snohomish County, and were not different in King County or across all 3 TZT counties combined. The number of BAC tests administered decreased 15.1 percent during the same time period across the combined comparison counties. Also, after the start of TZT, the mean BAC levels of tested drivers decreased between 1.2 percent and 1.7 percent among the TZT counties, with a 1.3 percent decrease combined across all three TZT counties. The mean BAC did not reliably change during the same time period combined across the comparison counties.

[2] The Datamaster® is designed so that each offender must provide two valid breath samples in order for the device to produce an evidential BAC. If an offender refuses to provide the second sample or cannot (or will not) blow sufficiently hard to provide either of the samples, the Datamaster® record had to be excluded from the sample and could not be used as evidence by law enforcement.

Table 11. **Crude Monthly BAC Tests Administered and Mean BACs in TZT and Comparison Counties, January 2006–June 2012**

Outcome County	M_{Pre}	M_{Post}	Δ_M	$\Delta_{\%}$
Drivers BAC tested				
TZT combined	1138.3	1171.8	33.5	2.9
King	529.2	542.5	13.2	2.5
Pierce	307.3	367.5	60.2*	19.6
Snohomish	301.8	261.8	-40.0*	-13.2
Comparison counties	413.4	350.8	-62.6*	-15.1
Mean BAC				
TZT combined	0.135	0.134	-0.002*	-1.3
King	0.135	0.133	-0.002*	-1.2
Pierce	0.138	0.135	-0.002*	-1.6
Snohomish	0.134	0.132	-0.002*	-1.7
Comparison counties	0.142	0.143	0.001	0.8

Note. The table figures are not adjusted for trend, seasonality, or autocorrelation. Comparison counties were Clark, Spokane, and Yakima. BAC = blood alcohol concentration. TZT = Target Zero Team. M_{Pre} = average monthly value January 2006– June 2010. M_{Post} = average monthly value July 2010–June 2012. Δ_M = crude pre-post difference in means. $\Delta_{\%}$ = crude percentage difference relative to the pre-TZT time period.
*$p < .05$. two-tailed t test.

The results of ARIMA analyses on the BAC data (Table 12) indicated that 14.4 percent more drivers were BAC-tested in King County, 23.5 percent more drivers were BAC-tested in Pierce County, and 14.8 percent more drivers were BAC-tested across the three TZT counties combined after the start of the TZT program ($p < .05$). The number of drivers BAC-tested did not change reliably from before to after the TZT program implementation in Snohomish County ($p > .05$). The ARIMA results also indicated a reduction in the mean BAC in all three of the TZT counties after the TZT program implementation ($p < .05$). Specifically, the mean BAC of tested drivers dropped 1.1 percent in King County, 3.0 percent in Pierce County, 1.6 percent in Snohomish County, and 1.6 percent overall across all three TZT counties as shown in Table 11 above.

Table 12. **ARIMA Results Comparing Monthly BAC Tests Administered and Mean BACs Before and After Target Zero Team Implementation**

Outcome County	Change vs. pre-TZT period only				Change vs. comparison counties			
	Δ	95% CI		$\Delta_{\%}$	Δ_{adj}	95% CI		$\Delta_{\%adj}$
Drivers BAC tested								
TZT Combined	119.5*	81.2	157.7	10.5	168.4*	124.7	212.1	14.8
King	16.2	-15.2	47.7	3.1	76.2*	28.6	123.7	14.4
Pierce	62.2*	46.2	78.2	20.3	72.3*	53.7	90.9	23.5
Snohomish	-27.5*	-43.8	-11.1	-9.1	-11.3	-29.4	6.9	-3.7
Mean BAC								
TZT Combined	-0.002*	-0.003	0.000	-1.2	-0.002*	-0.004	-0.001	-1.6
King	-0.001	-0.003	0.000	-0.9	-0.002*	-0.003	0.000	-1.1
Pierce	-0.004*	-0.006	-0.002	-2.8	-0.004*	-0.006	-0.002	-3.0
Snohomish	-0.002*	-0.004	-0.001	-1.6	-0.002*	-0.004	-0.001	-1.6

Note. All estimates are based on sudden-permanent ARIMA models. Comparison counties were Clark, Spokane, and Yakima. BAC = blood alcohol concentration. TZT = Target Zero Team. Δ = monthly difference subsequent to TZT implementation. 95% CI = 95% confidence interval for the difference. $\Delta_{\%}$ = percentage change relative to the pre-TZT period. *$p < .05$, two-tailed from ARIMA model.

In general, these findings suggest the TZT program implementation was associated with higher numbers of drivers being BAC tested in King and Pierce counties, but not Snohomish County where the NEET program may already have increased testing rates. After the implementation of TZT, the mean BAC levels of drivers tested went down slightly in all three intervention counties.

Driver Alcohol Involvement in Fatal Crashes

Analyses included ARIMA models to assess if driver alcohol involvement in fatal crashes changed during the TZT time period (July 1, 2010, to June 30, 2012) in Washington. Due to the relatively small number of fatalities per county, researchers tallied quarterly counts of fatalities for all TZT counties combined and compared them to quarterly counts for the comparison counties combined and to the rest of the State. Analyses used actual measured driver BAC when known. Otherwise, researchers used an imputation model to estimate probabilities of alcohol involvement based upon known BAC results from Washington as well as from known and official NHTSA imputed data based on national FARS. These imputed probabilities, when aggregated over a large group and/or time period, create estimates of the sum pool of drivers at each level generally accepted as reliable by the research community. Additionally, the alcohol-positive time series were expressed as ratios to the alcohol negative series for the same group in order to account for the various external influences that affect driving volumes and safety generally (i.e., not specific to alcohol involvement). These ratio series essentially represent the odds of a driver in a fatal crash being alcohol-involved.

The first set of analyses modeled alcohol-involved drivers with any BAC greater than or equal to .01 g/dL in fatal crashes as a ratio by dividing by the alcohol-negative drivers in fatal crashes. Given the relatively small counts of fatal crashes in the counties, this first approach that included all alcohol-involved fatal crashes stood the best chance of identifying any statistically significant changes after the start of TZT.

The second set of analyses repeated the first but for drivers with a BAC greater than or equal to .15 g/dL. This BAC cut-off point was selected because most fatal alcohol-involved crashes involve drivers at this BAC level or higher. Also, the mean BAC of drivers arrested for DUI as shown earlier approaches this level. Both sets of analyses considered driver alcohol involvement for three groups: TZT counties, comparison counties, and the balance of the State. Both sets first analyzed driver alcohol involvement with a series of three separate ARIMA models (one for each of the three geographical groups) and accompanying statistical comparisons between the key group series. Both sets then analyzed a single ARIMA model that included the comparison group series as covariates rather than statistical comparisons. All analyses incorporated an intervention "step function" dummy variable to estimate and test any shift (or other change) that took place during the TZT period versus whatever trends or patterns had occurred in those series up to just prior to the intervention. All ARIMA models involved the natural log of the series to ensure homoscedasticity and to express any intervention change in terms of relative percent to expected level.[3]

[3] For a more complete discussion of the requirements for an ARIMA and its output parameters, the interested reader should consult a basic reference on the subject (e.g., Box & Jenkins, 1970; Box & Tiao, 1975)

Table 13 outlines the modeling approach for both high BACs (BAC ≥ .15) and any positive BAC (BAC ≥ .01) for driver-alcohol-involved fatal crashes.

