DRAFT SUPPLEMENTAL REPORT

A National Model for the Evaluation of CMV Selective Enforcement Programs

Supplemental Report

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Executive Summary

The project entitled "A National Model for the Evaluation of CMV Selective Enforcement Programs" had the goal of describing best practices for the evaluation of Ticketing Aggressive Cars and Trucks (TACT) projects. The methodology and examples are typically not restricted to formal TACT projects, and they generally apply to any project involving selective enforcement and Public Information and Education (PI&E) with regard to large trucks. For this reason "TACT" was omitted from the project title, but for purposes of brevity these projects will generally be referenced as TACT projects in this report.

The final report for this project is separated into two documents: (1) a brief Methodology Manual (MM) to provide a step-by-step approach to the evaluation of TACT projects, and (2) a Supplemental Report (SR) that presents detailed examples to provide further guidance in areas where it might be required. Throughout these two documents the word *project* is used to refer to a specific implementation within an overall *program.* The acronym TACT refers not only to the FMCSA sponsored TACT programs, but to all selective enforcement that would involve commercial motor vehicles (CMVs), recognizing that the methodology and examples have general application. Thus, *TACT projects* should generally convey the meaning of *TACT and/or TACT-type projects*.

These two documents have the goal of providing those doing TACT project evaluations with an overall methodology to apply to their evaluations. Specifically, the data collection and analytical techniques to be employed are targeted at law enforcement personnel who have statistical and evaluation interests and the corresponding expected level of expertise in this regard. The evaluations are intended to be ongoing for the purpose of continued improvement as opposed to highly scientific evaluations that might draw undue resources away from the projects themselves. Consultants and university researchers are expected to be employed on these types of evaluations on a minimal "advisory" basis as opposed to turning the entire evaluation process over to them.

The formal Ticketing Aggressive Cars and Trucks (TACT) program is the result of the collaboration of the Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA), both of which have major traffic safety responsibilities. TACT is a high-visibility traffic enforcement program that uses communication, enforcement, and evaluation activities to reduce car-truck crashes, fatalities, and injuries. According to FMCSA, the TACT program "is an evidence-based traffic enforcement model that can help States reduce crashes between large trucks and personal vehicles, by promoting safe driving behavior around commercial motor vehicles (CMVs)." TACT's goal is to deter unsafe driving behaviors by personal vehicle and commercial motor vehicle drivers when they interact to share the road, and thereby to reduce CMV-private vehicle crashes, injuries, and fatalities.

As its name implies, enforcement is at the heart of the TACT effort. In this regard the specific unsafe acts (e.g., primary contributing circumstances) involving both passenger vehicles and

Commercial Motor Vehicles (CMVs) have been identified as those which can be used to identify citations and crashes that would qualify to be considered within a TACT evaluation.

The evaluation model presented requires planning prior to the project. For example, analytical tools are used at this point to determine the best possible locations in which the selective enforcement portion of the program will be performed. Model examples for these pre-project planning steps are illustrated by an interactive Web site whereby officers locate the hotspots throughout the state. This web display is based on the Critical Analysis Reporting Environment (CARE), which provides additional functionality for producing information on the specified hotspots. In particular, locations are to be sought that are especially over-represented in car-truck (CMV) crashes in which one of the vehicles was guilty of one or more of the TACT offenses (as opposed to crashes in general).

The TACT programs under consideration for evaluation generally involve two major components – a Public Information and Education (PI&E) component and a selective enforcement (SE) component. Usually, PI&E involves both industry and media participation, while the SE involves patrol officers working special details in specific locations and time periods. These efforts can involve local agencies, general DPS Highway Patrol officers, and special DPS Motor Carrier Safety Unit (MCSU) officers.

After-the-fact evaluation without sufficient planning may provide some useful information, but it certainly is most desirable to start the evaluation process well before the projects are to be implemented. The report calls for evaluation planning to be integrated into the overall TACT planning process, since the "before" aspects of the evaluation process can provide valuable information toward optimizing the TACT projects. Called *problem identification,* this process involves determining the "who, what, when, where, how and why" of the types of crashes under consideration, in this case CMV-involved crashes. Problem identification and planning are heavily emphasized the two report documents, and several examples are given both before and after the projects are implemented.

The effectiveness evaluation procedure requires that detailed records be kept during the selective enforcement effort, which is also the basis for the administrative evaluation. The examples given involve a secure online enforcement summary form that was developed for participating law enforcement officers. Each TACT officer enters his/her name, department, enforcement location, enforcement time period, and counts for each type of citation issued. Citations that are entered are further categorized by the vehicle type issued to: CMV or Non-CMV. Motor carrier officers can also report CMV inspections using this same form. In order for the evaluation to consider specific areas and locations, officers must submit a form for each separate location and time period they patrolled. Based on these data, daily, weekly, and monthly reports can be automatically generated and made available on the Internet. In the system illustrated, these

reports can be available for the entire state, for each participating agency or DPS troop, or for individual officers.

The first TACT project was quite comprehensive in scope, at times involving almost all patrol officers in Alabama. Several examples are given for this effort in which over 30,000 citations and warnings were issued as part of the TACT program. Of these, the vast majority (94%) of citations were issued to private motorists, and only about 10% of the contacts resulted in warnings as opposed to citations.

Several types of evaluations are exemplified in the Supplemental Report:

- A comparison of crashes before and during the TACT projects,
- A crash comparison of months in which TACT selective enforcement was being applied against months in which there were little or no TACT efforts.
- A comparison of citations issued before and during the TACT projects,
- Two attitude surveys for participating officers and truckers,
- A survey of drivers distributed at driver licensing stations.
- Observational studies that employed existing cameras to determine if PI&E, billboards and selective enforcement was changing driver behavior.

The crash comparison examples considered two types of crashes: all crashes involving CMVs, and two vehicle crashes involving a CMV and a Personal Vehicle (car). The more significant findings were in the overall CMV crashes as opposed to the two vehicle case where a CMV and a car were involved. In all cases significant reductions in crashes were found. The following two tables presents a summary of the crash-reduction results estimated: (1) for CMV-involved crashes during the first TACT project, and (2) a number of follow-on projects that were conducted during the 17-month *interim* period beginning after the completion of the first project and finishing before the most recent TACT effort, which that took place in June 2011. These results are rounded to the nearest crash with the exception of the fatal crash category, and the counts are of crashes, not persons injured or persons killed.

Estimates of Crash Savings per Month for the First TACT Project Months

SEVERITY	CMV-INVOLVED CRASHES
Property Damage Crashes	35
Non-Fatal Injury Crashes	9
Fatal Crashes	0.8

Estimates of Crash Savings per Month for the Interim Project Months

SEVERITY	CMV-INVOLVED CRASHES
Property Damage Crashes	35
Non-Fatal Injury Crashes	17
Fatal Crashes	0.6

These results are surprisingly comparable given the realization that they were obtained through two quite different estimation techniques. The first TACT program was evaluated by comparing crashes before and during the program. The interim projects were evaluated by comparing months in which TACT effort hours exceeded 100 hours against those that had less. All but two of the non-TACT months had zero hours worked. These crash-reduction estimate example results are a by-product of the Model Evaluation project, which had as its goal to illustrate sound evaluation methods, and not necessarily to evaluate any particular project.