Table 13. **Modeling Approach for Driver Alcohol Involvement in Fatal Crashes**

Driver BAC g/dL	ARIMA Models	Comparisons
BAC ≥ .15	3 Separate ARIMA Models (TZT Counties, Comparison Counties, Rest of State)	TZT vs. Comparison TZT vs. Rest of State
BAC ≥ .15	Single Covariate ARIMA Model (Comparison Counties + Rest of State + TZT Counties)	
BAC ≥ .01	3 Separate ARIMA Models (TZT Counties, Comparison Counties, Rest of State)	TZT vs. Comparison TZT vs. Rest of State
BAC ≥ .01	Single Covariate ARIMA Model (Comparison Counties + Rest of State + TZT Counties)	

Driver BACs ≥ .01 in fatal crashes. Table 14 lists the parameter coefficients and statistical inference tests for each individual BAC ≥ .01 model. Results indicated a significant increase in driver alcohol involvement in the comparison counties series, $t(74) = 2.28$, $p = .026$, but no significant increase in the TZT counties, $t(74) = 0.18$, $p = .861$ and a trend towards an increase in the rest of the state, $t(74) = 1.77$, $p = .081$. Difference tests between the coefficient for the TZT counties and the coefficient for the comparison counties almost reached statistical reliability ($p = 0.056$), but the comparison to the rest of the state was non-significant (Table 15). The small number of fatalities likely kept the differences from being statistically significant even though the change in the TZT counties relative to the comparison counties was fairly large at -24.8 percent (Table 15).

Table 14. **Individual Models Where BAC ≥ .01**

Group	Coeff (*SE*)	*t*	*p*
TZT Counties	0.01 (.07)	0.18	.861
Comparison Counties	0.30 (.13)	2.28	.026
Rest of State	0.23 (.13)	1.77	.081

Table 15. **BAC ≥ .01, Contrasts Between TZT Counties and Other Groups**

Contrast	Relative % Change	*t*	*p*
TZT vs. Comparison Counties	-24.8%	-1.94	.056
TZT vs. Rest of State	-19.3%	-1.48	.144

Researchers repeated analyses for drivers with a BAC of .01 or more using the covariate approach with comparison series included in the same ARIMA as regressors. The model parameters for both the comparison counties and the rest of the state correlated moderately with the parameter for the TZT counties (Table 16). As such the comparison series served as effective covariates. The analyses revealed no significant reduction in driver alcohol involved (BAC .01 or more) fatal crashes in the TZT counties.

Table 16. **Covariate Model Where BAC ≥ .01 g/dL**

Regressor Group (*r*)	Coeff (*SE*)	*t*	*p*
TZT, vs. Comparison Counties (.23)	-0.07 (.09)	0.82	.417
TZT, vs. Rest of State (.49)	-0.10 (.08)	1.28	.206

Driver BACs ≥ .15 in fatal crashes. Table 17 lists the parameter coefficients and statistical inference tests for each individual high-BAC model. Results indicated a significant increase in driver alcohol involvement (BAC ≥ .15) after the TZT program began for the comparison sites, $t(74) = 2.53$, $p = 0.014$, and the rest of the state, $t(74) = 2.17$, $p = .033$, but no significant increase in the TZT counties, $t(74) = 0.95$, $p = 0.346$. Difference tests between the coefficient for the TZT counties and the coefficients for the comparison counties and the rest of the state were non-significant despite what appear to be fairly large relative reductions (Table 18). Similar to the analyses involving any BAC ≥ .01, the small number of fatalities involving a driver at a BAC ≥ .15 likely kept the differences from being statistically significant even though the change in the TZT counties relative to the comparison counties was a relatively large -22.4 percent (Table 18).

Table 17. **Individual Models Where BAC ≥ .15 g/dL**

Group	Coeff (*SE*)	*t*	*p*
TZT Counties	0.15 (.15)	0.95	.346
Comparison Counties	0.40 (.16)	2.53	.014
Rest of State	0.32 (.15)	2.17	.033

Table 18. **BAC ≥ .15, Contrasts Between TZT Counties and Other Groups**

Contrast	Relative % Change	*t*	*p*
TZT vs. Comparison Counties	-22.4%	-1.16	.252
TZT vs. Rest of State	-16.2%	-0.83	.410

The covariate analysis approach involved the inclusion of comparison series in the same ARIMA models as regressors. The model parameters for both the comparison counties and the rest of state counties correlated highly with the parameter for the TZT counties (Table 19). As such, the comparison series were effective covariates, but the results showed no significant reduction in driver alcohol involved fatal crashes in the TZT counties after TZT began.

Table 19. **Covariate Model for BAC ≥ .15 g/dL**

Regressor Group (*r*)	Coeff (*SE*)	*t*	*p*
TZT, vs. Comparison Counties (.58)	-0.05 (.10)	-0.52	.604
TZT, vs. Rest of State (.83)	-0.07 (.09)	-0.78	.438

Driver alcohol-involved fatalities avoided. In order to estimate the number of fatalities avoided by TZT, researchers calculated an ARIMA model of the baseline period driver alcohol involvement in fatal crashes (BAC ≥ .01) in the TZT counties using the comparison counties as a covariate series. The baseline model was then used to project driver alcohol involvement in fatal crashes as if TZT had not occurred. The projected data were compared with the actual data for the TZT operational period. Results of this analysis showed the TZT counties experienced 13.24 fewer alcohol-positive drivers involved in fatal crashes than expected for the 24-month period. This translates to approximately 11 fatalities avoided when using conservative assumptions regarding the number of deaths per crash involving an alcohol-positive driver.

Summary of driver alcohol involvement in fatal crashes. Researchers examined the ratio of alcohol involved drivers in fatal crashes to non-alcohol involved drivers in fatal crashes in the TZT and comparison counties. Ideally, one would hope to find that the TZT counties would show a reduction in the ratio of alcohol involved drivers to non-alcohol involved if TZT removed enough high-risk drivers or substantially deterred drunk driving in general. For the TZT counties, there was virtually no change in the ratio of fatal crash involved drivers with any BAC greater than or equal to .01 while the rate in the comparison counties and the rest of the State increased. Results showed the ratio of fatal crash involved drivers with high BACs (BAC ≥ .15) to drivers with a negative BAC increased in the TZT counties after TZT began, but at a rate less than that of the comparison counties and the rest of the State. Both results suggest that while TZT did not appear to be associated with absolute reductions in the ratios of alcohol involved drivers in fatal crashes, it was associated with relative reductions since the comparison counties and the rest of the State were showing increases during the same time period. This suggests that the TZT program could have had an effect in controlling fatal crashes involving drivers with both any positive BAC and BACs at or above .15, but sample sizes likely prevented the reductions from reaching statistical significance. An analysis of driver alcohol-involved fatalities avoided estimated that 11 fatalities were avoided in the TZT counties during the time period the program was operating. While the above results are already positive, the cumulative effect of TZT on driver alcohol involvement in fatal crashes may also be lagging the initial years of implementation. Since the State has funded the TZT program to continue for 2 additional years, the possibility exists of an additional reduction in driver alcohol involvement in fatal crashes to a level of definitive statistical significance.

Public Awareness and Self-Reported Behavior

WTSC, with the assistance of the Washington Department of Licensing (DOL), assessed public awareness of the TZT program via a survey of DOL customers. A total of 12 licensing offices, 2 from each of the intervention and comparison counties, participated in the WTSC/DOL data collection. The DOL asked its customers to complete one-page of questions (see Figure 8 for the questions) about their awareness of DUI enforcement activities and self-reported behaviors related to alcohol consumption and driving. DOL customers completed the forms at their own pace during waiting time at the DOL offices and returned them to staff or placed them in a drop box. DOL collected awareness during the following time periods:

- Wave 1 - June 2010; before start of TZT program;
- Wave 2 - July 2010; a few weeks after TZT program start;
- Wave 3 - July 2011; 1 year after TZT program start; and
- Wave 4 - July 2012; 2 years after TZT program start.

Analyses pooled data for the intervention counties and separately for the comparison counties. The analyses looked for changes in the distributions of responses over time for each group (intervention and comparison) separately using the Chi Square Test for Independence and Column Proportions Z-tests to make specific pairs of comparisons when the omnibus chi-square test indicated a significant ($p < 0.05$) result. Rather than present numerous statistical results, the text and tables highlight statistically significant differences and describe the patterns of responses. Given the large sample size and number of analyses conducted, some of the analyses may have produced statistically significant results despite the changes not being operationally consequential. The reader is encouraged to examine the patterns of the data presented to make his or her own judgment as to the importance of the findings.

1

The King County offices of the Washington Department of Licensing are assisting in a study about highway safety in the State. Your answers to the following questions are voluntary and anonymous. Please complete the survey and then put it in the drop box or return it to the person who gave it to you.

Your sex? ☐ Male ☐ Female **Your Zip Code?** _____

Your age? ☐ Under 18 ☐ 18-20 ☐ 21-25 ☐ 26-34 ☐ 35-49 ☐ 50-59 ☐ 60 plus

Your race? ☐ White ☐ Black ☐ Asian ☐ Native American ☐ Other

Are you of Spanish/Hispanic origin? ☐ Yes ☐ No

About how many miles did you drive last year?
☐ Less than 5,000 ☐ 5,000 to 10,000 ☐ 10,001 to 15,000 ☐ More than 15,000

What type of vehicle do you drive most often?
☐ Passenger car ☐ Pickup truck ☐ Sport utility vehicle ☐ Mini-van ☐ Full-van ☐ Motorcycle ☐ Other

How much of your driving is done after dark?
☐ None ☐ Very little ☐ Less than half ☐ About half ☐ More than half ☐ All

How likely is it that the police in this area will catch a drunk driver?
☐ Very unlikely ☐ Somewhat unlikely ☐ Somewhat likely ☐ Very likely

What priority do police in this area place on the enforcement of drunk driving laws?
☐ Very low ☐ Low ☐ Moderate ☐ High ☐ Very high

In the last 30 days, have you noticed increased police traffic enforcement in this area?
☐ Yes—I was stopped ☐ Yes—I noticed but was not stopped ☐ No

Check all places where you have seen or heard a message about drunk driving enforcement during the last 30 days?
☐ Newspapers ☐ Radio ☐ TV ☐ Posters ☐ Brochures ☐ From Police officers ☐ From Family/Friends
☐ On Internet ☐ From Other Source _____ ☐ Have not seen/heard any messages in last 30 days

Which of the following drunk driving programs have you heard of? (check all that apply)
☐ Over the Limit, Under Arrest ☐ You Booze, You Lose ☐ Under the Influence? Under Arrest!
☐ Target Zero Teams ☐ Friends Don't Let Friends Drive Drunk ☐ Drive Hammered. Get Nailed
☐ X52: Extra Patrols Every Week ☐ None of the above

During the last 6 months, how often did you drink any beer, light beer, wine, wine cooler, or liquor?
☐ Every day ☐ Several days a week ☐ Once a week or less ☐ Weekends only
☐ Celebrations/special events ☐ Never

IF YOU EVER DRINK ALCOHOLIC BEVERAGES, PLEASE ANSWER THE QUESTIONS BELOW

How many times in the past 30 days have you had 5 or more drinks when you were drinking alcohol? _____

In the past 30 days, have you ever driven a motor vehicle WITHIN 2 HOURS AFTER drinking alcoholic beverages?
☐ No ☐ Yes → **About how many times?** _____

About how many times in the past 30 days did you drive when you thought you HAD TOO MUCH TO DRINK?_____

In the past 30 days, have you ever deliberately avoided driving a motor vehicle because you felt you probably had too much to drink to drive safely?
☐ Yes ☐ No

Figure 8. **DOL Awareness Questions**

Across all four collection periods, DOL collected 11,846 responses. The numbers of responses collected during Waves 2, 3, and 4 (See Table 20) were smaller than baseline because these periods only involved one week of sampling compared to two weeks for the June 2010 baseline measure.

Table 20. **Number Of Surveys Collected**

		June 2010	July 2010	July 2011	July 2012	Total
TZT Counties	Count	2104	1424	1721	1109	6358
	Column %	51.5%	52.3%	69.7%	43.2%	53.7%
Comparison	Count	1983	1297	747	1461	5488
Counties	Column %	48.5%	47.7%	30.3%	56.8%	46.3%
Total	Count	4087	2721	2468	2570	11846
	Column %	100.0%	100.0%	100.0%	100.0%	100.0%

Initial analyses examined demographic variables and identified no notable changes in these variables over time. Overall, 53.0 percent of the sample were female, 72.9 percent White, 55.4 percent drove passenger cars, and the great majority of respondents were 21 to 59 years old.