The analysis of eCite-issued citations was performed to determine if there was a more concentrated effort during the TACT program times to issue citations for TACT type offenses. The following is an example summary of the results for the first TACT project.

Change in Citations Issued During TACT Period

VIOLATION TYPE	May-Aug 2009*	Sep-Dec 2009	% Inc (+)/Dec (-)
Speeding	60,730	61,928	+2.0%**
Following Too Close	1,847	1,966	+6.4%**
Improper Lane Change	901	1,258	+39.6%**
Failure To Signal	443	628	+41.9%
No Seatbelt	28,941	25,589	-11.6%**
No Insurance	15,401	16,062	+4.3%**
Drivers' License	10,599	11,432	+7.9%**
Improper Passing	262	260	-0.8%

* Adjusted so that the two four-month periods are comparable.
** Statistically significant increases at alpha less than 0.01.

All of the violation type categories showed statistical significant increases or decreases at the alpha level of 0.01 or less with the exception of Failure to Signal and Improper Passing.

The example officer survey indicated that officers' attitudes toward the TACT program are generally positive. The only possible exception is the question with regard to whether TACT was best run as a statewide program or left for individual officers to enforce. Although more Officers responded they could best perform TACT-related activities on their own, over half

indicated that awareness of car and truck interactions led to more citations after conducting the TACT program.

Similarly, there was an overall positive attitude expressed toward the TACT conveyed via the example trucker survey. There were fifteen responses to the online trucker survey, and of these the majority was administrators (i.e., owners and managers). The results indicated industry support for TACT. Specifically, 94% of the respondents indicated the program was positive and 100% indicated they felt the enforcement was fair. Interestingly, the trucker survey indicated more support for large-scale organized programs such as TACT as opposed to more ad hoc, individual officer based enforcement.

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1.0 Introduction and Background

TACT programs are primarily interested in reducing the conflicts between CMVs and other vehicle types. These other vehicle types are often referenced as "passenger vehicles" or "personal vehicles." This report uses the word "cars" to collectively represent all of these "non-CMV vehicle types." This is done for brevity recognizing that there are many private vehicle types that would qualify, including sedans, vans, mini-vans, pickup trucks, SUVs, etc. A crash between a CMV and a car (or a car and a CMV) is referred to as a CMV-car crash. In using this term (CMV-car), unless otherwise stated there is no implication as to which of the two vehicles (or their drivers) caused the crash. The term CMV-car is used for consistency, but it is undistinguishable from car-CMV; the two should be considered interchangeable in the context of this report.

This section will consist of an introduction to establish the purpose of this document and the ways that it is different from most documents on the subject of TACT evaluation. After a discussion of overall goals and motivation, background material is exemplified for the first TACT evaluation and an update is exemplified by the second evaluation.

1.1 Purpose, Mission and Strategy

In order to understand the purpose, mission and strategy of the TACT model evaluation project, is it important to understand those of TACT. The following is quoted verbatim from the FMCSA TACT web page (http://www.fmcsa.dot.gov/safety-security/tact/abouttact.htm):

"Purpose. TACT provides a research-based safety model that can be replicated by States when conducting a high-visibility traffic enforcement program to promote safe driving behaviors among car and truck drivers.

"Mission. The mission of the TACT program is to reduce CMV-related crashes, injuries, and fatalities. FMCSA is achieving its mission by educating car and truck drivers on how to share the road safely.

"Strategy. The TACT program combines communication and evaluation with targeted enforcement activities to raise awareness among car and truck drivers about safe driving behaviors. Unsafe driving behaviors may include, but are not limited to: unsafe lane changes, tailgating, failing to signal lane changes, failing to yield the right of way, speeding, and aggressive driving (a combination of two or more behaviors). Pre-planning activities for States

include problem identification and goal setting. Outreach and education activities are supported by a communications plan that includes print or Web-based outreach and paid or earned media placement. Evaluation of the reduction in crashes following a TACT enforcement period is followed by post-program activities such as reporting and recognition and rewards programs."

The purpose of TACT evaluations are twofold: (1) to assure that the above purpose, mission and strategy as given above are being accomplished to their maximum extent possible under the resource constraints, and (2) to discover ways in which the purpose, mission and strategy can continue to improve over time as part of a continuous improvement approach.

It is important to differentiate between the goals that this model evaluation project is attempting to accomplish and that of TACT projects in general. Clearly TACT projects have the goal of overall crash reduction between CMVs and private vehicles. The current project (and this document) involved using actual TACT Public Information and Education (PI&E) and Selective Enforcement (SE) for case study examples, but it is not a report on this TACT project per se. The recommendations made in this document are recommendations for ways to evaluate and improve TACT programs in general. It is not our goal to promote any tactic applied in Alabama or any other state – only to provide an effective means for their evaluation. It is intended that the techniques illustrated be applicable to any TACT or TACT-like program regardless of the specifics.

Finally, it is not the intention that this be a stand-alone document. The implementation of the recommended evaluation procedures will be best realized if the companion document entitled "Methodology Manual – A National Model for the Evaluation of CMV Selective Enforcement Programs." That document, henceforth reference as the *Methodology Manual*, should provide the basic guide and the current document should be used to get more details and examples when they are needed. For ease of referencing, the section numbers of the current Supplemental Report are generally consistent with those of the Methodology Manual to facilitate the reference to the examples contained herein.

1.2. Discussion of Motivation

Traffic safety has suffered immeasurably from evaluations that were motivated by very little other than a desire to prove a program to be worthy of continued funding. Clearly, programs are best conceived and implemented when overall funding decisions are not based solely on the evaluation of one component of a total traffic safety program. All components need to be evaluated and their costs and benefits assessed so that the total program can be optimized. The primary motivation for evaluating any given component (e.g., a TACT project) must be that of improving that component's effectiveness in the future. "Improvement" in this context might consider major re-direction of future resources, but generally it will be geared toward minor

modifications that will continue to enhance the project in future implementations. If problem identification and evaluation can be viewed in this context it will lead to greater objectivity and dramatically improved programs.

Given this motivation, the following are some objectives that might be set to be accomplished by the evaluation process:

- To determine the benefits of the specific TACT project, and to establish the best estimate of its effectiveness in terms of reduced crash frequency and severity;
- To find at least one weakness in each of the TACT components;
- To overcome these weaknesses by formulating recommendations for future TACT projects; and
- To seek out and establish, if possible, new and creative strategic approaches toward reducing the frequency and severity of CMV involved crashes.