The item that asked, "*How likely is it that the police in this area will catch a drunk driver?"* showed no notable changes that would have indicated an effect of TZT in the intervention counties. For "*What priority do police in this area place on the enforcement of drunk driving laws?*" the response patterns were virtually identical for the intervention and comparison sites with about 20 percent of respondents saying "very high" and about 37-40 percent saying "high" each wave. For "*In the last 30 days, have you noticed increased police traffic enforcement in this area?*" the intervention and comparison sites showed very similar results with just around 5 percent indicating they had been stopped, but no sites showed meaningful changes over time (Table 21).

Table 21. **In the Last 30 Days, Have You Noticed Increased Police Traffic Enforcement in This Area?**

			June 2010	July 2010	July 2011	July 2012	Total
TZT Counties	Yes- I Was Stopped	Count	126	70	79	54	329
		Column %	6.1%	5.1%	4.7%	4.9%	5.3%
	Yes- But Not Stopped	Count	923	651	800	448	2,822
		Column %	44.8%	47.0%	47.6%	40.8%	45.4%
	No	Count	1,009	665	800	596	3,070
		Column %	49.0%	48.0%	47.6%	54.3%	49.3%
	Total	Count	2,058	1,386	1,679	1,098	6,221
		Column %	100.0%	100.0%	100.0%	100.0%	100.0%
Comparison Counties	Yes- I Was Stopped	Count	102	77	46	65	290
		Column %	5.3%	6.1%	6.3%	4.5%	5.4%
	Yes- But Not Stopped	Count	890	597	331	667	2,485
		Column %	45.9%	47.2%	45.3%	46.4%	46.3%
	No	Count	946	592	353	705	2,596
		Column %	48.8%	46.8%	48.4%	49.1%	48.3%
	Total	Count	1,938	1,266	730	1,437	5,371
		Column %	100.0%	100.0%	100.0%	100.0%	100.0%
Total	Yes- I Was Stopped	Count	228	147	125	119	619
		Column %	5.7%	5.5%	5.2%	4.7%	5.3%
	Yes- But Not Stopped	Count	1,813	1,248	1,131	1,115	5,307
		Column %	45.4%	47.1%	46.9%	44.0%	45.8%
	No	Count	1,955	1,257	1,153	1,301	5,666
		Column %	48.9%	47.4%	47.9%	51.3%	48.9%
	Total	Count	3,996	2,652	2,409	2,535	11,592
		Column %	100.0%	100.0%	100.0%	100.0%	100.0%

One question asked respondents to, "*Check all places where you have seen or heard a message about drunk driving enforcement during the last 30 days?*" Table 22 shows the percentage of respondents in each wave who indicated they had seen or heard a message from the various media types. For the intervention sites, only posters and Internet showed statistically significant ($p < 0.05$) increases in exposure from the baseline period with both of the significant increases coming in July 2012.

Table 22. **Percentage Who Heard or Saw Message by Media Type**

Source	Intervention/Comparison	June 2010	July 2010	July 2011	July 2012
Newspaper	Intervention	26.8	26.1	25.6	24.8
	Comparison	24.5	26.8	21.7	25.3
Radio	Intervention	52.2	52.2	47.8	50.9
	Comparison	51.0	49.9	45.6	53.0
TV	Intervention	68.1	69.5	64.9	64.9
	Comparison	71.0	68.9	61.6	69.0
Posters	Intervention	21.5	23.1	24.4	28.2*
	Comparison	22.4	26.0	23.2	23.8
Brochure	Intervention	6.2	6.5	6.3	7.1
	Comparison	6.2	7.4	7.0	7.0
Police	Intervention	7.3	7.4	6.2	8.4
	Comparison	7.1	8.6	8.3	7.5
Family/Friends	Intervention	20.9	18.0	20.2	21.9
	Comparison	16.8	21.6*	19.7	20.9*
Internet	Intervention	17.5	17.3	18.4	23.4*
	Comparison	13.7	14.6	12.4	20.1*
Other	Intervention	6.0	6.7	5.9	6.0
	Comparison	7.2	5.9	9.4	7.0
None	Intervention	10.8	10.0	17.4	11.7
	Comparison	11.7	10.3	21.0	12.3

*Significantly higher than June 2010 (baseline measure), $p < 0.05$.

Table 23 displays the recognition rates for various drinking and driving media campaign slogans. The intervention and comparison sites both showed statistically significant increases in recognition of "Over the Limit, Under Arrest" by July 2012. The intervention sites also showed a significant increase in recognition of "Target Zero Teams," but the highest rate achieved was only 5.1 percent during July 2012.

Table 23. **Percentage Who Knew Slogan**

Slogan	Intervention/ Comparison	June 2010	July 2010	July 2011	July 2012
Over the Limit Under Arrest	Intervention	26.6	26.1	29.6	29.6
	Comparison	34.6	34.2	33.6	33.6
You Booze, You Lose	Intervention	21.2	20.2	20.6	23.0
	Comparison	22.1	23.6	19.0	20.5
Under the Influence? Under Arrest	Intervention	21.4	21.9	25.8*	29.3*
	Comparison	27.0	29.8	32.0	32.4*
Target Zero Teams	Intervention	2.4	3.2	4.1*	5.1*
	Comparison	3.5	3.2	3.1	2.4
Friends Don't Let Friends Drive Drunk	Intervention	68.2	68.6	69.0	67.2
	Comparison	74.5	70.1	65.6	67.1
Drive Hammered Get Nailed	Intervention	61.8	64.9	58.3	59.2
	Comparison	63.0	66.2	54.5	62.4
X52: Extra Patrols Every Week	Intervention	17.6	17.3	14.1	17.2
	Comparison	11.3	13.0	9.1	14.6*
None	Intervention	9.9	8.9	10.8	10.3
	Comparison	6.0	7.0	9.5	8.4

*Significantly higher than June 2010 (baseline measure), $p < 0.05$.

Another set of four items applied only to people who actually drink alcoholic beverages. For the item that asked, "*How many times in the past 30 days have you had 5 or more drinks when you were drinking alcohol?*" the percentage saying "0" increased from 72.6 percent at baseline, to 76.3 percent in July 2010, to a high of 83.9 percent in July 2012 at the intervention sites while it dropped from 74.5 percent to 70.4 percent at the comparison sites in July 2010 before rising to 84.0 percent in July 2011 and 81.0 percent in July 2012. The next item then asked, "*In the past 30 days, have you ever driven a motor vehicle WITHIN 2 HOURS AFTER drinking alcoholic beverages?*" There was a significant ($p = 0.013$) change in the percentage saying "yes" at the intervention sites from baseline to July 2011, going from 16.7 percent at baseline, to 13.2 percent in July 2010, to 12.9 percent by July of 2011, but rising back to 16.2 percent in July 2012. The comparison sites showed a significant ($p = 0.023$) change in "yes"

responses from baseline to July 2012, going from 16.0 percent, to 14.6 percent, to14.3 percent, and down to 11.5 percent by July 2012.