1.3 Example Background Sections

This section presents examples of the type of introductory information that might be included in a TACT evaluation. Generally the background material should cover enough of the history of the program to enable the evaluation to be placed in its proper context. The following subsections present the introduction to the first TACT evaluation and the added history for the evaluation of the smaller project that was implemented in June 2011. Examples from both of these evaluations will be given in the more detailed planning and evaluation illustrations in subsequent sections of this report. Some of the general statistics have been update to the most recent compete available year (CY2010 for Alabama) in order to make the examples more current.

1.3.1 Background – First TACT Evaluation in Alabama

This example of background information was extracted from the original TACT program evaluation that was completed in September 2010, which was before the 2010 data were available. However, to make some of the introduction paragraphs more useful and current, the numbers have been updated to those obtained after the 2010 crash data closeout, and they are inclusive of 2008-2011 data through the equivalent of about August 15, 2011. However, the rest of the example background material will be from the time span of the original TACT project.

Nationally, since 2008 approximately 4,000 people have died annually in large truck crashes, and over 100,000 were injured (http://www.fmcsa.dot.gov/safety-security/tact/resources.htm). In calendar year 2010, Alabama had 8,914 CMV crashes of which 114 were fatal crashes that resulted in 127 fatalities (one of the crashes caused 4 fatalities). These crashes are quite often very spectacular and severe mainly due to the physics involved. A small passenger car does not

have much of chance up against an 18-wheeler. In the 2008-2011 (most current 3.71 years) data, the total number of crashes, fatalities and injuries is given in the following table:

Severity Indicator	Number (2008-2011)	Number per Year
Total Crashes	29260	109.2
Injuries	17301	4665.4
Fatalities	405	789.3

The driving public tends to blame trucks for most car-truck crashes. This would seem to be a reasonable assumption, given the increased size and reduced maneuverability of most commercial motor vehicles (CMV). Recognize first that if fault is divided evenly between any two types of vehicles that crash, it can be reasonably be expected that each will be causal in 50% of the crashes in which they are involved. Now consider the following percent of car-truck crashes caused by CMVs 2008-2011:

	% Caused by CMV
All Crashes	43.0%
Injury Crashes	39.8%
Fatal Crashes	20.8%

In all cases the trucks were assigned by the reporting officers to be the causal vehicle well under half of their expected value of 50%, which is obviously statistically significant at the highest level of testing.

In two-vehicle fatal crashes, nearly 80% are indicated to be caused by the personal motor vehicle. It is very clear that if fatalities and severe injuries are to be reduced, then there must be a collective effort on the part of both the truckers and the private motorists to work on eliminating these crashes.

Passenger cars can often be observed rushing around 18 wheelers, cut them off getting back into the right lane, and then slow down. Likewise, big trucks can be observed exhibiting aggressive behavior such as tailgating cars. These are the types of behaviors that can easily lead to fatal crashes, especially since the larger vehicles do not have the maneuverability or the breaking capabilities of the smaller vehicle. It is up to those driving the personal vehicles to make themselves visible, stay out of the blind spots, and to the extent possible, just stay as far away from the larger vehicles as possible. At the same time, it is imperative that truckers have respect for their four-wheeled counterparts as they share the road. This must be a cooperative effort.

To help reduce crashes and fatalities, Congress directed the Federal Motor Carrier Safety Administration (FMCSA) and the National Highway Traffic Safety Administration (NHTSA) to work together to educate motorists on how to share the road safely with commercial motor

vehicles (CMVs). The result of this government collaboration was the development of the Ticketing Aggressive Cars and Trucks (TACT) program—a high-visibility traffic enforcement program that uses communication, enforcement, and evaluation activities to reduce car-truck crashes, fatalities, and injuries.

As part of this effort, in the fall of 2004 Washington State was selected as the first pilot State for the Ticketing Aggressive Cars and Trucks (TACT) program. Based on the success of the Washington State TACT program and other traffic enforcement programs, FMCSA encouraged additional States to undertake TACT programs on roadways with injuries and fatalities resulting from crashes between cars and trucks. A second state (North Carolina) was funded for a follow-up effort. This was quickly followed by three additional states – Georgia, Kentucky and Pennsylvania. Currently there are 16 States participating in the TACT program: Alabama, Connecticut, Georgia, Indiana, Kentucky, Maine, Montana, Nevada, New Jersey, North Carolina, Oregon, Pennsylvania, Rhode Island, South Dakota, Texas, and Washington.

According to the TACT State Resource Toolkit (http://www.fmcsa.dot.gov/documents/safety-security/TACT-Toolkit-Users-Guide.pdf), "the *Ticketing Aggressive Cars and Trucks* (**TACT**) Program is an evidence-based traffic enforcement model that can help States reduce crashes between large trucks and personal vehicles, by promoting safe driving behavior around commercial motor vehicles (CMVs)." TACT's goal is to deter unsafe driving behaviors by personal vehicle and commercial motor vehicle drivers when they interact to share the road, and thereby reduce CMV-private vehicle crashes, injuries, and fatalities.

Alabama got involved with the National TACT program with planning efforts for a TACT Readiness grant application. The effort involved the Alabama Department of Public Safety (DPS) Motor Carrier Safety Unit (MCSU), which began conducting high visibility enforcement details in May 2008. This was not the main TACT program; it was implemented to collect data in support of the TACT Readiness grant application. This effort was followed up in May 2008 by two separate enforcement details from which data were collected. The first of these utilized Highway Patrol supervisors and resulted in a total of 832 citations issued over a two-day period. The entire Highway Patrol Division was involved in the second detail, and 16,281 citations were issued to a combination of CMVs and personal vehicles for TACT-emphasis offenses. This led to a pre-TACT meeting in November 2008, where 21 local law enforcement agencies participated. The agenda covered TACT goals and the role that local agencies would play.

Shortly before the Alabama TACT program was fully initiated, a news conference was called by Col. J. Christopher Murphy, Director of DPS, to announce the program. In additional to Col. Murphy, the following individuals took part in the news conference:

- Darrell Ruban, FMCSA Southern Service Division field administrator,
- Judy C. VanLuchene, FMCSA division administrator,
- Joe McInnes, Director of the Alabama Department of Transportation (ALDOT),
- Frank Filgo, president and chief executive officer of the Alabama Trucking Association (ATA), and
- Several local law enforcement agencies that have partnered in commercial vehicle enforcement.

This news conference was followed immediately by a press release. There were also a number of local TV news reports on the TACT program that were initiated by the various DPS posts over this time frame.

This participation showed the cooperation of not only the federal, state and local law enforcement, but also the trucking industry through its recognized trade association. The major reason for this cooperative support for TACT is that all of these agencies and companies have much to gain from increased safety in and around commercial motor vehicles, which is the primary goal of TACT. The accomplishment of this goal depends upon the realization of the various objectives established for the program. These include the following:

- Detect and respond to offenses in the commercial vehicle environment whether they be committed by the truck driver or the private motorist.
- Focus especially on those offenses and driver behaviors that cause severe (fatal or severe injury) crashes as given by information generated from past car-truck crash records; among there are the following contributing circumstances (offenses):
    - Unsafe lane changes (e.g., too close to trucks when passing),
    - Following too closely,
    - Failure to signal lane changes,
    - Failure to yield the right of way,
    - Speeding,
    - Erratic driving (e.g. inconsistent speeds and braking) while around trucks,
    - Remaining in trucks' blind spots for unreasonable time, and
    - Any other unsafe or risky behavior, or any combination of these unsafe acts.
- Concentrate especially on aggressive driving. Since the motivation for multiple offenses usually involves some emotional issues, the combination of two or more offenses by a given driver is defined to be *aggressive driving*; as indicated by the TACT program name, aggressive driving by either car or truck drivers was given special attention, and the maximum citations were given.
- Condition officers to look for and be more aware of violations in the commercial vehicle environment.

- Prevent future unsafe activities through a combination of Public Information and Education and the continued threat of strict enforcement.
- Demonstrate how crash and citation data can be used to guide, not only the design of the program details, but also the evaluation of its effects.

This goal and these objectives established a firm basis for moving ahead with the program.

Prior to the program, the Critical Analysis Reporting Environment (CARE) system was used to run several "hotspot" analyses to determine the best possible locations for the selective enforcement portion of the program. This was done with the aid of the University of Alabama's Center for Advanced Public Safety (CAPS), which also developed an interactive Web site whereby officers could locate the hotspots throughout the state. (See http://caps.ua.edu/ for additional information on CAPS.) In particular, locations were sought that were especially over-represented in car-truck (CMV) crashes in which the causal vehicle was guilty of one or more of the offenses listed above (as opposed to crashes in general). Details of the location selection are given in the project description below.

The first MCSAP funding received from the Federal Motor Carrier Safety Administration (FMCSA) for TACT was in April 2009 for purposes of taking the experience to date and applying it to a full-blown TACT effort, including an evaluation component to assess changes in crashes and citations as well as driver behavior and awareness. The $645,000 grant DPS received from FMCSA, was matched by a major part of the effort that involved all DPS posts and several local agencies.

The program itself involved two major components – a Public Information and Education (PI&E) component and a selective enforcement (SE) component. PI&E involved both industry and media participation. The SE involved the working special details in seven time periods between early September (Labor Day) and the end of the year. These efforts involved local agencies, general DPS Highway Patrol officers, and special DPS Motor Carrier Safety Unit (MCSU) officers. Enforcement details were scheduled for the following periods:

- September 6-12, 2009 (1 week)
- October 4-17, 2009 (2 weeks)
- November 15 – December 12, 2009 (4 weeks).

The first two of these time slots (about three weeks total) were worked by both the DPS and the local city CMV-certified officers. The final period was worked only by DPS. Details of the particular hours worked and the issued citation types are given in the project description below.

The PI&E effort for TACT was a joint effort led by the Department of Public Safety, but also heavily involving the Alabama Department of Transportation (ALDOT), the Alabama Trucking Association (ATA), and the Federal Motor Carrier Safety Administration (FMCSA). This part of the program had the goal of educating motorists about safely sharing the road, and it was implemented through posters, electronic message boards, and displays on commercial motor vehicles.

The Alabama Trucking Association enlisted six of their members to donate one trailer each for the installation of TACT graphics, as shown in Display 2.1.1 of the original evaluation report (24). Generally referenced as trailer "wrappers," these mobile billboards were on the road throughout the TACT program.

The posters that were ordered and distributed as part of the TACT program carried the basic TACT message, as illustrated in Display 2.1.2 of the original evaluation report for Alabama (24). Over 150 posters were produced, and they were distributed to drivers' license offices, rest areas, trooper posts, DPS headquarters, truck stops and trucking companies. The Alabama Department of Transportation also provided two electronic message boards that were illustrated in the first report (24).

In summary, the TACT program combined outreach, education, and evaluation with targeted enforcement activities to raise awareness among car and truck drivers about unsafe driving behaviors, several of which were mentioned above.

1.3.2 Example Background Update from Recent TACT Project and Evaluation

The following is a 2010 update of Alabama large truck crash statistics derived from the Fatality Analysis Reporting System (FARS) & the Motor Carrier Management System (MCMIS) as given on http://ai.volpe.dot.gov/crashprofile/crashprofilemainnew.asp?STATE_ID=AL&dy=2010:

- 2,074 large trucks and 144 buses involved in non-fatal crashes,
- 907 large trucks and 78 buses involved in injury crashes,
- 1,274 injuries in crashes and 161 injuries in crashes involving buses,
- 1,167 large Trucks and 66 buses involved in tow-away crashes,
- 5 Large trucks and 0 buses involved in hazmat (HM) placard crashes.

The above shows the overall scope of the problems of commercial vehicle crashes that are being addressed by TACT programs.

The most recent TACT project that was considered in the model evaluation project was originally planned to consist of a number of waves of TACT selective enforcement accompanied

by a PI&E effort that included two billboards on I-59 near Tuscaloosa, Alabama. The original start date was set for mid-February. However there were delays in getting the billboards designed and contracts negotiated that delayed the project one month. In mid-April a round of tornadoes further delayed the project in that patrol officers were sidetracked to the affected areas and it was determined that the billboards would not be created until the officers were ready to be allocated to the selective enforcement effort. Then, on April 27, 2011 a major tornado disaster in the Tuscaloosa and several other diverse areas of the state further occupied the majority of DPS patrol officers for several weeks. These tornado incidents were well documented in the National news and will not be described further here.

The billboard provider was quite patient and implemented the billboards on or about June 1, 2011. The patrol officers, however, were not available until June 15th when the full project actually started. This did provide two weeks of "billboard only" treatment that could provide information for the evaluation effort. The selective enforcement portion of the project continued through the end of June, and it involved about three TACT-dedicated officers working in the vicinity of the billboards. While this was a microscopic effort compared to the original massive statewide project, it accomplished the purpose of enabling observational and other types of studies to be exercised, and to provide examples of how even the smallest of TACT efforts can be effectively evaluated.

2.0 Literature Review and Guide to Using this Document

2.1 Literature Review

This section will reference (by number) the annotated literature review given in Section 8. As a summary to that, the following is a categorization of the references found:

- Alabama websites/reports referencing TACT and CARE (13, 21, 26, 27);
- Federal websites/reports referencing TACT (2, 3, 4, 8, 14, 17, 20, 23, 28, 29, 30, 31, 32; 33, 34, 35);
- State level evaluation studies (1, 5, 9, 10, 11, 16, 18, 19, 22, 25; 37);
- Published evaluation studies (15);
- TACT alternative approaches and TACT enhancements (6, 7, 12, 36).

Of particular mention is an FMCSA publication called *A Guide for Planning and Managing the Evaluation of a TACT Program* (33), which is a forerunner of the current document. This *Guide* is an excellent description of the TACT program structure and the integration of evaluation into that structure. It contains very useful checklists, especially the administrative and effectiveness evaluation metric checklist in Appendix A. Since it was assumed that all TACT managers and evaluators will avail themselves of this *Guide*, no attempt was made to replicate this material either in the Methodology Manual or the current document. A review of this *Guide* is highly recommended before applying the recommended procedures in the Methodology Manual.