The next item asked, "*About how many times in the past 30 days did you drive when you thought you HAD TOO MUCH TO DRINK?*" The percentage saying "0" increased from 92.9 percent at baseline, to 96.5 percent in July 2010, 96.4 percent in July 2011, and 96.7 percent at the intervention sites. This change at the intervention sites was statistically significant ($p < 0.001$) with all three post-TZT start waves being significantly higher than baseline. At the control sites, the percentage saying "0" decreased from 95.0 percent at baseline, to 92.4 percent in July 2010, and 90.8 percent in July 2011 at the comparison sites before increasing again to 95.6 percent in July 2012. This change was also statistically significant ($p = 0.001$).

A final item asked, "*In the past 30 days, have you ever deliberately avoided driving a motor vehicle because you felt you probably had too much to drink to drive safely?*" The percentage saying "yes" showed a non-significant ($p > 0.05$) increase at the intervention sites going from 36.0 percent at baseline, to 37.5 percent in July 2010, 39.0 percent in July 2011, and then decreased slightly to 37.4 percent by July 2012. There was a significant change at the comparison sites ($p = 0.010$) with "yes" responses going from 38.6 percent at baseline to 43.9 percent in July 2010, but then dropping back to 40.6 percent in July 2011, and 36.4 percent in July 2012.

Cost/Benefit to State

Evaluations of operational highway safety interventions often include a cost/benefit analysis to shed light on the issue of whether society received a net benefit from the cost of the intervention. Researchers typically express cost/benefit results in terms the ratio of cost to benefit (i.e., the cost per unit of benefit) or as the ratio of benefit to cost (i.e., the "payback" of the cost investment).

Researchers could not conduct a comprehensive cost/benefit analysis of the TZT program because of the unavailability of much relevant cost and benefit data. For example, on the cost side TZT participants captured no information on time spent on the program by personnel not directly paid by it. Likewise, calculating an accurate value of the earned media generated would require detailed records of the circumstances of the media exposure that participants could not collect.

On the benefit side, there are numerous potential benefits of TZT including reduced alcohol-related fatalities and injuries, fewer property damage crashes due to alcohol, increased seat belt use, and a lowered number of crashes related to speeding and other non-alcohol offenses due to the high visibility and added patrol hours produced by TZT. Researchers could not obtain all of these data with a degree of accuracy that would support a comprehensive cost/benefit analysis. Moreover, it is a reasonable expectation that some of the anticipated benefits of TZT will only emerge in the future and cannot be estimated at this time.

Given the absence of data for a comprehensive analysis, researchers addressed the question of cost/benefit by focusing on the analysis of alcohol-involved fatalities avoided presented earlier and the total direct cost of the TZT program spent by WTSC. Combining these

two measures provided an estimate of whether the reduction in driver alcohol-involved fatalities attributable to TZT during the program period (July 1, 2010, to June 30, 2012) alone resulted in sufficient economic benefit to offset the direct program costs, which presumably represent the major TZT cost component. A benefit to cost ratio greater than one with just these two major components would strongly support the conclusion of a positive cost/benefit outcome for TZT.

Table 24 shows that WTSC spent a total of just over $6 million during the 2-year active period of TZT. Table 25 shows the resulting benefit to cost ratios of saving 11 lives based on three different assumptions about the cost to society of a traffic fatality. The first assumption comes from an analysis performed by the Federal Highway Administration (FHWA) in 1994 (FHWA, 1994). At that time and in 1994 dollars, FHWA estimated the cost of a fatality at $2.6 million. Inflation alone would raise that estimate to $3,946,298 in 2011 dollars (McMahon, 2013). Using the original 1994 estimate, the avoidance of 11 fatalities resulted in a benefit to cost ratio of 4.74:1, indicating TZT saved almost 5 times the cost of the program based on driver alcohol-involved fatalities avoided alone. Researchers conducted the same analysis with more recent and higher estimates of the cost of a fatality. The National Safety Council (NSC) produced an estimate of the 2011 cost of a fatality of $4,459,000 (NSC, n.d.). As shown in Table 25, this resulted in a benefit to cost ration of 8.12:1. A study for the American Automobile Association (AAA) by Cambridge Systematics (2011) estimated the cost of a fatality at $6 million. Using this estimate, the benefit to cost ratio for TZT is almost 11:1 (Table 25).

Table 24. **TZT Total Cost and Major Cost Components**

Period	Description	Spent
July 1, 2010 - June 30, 2012	WSP vehicles, salaries, benefits	$4,669,316.29
	Local law enforcement OT, PI&E	$1,030,201.78
	TZT prosecutors	$338,844.48
	Total	$6,038,362.55

Source: data provided by WTSC.

Table 25. **Dollars Saved by TZT and Benefit to Cost Ratios**

Source	Cost per Fatality	Dollar Amount Saved by TZT*	Benefit:Cost
FHWA	$2,600,000	$28,600,000	4.74:1
NSC	$4,459,000	$49,049,000	8.12:1
AAA	$6,000,000	$66,000,000	10.93:1

*Based on 11 fatalities avoided in fatal crashes with driver alcohol involvement.

In summary, although researchers could not conduct a comprehensive cost/benefit analysis of TZT, an analysis based only on fatalities avoided in the three intervention counties from July 1, 2010, to June 30, 2012, showed savings from about 5 to as much as 11 times the direct cost of the program expended by WTSC. This leaves virtually no doubt that expenditures on TZT, even if all direct and indirect costs and all benefits could be considered, produced a cost benefit to society.

Discussion

Several aspects of the TZT program support the promise of instituting such a comprehensive enforcement approach to traffic safety. The TZT program clearly led to increased DUI enforcement activities by the WSP and participating local agencies in the TZT counties. Data from WSP's TAS and BAC databases, local agency grant logs, and AOC's citation/arrest records showed increases in traffic stops for DUI, subsequent increases in BAC testing, and increased numbers of arrests for DUIs. It should be noted that the net increases in DUI enforcement activities varied among TZT counties. The gains from King County's TZT detachment activities appeared to be somewhat offset by a decrease in DUI stops by non-TZT troopers during the program.

Snohomish County represented a unique situation because the NEET program, the model for TZT, had been in operation there before TZT started. Thus, Snohomish had a continuous TZT-like enforcement operation in both the baseline and intervention periods. Nevertheless, the county showed an overall increase in DUI arrests and warning stops above the prior 2 years when NEET was operating. This suggests the well supported TZT implementation of the dedicated enforcement team model produced value above and beyond the positive results NEET had already accomplished.