To most impressive state-level evaluations found were from North Carolina, Kentucky, Pennsylvania and Washington State. These all involved external experts (from universities and consulting firms) who were retained specifically for the evaluation of specific TACT projects. This is certainly commendable, and their reports provide impressive targets for the evaluation of future TACT projects.

It was the goal of the current document and the model project, however, to enable relatively skilled in-house analytical individuals to perform the actual evaluations, perhaps with a small number of days of advisory assistance from an outside consultant. The current report is not meant to replace the retaining of experts if resources to that effect are available. However, it would be expected that if this is the course chosen by the state, that the expertise of the consultant group chosen would be such to enable them to go beyond the analytical techniques that recommended in this report (as was the case in these reports). It may be infeasible for states to bear the continued cost of such consultants for all future TACT projects, and an ongoing integrated evaluation presence is necessary for continuous improvement forever. This is not a criticism of these excellent efforts; it is just a statement that their one-time intensive evaluations are different in scope and application from the methodologies documented in this report. The cost and benefit of evaluation has to be balanced against the sacrificed hours of selective enforcement and PI&E.

2.2 Guide to Using this Document

As indicated above, this document is intended to serve as a supplementary resource to the Methodology Manual a checklist for project administrators and evaluators. *The section numbers of this document are generally identical to the corresponding section numbers in the Methodology final report,* thus providing a direct means for referencing additional information on any given subject. Generally the reader will not be reminded that the Methodology Manual is the overall guide to be used first, and that the materials in this Supplemental Report are intended to provide examples and more detailed instructions.

The topics are considered in the same (chronological) order as they are expected to be implemented for any particular *project.* It is expected that the entire TACT *program* that is implemented by a state will consists of several such projects, often referenced as *waves* or *details*. Programs (consisting of a series of projects) are usually defined by an allocation of funds to TACT for a given period of time. The approach toward evaluation given here applies to one project at a time, and not necessarily to the entire program (depending on how large or over what period of time the program is implemented).

The evaluation itself should be viewed as two separate entities:

- Administrative evaluation – a series of ongoing measurements to verify that the projects (and ultimately the program) accomplish the activities that were specified in the project plan (e.g., 1000 hours of TACT-related overtime). For additional administrative purposes, data on the actual activities will be accumulated (e.g., names involved, times, locations, etc.), and this information could be extremely useful in the effectiveness evaluation. For example, the specific times, officers involved and locations might be applied to determine the particular citations that were issued as a result of the program.
- Effectiveness evaluation – measurements to determine the effectiveness of the particular project (or combination of projects) in bringing about the program goals. For example, a goal might be to reduce the proportion of CMV-related multiple vehicle crashes that are caused by young drivers.

For funding and accountability purposes, generally all projects within a program will be given the same administrative evaluation. However, program resources allocated to the effectiveness evaluation will generally not allow all of the projects to be given the same intensive consideration. Thus, considerable up-front planning must go into determining the particular evaluation metrics that will be applied and the set of projects to which they will be applied. The sections below are generally in chronological order starting from the planning process before the project(s) to be evaluated and continuing through to the statistical analysis of the evaluation metrics.

To summarize, these various sections follow the same numbering scheme as in the Methodology Manual that should accompany this document. The Methodology Manual documents the steps necessary to perform the evaluations. This document provides the examples that illustrate these steps. While much of the information contained in this document is quite valuable from the point of view of assessing the value of TACT programs in general, *the purpose of this document is not to present evaluation results per se.* It is to rather to illustrate by giving examples of the documentation that would accompany a sound evaluation.

3.0 Preparation for the Project

3.1 Establishing the Project Plan

In most cases TACT programs supported by federal funds will require a project plan prior to the approval of funding. The project plan does not need to be long and complex – it just needs to specify what is currently known and anticipated about the project. Further, the plans are tentative and dynamic – they should not lock in decisions that may be improved with more current information. For example, as the problem identification is performed for the project it will generally modify the project parameters that were originally assumed. Plans should be considered for:

- The overall selective enforcement project itself;
- The PI&E effort;
- Observational studies;
- Special emphasis areas and their analyses;
- Administrative evaluations

These will be covered in the 3.1 subsections.

Plans often emanate from meetings, and it is quite important that all meetings are followed up with minutes that, in essence, document that plans as they evolve.

3.1.1 Plan for the Selective Enforcement Project Itself

Following the check-list in the Methodology Manual, the following is an example plan for the TACT program implemented in early spring 2011 in Alabama:

- Who will be involved? The DPS Motor Carrier Safety Unit (MCSU) will provide the management and most of the officers for conducting the selective enforcement details. As in past details, local law enforcement who are trained in CMV enforcement will be recruited as part of the effort.
- What specifically will they be instructed to do? In particular, how will the TACT project be different from their normal details? Most of the involved officers are experienced in TACT operations. However there will be training as to the particular TACT-related, and new officers will be given more intensive training. This training will take place about two weeks before the start of the project.
- How much time will each of them be allocated to accomplish their tasks? As part of the training prior to the project, each involved officer will be informed as to the amount of normal and over-time that will be allocated to the project.

- Where will they be required to perform these activities? As determined by the problem identification effort discussed in Section 3.2 below, the sections will include major sections of I-59.
- When will they do it? The general time frame will be March 27 through April 30, 2011. They will put special emphasis on TACT on weekdays immediately after the early rush hours.
- Are there any special support resources that they will need (e.g., training)? Some overtime funding is being reserved for the project.
- What administrative requirements will need to be met (see administrative evaluation recommendations below)? Officers will complete their standard TACT web based time sheets (discussed in Section 3.1.6)

3.1.2 Plan for the Public Information and Education (PI&E) Effort

Plans for the PI&E effort included billboard design and implementation and earned media involvement. The following responds to the planning questions with regard to the PI&E component of the project:

- Who will be involved and in what capacity? A person was assigned the task of working with a university-based art department and establishing a competition among teams to design the billboards. The final selection would be made by the Steering Committee. The selected billboard artistry would also be used in a poster that would be distributed to rest areas and universities first in the area of the SE during the time of the SE, and ultimately to all that could be reached statewide. The DPS publicity director assigned personnel to coordinate the media efforts, which would include some media ride-alongs.
- What resources are available. The resources for the PI&E efforts for this project were quite limited – a total of $16,000 for all costs incurred.
- Where will they be required to perform these activities? The specific locations for the billboards could not be specified at this time since costs and location availability had to be determined. However, generally they would be in the I-59 corridor as close to Tuscaloosa as possible in order to take advantage of the younger drivers in that general area (see Problem Identification, Section 3.2 for the decision to concentrate on younger drivers). Note: while the PI&E concentrated on younger drivers, there was no attempt to profile the SE effort in this regard – involved SE field officers were not aware that the PI&E efforts were targeted at younger drivers.
- When will they do it? – Immediately prior and then concurrently with the SE efforts.
- Are there any special support resources that they will need? In this case some special resources were used for purchasing and for the billboard design.
- What administrative requirements will need to be met (see administrative evaluation recommendations below)? It is essential to document the times and places of each of the

PI&E efforts, especially if they are not timed simultaneously with the SE effort. While the plan is to have them occur simultaneously, events out of the control of the TACT administrators may prevent this from happening.

3.1.3 Plan for the Use of Crash, Citation and Survey Data

This will be considered in terms of the four areas of evaluation that were considered as part of this project:

- Crash and citation data.
- Driver survey
- Law Enforcement Survey
- Trucker Survey

3.1.3.1 Crash and Citation Data

The crash and citation comparative evaluations (before-during-after) did not require any special planning efforts for the Alabama projects, since there are systems in place that both capture all of the data needed (eCrash and eCite) and perform the necessary analysis (CARE) on these data for their accomplishment. This would be true in all states that have electronic crash and citation systems, and in most that have paper entry systems as well. If this is not then case, then some special provision would have to be made before the project to assure that these data would be available for the evaluations. As an example, prior to the eCrash system being installed in Alabama it was impossible to utilize the crash data for any type of comparisons for at least three months after the project was over, since the latency in getting the data into the database required a manual entry that tended to be unpredictable. Similarly, access to citation information was quite difficult. In situations like this it would be essential to obtain permissions from the database administrators prior to the project to make the data available to the project team as soon as practical. In some cases special data collection might be required for the relatively few crashes that involving CMVs. The most important part of the planning is to assure that sufficient data are available for the "before" time period. In most cases these data have been collected continually for a number of years, so it is just a matter of obtaining the data from the appropriate database.

It is important that the filters be defined to include those crashes and citations of interest. This presented somewhat of a problem for Alabama since there was a major change of reporting over the time span of the study. In June 2009 an electronic crash (eCrash) system began to be deployed throughout the state, beginning with the Department of Public Safety, which reports the vast majority of CMV crashes (all on the state and Interstate highway systems). An integrated dataset was formed of both the old paper system and the new eCrash gathered data. The crashes that were identified as involving heavy trucks and/or CMVs had the following characteristics

(note that E indicates that the record was generated with eCrash, while P indicates that it was generated from a paper form):

(D101 = E Single-Unit Truck 3 Axles or More
OR E Truck Tractor with Trailer
OR E Truck Tractor Only - Bobtail
OR E Tractor/Semi-Trailer
OR E Tractor/Doubles
OR E Tractor/Triples
OR E Other Heavy Truck -- Cannot Classify Otherwise
OR E Mobile Home Transport
OR E Maintenance/Construction Vehicle
OR P Truck Tractor
OR P Other Truck
OR P Commercial Bus)
OR
D103: Commercial Motor Vehicle Indicator = Unit is CMV

The rationale for this filter was that the TACT program is not limited to reducing crashes to only CMVs, but on the other hand, all CMV crashes should be included. Thus, both the body style and the CMV crash indicator were used in creating the filter. This filter definition, or slight derivations from it, was used in all of the before and after comparisons.

3.1.3.2 Driver Survey

In the Alabama example, it was determined to perform driver surveys utilizing drivers' license renewal offices (DLRO). This had several advantages over alternatives that were proposed: (1) they were readily available and could be targeted to the test and control areas under consideration; (2) they were under DPS control, and DPS was a fully participating partner, not only in the TACT program but in the evaluation process; and (3) they would by their very nature generate a random sampling of drivers, since there is very little (if any) demographic bias as to who comes in for renewal during any given time period. Display 3.1.3.2 shows the locations of the DL offices (Lee, Macon, Shelby and Tuscaloosa counties) surveyed relative to the hotspot corridors and the State as whole.

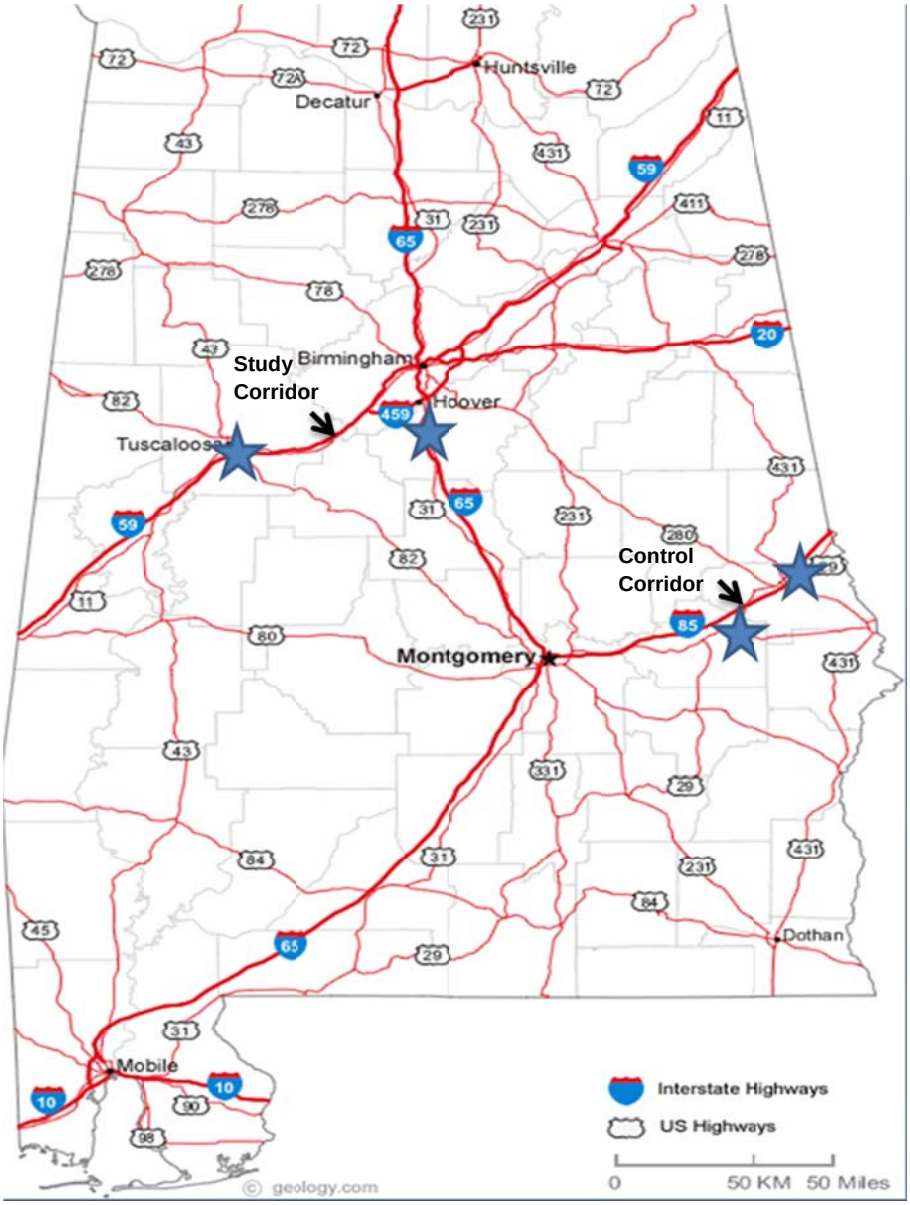
This last point needs some qualification. Certainly there might be a geographical demographic bias. However, this would be beneficial to the study since it would tend to include those drivers who should have been exposed to the project from the test area, and not exposed to it for the control area. The only thing that would create a bias could be the reluctance of some subsets (e.g., an age subset) of the population of drivers having their licenses renewed that might be