The TAS data also revealed the TZT troopers had substantially higher percentages of contacts resulting in DUI arrests and official warnings of all types than did their non-TZT counterparts in the same and other counties. One of the side effects of this focused productivity was a reduction by the TZT troopers in citations for other infractions such as speeding or failure to wear seat belts. Stops for these offenses likely resulted in warnings rather than citations. By avoiding the time needed to issue a citation for a non-DUI offense, the troopers maximized the time they could devote to DUI enforcement. Obviously, when the offense prompting the stop was flagrant or extreme, the troopers issued a citation.

The results of the crash analyses suggested that TZT was related to crash reductions of all types in Pierce County and certain types of crashes in King County. Most notably, the ARIMA analyses indicated that after TZT began, total crashes decreased 7.1 percent in King County, 7.0 percent in Pierce County, and 3.8 percent across the three TZT counties combined, as compared to comparison counties. Nighttime crashes decreased 3.8 percent in King County, 8.7 percent in Pierce County, and 6.0 percent across the TZT counties combined. Analyses also showed single-vehicle nighttime crashes (a widely used alcohol involved crash surrogate measure) decreased 8.7 percent in Pierce County, but did not reliably change in King or Snohomish counties. As noted above, Pierce County showed the highest net increase in DUI enforcement activities which may explain why this county showed the greatest reductions in crashes of all types.

The TZT counties showed virtually no change in the ratio of drivers in fatal crashes with positive BACs (> .01), but the rate in the comparison counties and the rest of the State increased. This represented a relative reduction of 24.8 percent for driver alcohol involvement (BAC ≥ .01) in fatal crashes for the TZT counties. The ratio of driver alcohol-involved crashes with high BACs (> .15) increased in the TZT counties, but at a rate less than that of the comparison

counties and the rest of the State. This represented a 22.4 percent relative reduction in high-BAC driver alcohol involvement in fatal crashes. This represented a 22.4 percent relative reduction in high-BAC driver alcohol involvement in fatal crashes. Both results suggest that while TZT does not appear to be associated with absolute reductions in the ratios of alcohol-involved drivers in fatal crashes, it was associated with relative reductions since the comparison counties and the rest of the State were showing greater increases during the same time period. Results of another analysis showed the TZT counties experienced 13.24 fewer alcohol-positive drivers involved in fatal crashes than expected for the 24-month TZT period which translates to approximately 11 fatalities avoided when using conservative assumptions regarding the number of deaths per crash involving an alcohol-positive driver. While the relative reductions in alcohol-involvement in fatal crashes appeared to be fairly substantial, the small number of fatalities in the TZT counties likely prevented the reductions from reaching statistical significance. The above findings suggest the TZT program was indeed effective at reducing or controlling (relative to the increases observed at the comparison sites and rest of State) alcohol involvement in fatal crashes, but that reducing the fatal crash involvement of drivers with high BACs (BAC $\geq$ .15) is likely a more difficult task than for low BACs or for alcohol negative drivers. Also, the type of general deterrence that high-visibility enforcement is designed to generate does not necessarily peak immediately upon the commencement of the intervention. Since WTSC plans to continue TZT efforts beyond the period this study evaluated, the possibility certainly exists that the effects of deterrence on crash reduction will amplify.

The measured BAC results suggest a relationship between the program activities and a small reduction in the average BAC of tested drivers. While the observed reductions in the TZT counties were statistically significant, the reader must remember that all 3 TZT counties still showed average BACs over .13. While lower than the average BAC for the comparison counties, .13 is still very high, and BACs at this level greatly elevate a driver's crash risk. Nevertheless, even a small reduction in the average BAC of drivers arrested for DUI represents a significant and rarely documented occurrence as a result of an anti-DUI program.

The increase in BAC testing produced by the TZT activities may also have affected the average BAC results. It is not clear what one might expect to find when more drivers are stopped for DUI and subsequently tested. One expectation is that the same distribution of BAC positive drivers would be found since many more DUI drivers likely exist on the roads than law enforcement can stop. On the other hand, dedicated DUI teams may stop more drivers with lower BACs who might otherwise have gone unnoticed by a team with less DUI enforcement experience and more conflicting duties.

Many of the WTSC/DOL public awareness measures showed very little change. However, the intervention and comparison sites both showed statistically significant increases in recognition of "Over the Limit; Under Arrest" by July 2012. The intervention sites also showed a significant increase in recognition of "Target Zero Teams." This is noteworthy, since the design of TZT did not include the extensive media efforts characteristic of traditional high visibility enforcement programs. However, the highest rate achieved was only 5.1 percent.

The projections used in the cost/benefit analysis suggest a substantial benefit to the State even though the calculations were very conservative since they only included fatalities avoided

due to reduced driver alcohol-involved fatal crashes. While the crash analyses suggested other reductions in crashes related to the start of TZT, it is more difficult to attribute the changes solely to TZT since the increased enforcement focused primarily on DUIs.

The research design and analytical approaches utilized here attempted to control biases in the results by considering prior trends in the data and by utilizing the best available comparison sites. It is nevertheless possible that external factors affected the reliability of the results. WTSC selected the TZT counties because they represented a substantial proportion of the State's population and DUI related crashes/fatalities. Therefore, even the best remaining counties for use as comparisons differed notably from the intervention sites in terms of population, urbanization, and travel patterns. This may have influenced both the actual implementation of the program and the results of the study. Specifically, the results of the TZT program may not be generalizable to less populated and urbanized areas where the number of potential DUI contacts is limited by the population size and the nature of the road network. Likewise, the use of comparison counties may not have removed as much bias as would have been possible if the counties had matched more closely.

Much of the data used for this study came from operational databases designed as query systems to monitor personnel activities or equipment or to support day-to-day operations. The various results sections highlighted the specific limitations of each data set. Despite these limitations, the various data sources provided a consistent picture of DUI-related activities across the State. All data sources showed increases in DUI activities in the TZT counties, which adds credibility to the observed crash and fatality results. It is not clear whether future research could avoid the issues associated with using operational databases. For example, a separate BAC database of research quality likely could not be assembled due to legal and operational limitations, as well as expense. Giving additional consideration to the time lag between events and their capture in the various databases, however, can lead to more complete data sets and additional data analysis time in future research of this type.

Overall, the TZT approach appears promising. Measures involving TZT enforcement activity (e.g., citations, increased numbers of BAC tests, TZT hours logged) were significant and positive, demonstrating support for the TZT program. The study results suggest that this increase in activity led to safety gains in at least two of the three TZT counties during the study time period. For Snohomish, the operation of the NEET program in the prior years may have mitigated the impact of TZT. The TZT process clearly produced operational gains in parameters that should relate to improved and lasting safety as general deterrence builds, but addition time is needed to determine the long-term impact. Given that WTSC plans to continue the TZT program in the three counties and may expand to other counties in the State, future research may wish to conduct follow-up efforts to see if the benefits achieved in the TZT counties continue to increase, plateau, or recede.

References

Box, G. E. P., & Jenkins, G. M. (1970). *Time series analysis: Forecasting and control*. San Francisco, CA: Holden Day.