reluctant to take the survey. The survey was totally voluntary, so if there were ages, races, gender or other factors that would make one subset more apt to take the survey than another, this could bias the results. However, for the most part this would be automatically adjusted since there was no reason to expect that this bias should be any different in the test area than in the control area. Nevertheless, this potential bias should not be ignored, and demographic information on the survey itself (age, gender, etc.) can be used to determine if this is a significant factor or not, and if the test areas are different in these factors from the control areas.
While using the drivers' license renewal offices (DLROs) seemed simple enough, there were still a number of issues that needed to be resolved:

- General permission and then specific contact of the commanders of each of the DLROs that were to be involved (this was handled by the participating DPS officers);
- An overall information sheet for the DLRO commander and staff (see Display 3.1.3.2a below);
- An instruction sign for the participants (see Display 3.1.3.2b below);
- The design of the survey form itself (see Display 3.1.3.2c below);
- A determination of the number of forms to be printed (in this case 100 per month per DLRO was seen to be a sufficient sample for statistical validity);
- Assurance that the specific DLRO was identified on the form (in this case different color forms were used to keep things from getting confused).

The survey form itself was patterned after that used in Washington State (19). Several data elements were eliminated and refined in order to make the form as simple as possible. One goal was to get it down to one side of one page so that it would be much more acceptable to those who were completing the form and thus obtain a greater sample size. However, no data elements that were necessary to the planned analyses for these data were sacrificed. Another goal was to avoid being unnecessarily intrusive if, in fact, a data element was either not needed for the analysis or could be obtained by other means.

Display 3.1.3.2 Location of DLROs relative to Study and Control Corridors



Display 3.1.3.2a Information Sheet for DLRO Commander and Staff

Date

Subject: TACT Surveys

Driver License Office Chief:

The Alabama Department of Public Safety is working with the University of Alabama on a study to determine the effectiveness of various countermeasures with regard to the Ticketing Aggressive Cars and Trucks (TACT) projects that are currently on-going in the state.

The Federal Motor Carrier Safety Administration (FMCSA) is particularly interested in safety project evaluation, and they have made evaluation an essential part of the TACT projects.

Officers will be bringing a stack of survey forms to your office near the first of each month. There will be a brief sign accompanying the surveys that will provide instructions for the general public. No action will be required on the part of your staff – everything should be self-explanatory. If this is not the case, please let us know.

It is imperative to the study that a continuum of results be obtained on a monthly basis. For this reason you can expect an officer to exchange the completed forms with a fresh batch of new forms at the beginning of each month. This will continue for several months, probably into the summer of 2011.

I know that you want to support this effort and help Alabama and the country in making decisions that will enhance the effectiveness of our TACT projects. Please do all that you can to support the survey and to assure that the results obtained are objective, representative and accurate.

We appreciate your cooperation and support.

Sincerely,

Display 3.1.3.2b Instruction Sign for Participants (Drivers)

PLEASE HELP

WE NEED YOUR INPUT

Please Complete One of These Quick Survey Forms

It Won't Take a Minute and it is Totally Anonymous

PLACE IN BOX WHEN COMPLETED

Thank You for Helping Save Lives in Alabama

Display 3.1.3.2c Drivers Survey

Date:* **Location:***

1. Do you feel comfortable driving around large trucks?

☐ Yes ☐ No

2. Which of the following do you think is important when driving around large trucks? (Check one)

☐ Do not pull in front of a truck and slow down

☐ Do not tailgate trucks

☐ Stay out of the truck driver's blind spots

3. Have you recently read, seen or heard anything about giving large trucks more space (check all that apply)?

☐ Yes, on TV

☐ Yes, on a billboard

☐ Yes, on the radio

☐ Yes, in the newspaper

☐ Yes, in a brochure

☐ None of the above

4. Has this information changed how you drive around trucks?

☐ Yes ☐ No ☐ Have not seen or heard this information

5. Do you know the name of any programs related to safety around trucks in Alabama? (check all that apply):

☐ **Trucks Need Space Too** ☐ Share the Road ☐ *Stay Safe, Give Trucks Space* ☐ Click It or Ticket

6. About how many miles did you drive last year?

☐ I do not drive

☐ Less than 5,000 ☐ 5,000 to 15,000 ☐ 15,001 to 20,000 ☐ More than 20,000

7. What type of vehicle do you drive most often?

☐ Passenger car ☐ Pickup truck ☐ Sport utility vehicle ☐ Mini-van ☐ Full-van

☐ Semi truck ☐ Motorcycle ☐ I do not drive

8. Are you (or have you ever been) a commercial truck driver?

☐ Yes ☐ No

9. Your age:

☐ Under 21 ☐ 21-25 ☐ 26-39 ☐ 40-49 ☐ 50-59 ☐ 60 Plus

10. Your gender:

☐ Male ☐ Female

11. Your Zip Code: _____

* The Date and Location fields were located in the Word margin to prevent them from being altered by the survey participants.

3.1.3.3 Law Enforcement Officer Survey

The law enforcement officer was considerably simplified compared to that of the drivers because it was internet-based. The URL was given to the officers involved in the study and they obtained the involvement of other officers in completing the survey before and after the specific TACT project. The following provides an example survey that was implemented for the Alabama projects.

Display 3.1.3 Law Enforcement Survey

The following survey is part of an evaluation that is required for the Ticketing Aggressive Cars and Trucks (TACT) program. It is very important that we obtain this information and that you provide candid and accurate responses to the best of your ability. The responses are anonymous, and they will be entered into a database without identifying information prior to any processing. With the possible exception of suggestions, all results will be reported in summary form. We appreciate your participation and assistance with this survey.