Box, G. E. P., & Tiao, G. C. (1975). Intervention analysis with applications to econometric and environmental problems. *Journal of the American Statistical Association, 70*, 70–79.

Cambridge Systematics, Inc. (2011). *Crashes vs. congestion – What's the cost to society?* Washington, DC: American Automobile Association

Chen, C., & Liu, L. M. (1993). Joint estimation of model parameters and outlier effects in time series. *Journal of the American Statistical Association, 88*, 284–297.

Cicchino, J. (2012). *Washington's Target Zero Teams Project: Reductions in fatalities during year one.*—Traffic Safety Facts Research Note. (DOT HS 811 687). Washington, DC: National Highway Traffic Safety Administration. Retrieved from ww.nhtsa.gov/staticfiles/nti/pdf/811687.pdf

Federal Highway Administration. (1994). *Motor vehicle accident costs* (T 7570.2). Washington, DC: Author. Retrieved from http://safety.fhwa.dot.gov/facts_stats/t75702.cfm#refs

Fell, J. C., McKnight, A. S., & Auld-Owens, A. (2013). *Increasing impaired-driving enforcement visibility: Six case studies.* (DOT HS 811 716). Washington, DC: National Highway Trafffic Safety Administration. Retrieved fromAvailable at www.nhtsa.gov/staticfiles/nti/pdf/811716.pdf

Fell, J. C., Tippetts, A. S., & Levy, M. (2008). Evaluation of seven publicized enforcement demonstration programs to reduce impaired driving: Georgia, Louisiana, Pennsylvania, Tennessee, Texas, Indiana, and Michigan. In *52nd AAAM Annual Proceedings, October 5-8, 2008* (pp. 23-38). Evanston, IL: Association for the Advancement of Automotive Medicine.

Liu, L. (2006). *Time series analysis and forecasting.* (2nd ed.). Villa Park, IL: Scientific Computing Associates Corp.

Longthorne, A., Subramanian, R., & Chen, C-L. (2010). *An analysis of the significant decline in motor vehicle traffic crashes in 2008.* (DOT HS 811 346). Washington, DC: National Highway Traffic Safety Administration. Retrieved from www-nrd.nhtsa.dot.gov/Pubs/811346.pdf

McCartt, A. T., Leaf, W. A., Farmer, C. M., & Eichelberger, A. H. (2012). *Washington State's alcohol ignition interlock law: Effects on recidivism among first-time DUI offenders.* Arlington, VA: Insurance Institute for Highway Safety.

McMahon, T. (2013). *Inflation Rate Calculator*. Retrieved from www.inflationdata.com/Inflation/Inflation_Calculators/Inflation_Rate_Calculator.asp

National Highway Traffic Safety Administration. (2012). *Alcohol-impaired driving: 2011 data.--* Traffic Safety Facts. (DOT HS 811 700). Washington, DC: Author.

National Safety Council. (n.d.). *Estimating the costs of unintentional injuries.* Retrieved from www.nsc.org/news_resources/injury_and_death_statistics/Pages/EstimatingtheCostsofUnintentionalInjuries.aspx

Stuster, J. W., & Blowers, M. A. (1995). *Experimental evaluation of sobriety checkpoint programs.* (DOT HS 808 287). Washington, DC: National Highway Safety Administration. Retrieved fromAvailable at ntl.bts.gov/lib/25000/25900/25932/DOT-HS-808-287.pdf

Washington Traffic Safety Commission. (2011). *Washington State impaired driving-involved traffic deaths, 2006-2010*. Olympia, WA: Author.

Washington State Office of Financial Management, Forecasting Division. (2013). Retrieved from www.ofm.wa.gov/pop/default.asp

Yaffee, R. A. (2000). *Introduction to time series analysis and forecasting with applications of SAS and SPSS*. New York: Academic Press, Inc.

APPENDIX

Development Timeline Prepared by WTSC
Crude Crash Rates

Washington State Target Zero Teams Project Development Time Line (Prepared by WTSC)

The following is a timeline which documents the conceptual design, project design, implementation, and project management activities conducted during the Target Zero Teams Project in Washington State from February 2009 to July 2010. The purpose of the TZTP timeline is to document major project activities as an important part of the program process and to assist States and/or agencies in the future who are considering such an initiative in their jurisdiction. The timeline will help to identify those activities necessary to replicate TZTP and those that were only necessary for the proof of concept.

Target Zero Teams Project Timeline

Washington State Pilot Project	Date/Time
Washington State Patrol/WTSC Nighttime Emphasis Enforcement Team Pilot Project.	**January 1, 2008 - February 15, 2009**

Concept/Design/Implementation Activities	Date/Time
February 2009	**Date/Time**
Review of NEET pilot project impact. Development of TZT approach and discussions with State and NHTSA staff regarding funding.	**Monthly Total Hours 13.5 Hours**
March 2009	**Date/Time**
Begin drafting a TZTP Strategic Plan to guide the project's development, implementation and evaluation processes. Contact law enforcement agencies about program. Continue development of the TZTP Planning Group structure and project research methodology	**Monthly Total Hours 32 Hours**
April 2009	**Date/Time**
Continue TZTP Strategic Plan and Evaluation Model development. TZTP Development Team meeting. Lowell Porter designated as the Project Leader.	**Monthly Total Hours 26.5 Hours**
May 2009	**Date/Time**
Draft TZTP Development Team meeting memo. TZTP project coordination/meeting follow-up. Prepare for TZTP Data Planning Group meeting. TZTP Data Planning Group follow-up. Continue work developing TZTP research methodology.	**Monthly Total Hours 18.5 Hours**

June 2009	Date/Time
Update WTSC staff on TZTP development. TZTP Development Team meeting. TZTP Strategic Plan update.	Monthly Total Hours 11.0 Hours
July 2009	**Date/Time**
Finalize Development Team material/reports. Prepare for and hold TZTP Development Team meeting.	Monthly Total Hours 8.5 Hours
August 2009	**Date/Time**
Meet with Washington Associations of Sheriffs and Police Chiefs (WASPC) President for input. Conference calls with Police and WSP TZTP troopers. TZTP Development Team meeting. Meet with NHTSA LEL on LEL support for TZTP/update.	Monthly Total Hours 10.0 Hours
September 2009	**Date/Time**
Meet with the Target Zero Task Force Managers, Local LEL's, NHTSA LEL, and WTSC staff to explain the TZTP concept, development and implementation strategies to gain their support for the project. Continue development of NHTSA demonstration project research proposal. First conference call with NHTSA research staff, to explain and discuss the TZTP. Meet with WTSC staff on TZTP funding and budget proposal. Continue work on TZTP local law enforcement presentation.	Monthly Total Hours 22.0 Hours
October 2009	**Date/Time**
Continue drafting TZTP overview for NHTSA HQ staff. Continue work on TZTP budget/funding. Continue work on TZTP research design. Outreach to WASPC member from local law enforcement for support of TZTP. Meet with WSP FOB leadership to discuss TZTP staffing and budget. Meet with NHTSA LEL on local LEL for the TZTP. Finalize the TZTP Planning Group contact list.	Monthly Total Hours 24.0 Hours
November 2009	**Date/Time**
Meet with NHTSA HQ leadership staff to seek their support of TZTP and NHTSA research. Continue to develop TZTP research on the DDACTS component and UCR crime rates. Meet with WSP Field Operations Bureau Leadership on TZTP planning, staffing, and budget.	Monthly Total Hours 27.5 Hours

December 2009	Date/Time
Meet with WTSC staff on WSP TZTP agreement and budget amendment. Meet with King County Prosecutor to discuss TZTP support and prosecution concerns. Continue work on TZTP program management tasks. Continue development of county level planning group structure/governance. Meetings with LEL and law enforcement agencies.	Monthly Total Hours 20.5 Hours
January 2010	**Date/Time**
Continue work on TZTP kick-off event planning. Conference call with WSP on outreach to local Chiefs and Sheriff for supporting the TZTP. Begin developing a TZTP presentation for outreach to local Chiefs and Sheriffs for support of TZTP. TZTP Development Team meeting.	Monthly Total Hours 23.0 Hours
February 2010	**Date/Time**
Continue work on developing the TZTP DDACTS component/research. TZTP Communications Planning Group meeting. Draft TZTP Development Team meeting material. Outreach presentation to Snohomish County Chiefs and Sheriff for support of the TZTP. Meet with WTSC Traffic Records Data Center staff on TZTP research data needs.	Monthly Total Hours 27.0 Hours
March 2010	**Date/Time**
Meet with WTSC staff on TZTP planning issues. Follow-up meeting with Snohomish County Prosecutors Office on TZTP support/involvement. TZTP Development Team meeting.	Monthly Total Hours 6.5 Hours
April 2010	**Date/Time**
First Tri-County Planning Groups (King, Pierce, and Snohomish counties) meeting for a combined effort to coordinate the planning and implementation of TZTP between the participating counties and the WTSC Development Team. Meet with the TZTP Communications Planning Group on TZTP kick-off event. Drafting correspondence for requesting the Governor, NHTSA Administrator Strickland, and Laura Dean-Mooney as guest speakers at the TZTP Kick-off event. TZTP Prosecutor funding meeting with WTSC staff.	Monthly Hour Total 16.0 Hours
May 2010	**Date/Time**
Conference call with Dunlap and Assoc. on TZTP research. TZTP Standard Operating Procedures meeting with	Monthly Total Hours 14.5 Hours

WTSC staff and WSP staff. **TZTP Tri-County Planning Group meeting.** **Draft talking points for the Chief of Staff for the TZTP kick-off press conference.**	
June 2010	**Date/Time**
Meeting to finalize TZTP funding strategy. **Phone conference with Richard Blomberg, Dunlap and Assoc., and Shelly on TZTP research, data, and analysis.** **Continue work on TZTP training presentation for enforcement personnel on data driven decision making.** **Deliver Data Driven Decision Making presentation to TZTP enforcement personnel from all three counties.** **Final preparations for TZTP kick-off event.** **Preparation session with Chief of Staff for his role at TZTP kick-off event.**	**Monthly Total Hours** **23.5 Hours**
July 2010	**Date/Time**
TZTP Press Conference and kick-off event, Boeing Field. **Follow-up meeting with TZTP research staff.**	**Monthly Total Hours** **3.5 Hours**

Crude Average Monthly Crash Rates per 100,000 Population in Target Zero Team Counties and Combined Comparison Counties, January 2002–May 2012

Crash outcome County	M_{Pre}	M_{Post}	Δ_M	$\Delta_{\%}$
Total crashes				
TZT Combined	231.1	174.9	-56.2*	-24.3
King	242.7	186.4	-56.4*	-23.2
Pierce	219.3	152.2	-67.1*	-30.6
Snohomish	211.2	168.2	-43.0*	-20.4
Comparison counties	187.5	133.7	-53.8*	-28.7
Nighttime crashes				
TZT Combined	70.6	53.4	-17.3*	-24.4
King	75.2	58.2	-17.0*	-22.5
Pierce	67.2	46.6	-20.6*	-30.6
Snohomish	61.6	47.4	-14.3*	-23.2
Comparison counties	57.1	43.0	-14.1*	-24.7
Daytime crashes				
TZT Combined	160.4	121.5	-38.9*	-24.2
King	167.6	128.1	-39.4*	-23.5
Pierce	152.1	105.6	-46.5*	-30.6
Snohomish	149.6	120.8	-28.7*	-19.2
Comparison counties	130.4	90.7	-39.7*	-30.4
Injury crashes				
TZT Combined	77.0	55.3	-21.7*	-28.2
King	78.6	58.1	-20.5*	-26.0
Pierce	80.3	52.7	-27.5*	-34.3
Snohomish	68.9	50.3	-18.6*	-27.0
Comparison counties	66.5	47.0	-19.6*	-29.4
Single-vehicle crashes				
TZT Combined	40.5	34.8	-5.7*	-14.1
King	40.0	34.9	-5.1*	-12.9
Pierce	39.9	32.6	-7.3*	-18.4
Snohomish	42.4	36.9	-5.5*	-13.0
Comparison counties	46.9	41.9	-5.1*	-10.8
Multi-vehicle crashes				
TZT Combined	190.5	140.0	-50.5*	-26.5
King	202.6	151.3	-51.3*	-25.3
Pierce	179.4	119.6	-59.7*	-33.3
Snohomish	168.7	131.2	-37.5*	-22.2
Comparison counties	140.5	91.8	-48.7*	-34.7
Single-vehicle nighttime crashes				
TZT Combined	20.2	16.5	-3.7*	-18.1
King	19.6	16.4	-3.2*	-16.3
Pierce	21.1	16.5	-4.5*	-21.4
Snohomish	21.0	16.9	-4.1*	-19.4
Comparison counties	23.3	20.9	-2.3*	-10.0

Note. The table figures are not adjusted for trend, seasonality, or autocorrelation. Comparison counties were Clark, Spokane, and Yakima. TZT = Target Zero Team. M_{Pre} = average monthly value January 2002– June 2010. M_{Post} = average monthly value July 2010–May 2012. Δ_M = crude pre-post difference in means. $\Delta_{\%}$ = crude percentage difference relative to the pre-TZT time period. *$p < .05$. two-tailed t test.

DOT HS 812 097
January 2015

U.S. Department of Transportation
National Highway Traffic Safety Administration

NHTSA
www.nhtsa.gov

10882-010715-v4