1. My Participation in the TACT program was as:

☐ A field enforcement officer ☐ An administrator

2. The extent of my participation was:

☐ Less than 5 hours ☐ 21 – 50 hours

☐ 5 – 10 hours ☐ Over 60 hours

☐ 11 – 20 hours

3. To what extent do you see TACT activities to be different from your normal patrol activities?

☐ **Not very much at all** ☐ **Quite a bit different**

☐ **Somewhat different** ☐ **Completely different**

4. I believe that it is best to perform TACT type of enforcement:

☐ **On my own** ☐ **As part of a coordinated statewide TACT program**

5. Since being involved in the TACT effort, I have been more aware of traffic offenses that involve interactions between cars and trucks:

☐ True ☐ False

6. Being more aware of traffic offenses that involve interactions between cars and trucks has led me to issue more citations for these types of offenses even after the TACT program was over:

☐ True ☐ False

7. Feedback that I have received from truckers as to the value of the TACT program has been:

☐ More positive than negative

☐ About the same, positive and negative

☐ More negative than positive

8. Feedback that I have received from the general public as to the value of the TACT program has been:

☐ More positive than negative

☐ About the same, positive and negative

☐ More negative than positive

9. Do you believe that the traffic law enforcement associated with the TACT program accomplished its objectives of changing driving behavior and saving lives?

☐ Yes ☐ No

3.1.3.4 Trucker Survey

Similar to the law enforcement officer survey, the trucker survey was considerably simplified compared to that of the drivers because it was also internet-based. The URL was given to the Alabama Trucking Association (ATA), and it encouraged its members to participate in completing the survey before and after the specific TACT project. The participation in the survey was completely voluntary and totally anonymous. The introductory paragraph was identical to that given for the officer survey above. The following provides an example survey that was implemented for the Alabama projects.

Display 3.1.3 Truck Driver Survey

1. My Participation in the TACT program was as:

☐ A truck driver ☐ A trucking company administrator

2. My participation in the program involved:

☐ No exposure to TACT program public service announcements
☐ A few observations to these announcements
☐ Several observations of these announcements
☐ Seeing these announcements almost every day during the program

3. To what extent did the TACT program change the way you view four-wheelers?

☐ **Not very much at all** ☐ **Quite a bit different**
☐ **Somewhat different** ☐ **Completely different**

4. I believe that the problem of car drivers not driving properly around trucks can be best addressed by:

☐ **Methods other than TACT that have been used in the past** ☐ **Implementing a coordinated statewide effort, like the TACT program**

5. Since being involved in the TACT effort, I have been more aware of traffic offenses that involve interactions between cars and trucks:

☐ True ☐ False

6. I believe that the TACT program:

☐ Was biased towards the private vehicle driver
☐ Was trying to be fair in addressing offenses of both cars and trucks
☐ Was biased toward trucks

7. My feelings as to the overall value of the TACT program is:

☐ More positive than negative ☐ More negative than positive
☐ About the same, positive and negative

8. Feedback that I have from the general public as to the value of the TACT program has been:

☐ More positive than negative ☐ More negative than positive
☐ About the same, positive and negative

9. I know of at least one trucker who received a ticket as a result of the TACT program:

☐ True ☐ False

10. Do you believe that the traffic law enforcement associated with the TACT program accomplished its objectives of changing driving behavior and saving lives?

☐ Yes
☐ No

3.1.4 Plans for Conducting Observational Studies

3.1.4.1 Considerations from the North Carolina TACT Evaluation

Cunningham, et al (25) conducted an excellent and intensive study of the North Carolina TACT projects. These results constitute a major contribution to the TACT program, and a discussion of their methods provides a good introduction into the subject for this section. Consider the following quotes from this effort:

- Justification for observational studied: "Documentation of how many speeding tickets from past evaluation efforts are issued during a TACT enforcement phase does not constitute evidence that vehicle speeds and following distances have been affected by enforcement presence. Neither do measures of TACT "media recognition" constitute evidence that TACT efforts have resulted in measurable changes in critical driver behaviors. Instead, data should be defensible and based on the effect of the treatment being employed, in this case public awareness/education campaigns and focused enforcement."
- Limitations in the police officer observation – either stationary or moving: "For maximum enforcement effectiveness, surveillance needs to be continuous and corridor-wide in its coverage, in addition to its ability to produce measurable detection evidence of the behaviors in question."
- Desirability of automated collection of TACT performance measures: "…it has the potential to a) greatly decrease analysis time, b) increase sample size, c) improve reliability across multiple sites, and d) eliminate human observer bias."
- Potential for totally automated data collection: "Alternatively, automated video-image processing software is commercially available that can be used to deliver lane-by-lane volumes, speeds, and classification data, and can further be adopted to identify short gaps … but the results are not necessarily tied to the selected product."
- Type of metrics collected: "It is critical for the adoption of TACT as a model program of effective enforcement that the behaviors in question be *observable* and *quantifiable*, and that a change in their frequency or rate can be shown to be associated with the presence of enforcement."

Clearly, automated data collection has not only the value of providing data for TACT evaluations, but the development of these technologies could lead to major operational data upon which to base selective enforcement tactical decisions. For example, if these monitoring tools were used and the resulting information fed to a central office, it could be then be used to dispatch selective enforcement resources to hot spots on a real-time basis. While exploring this use of the technology is beyond the scope of the model evaluation, it bears mentioning since those involved with TACT and TACT evaluations would certainly be interested in such for future applications.

It should be noted that the automated data collection documented in the North Carolina study was restricted to the following specific applications:

"Consequently, the three primary TACT performance measures are:

- RLV - Restricted Lane Violations: RLV events are strictly defined by a count of CMV vehicles in a restricted lane (if applicable). The performance measure is defined in terms of an absolute count of events, as well as a rate of RLV events over time (e.g. violations per hour).

- VPS - Violation of Posted Speed: VPS events are defined as a count of vehicles (CMV or passenger car) observed to travel more than 9 miles per hour in excess of the posted speed limit. The performance measure is again reported as a count of events (per lane), and a rate of violations over time.

- FTC - Following-Too Close: An FTC event occurs when one vehicle (CMV or car) follows the vehicle in front of it at a specified time gap that does not allow adequate reaction time if the leading vehicle were to unexpectedly apply its brakes. An FTC event is especially critical for a CMV following another vehicle, because large trucks generally cannot decelerate as quickly as passenger cars due to their larger mass. (25)"

The exact definition for what was considered to be "too close" is given in (25) and will not be repeated here. It is defined in following sections for the observations conducted under the current study. It must be noted that that a very precise and consistent definition is required for any such study to produce meaningful results.

RLV are not of concern in Alabama and many other states, so will not be further discussed here, although it should be important to those where this is relevant to explore the relationship of RLV to safety.

There exists an issue with simply judging an occurrence to be unsafe if two vehicles are less than a given distance apart. While this might be a criterion in the extreme case, the NC study indicated that it would not be useful to use the legal definition of tailgating. So many are in violation of this technical definition that it would be impossible to measure any changes in it, and the TACT program is designed to increase safety, not to enforce a rigid legal standard that is rarely reflected in driver behavior. In other words, if the overall following distances are measured and compared, and those during and after the program are significantly higher than before, this is clearly an improvement in safety (i.e., a reduction in the potential for and probability of a crash). While counting the number that fall within a minimum following

distance is certainly one way to measure this, it does not take into account another very important factor: the relative motion between the vehicles. For example, if a car is traveling 10 MPH faster than a CMV and pulls in 30 feet in front of it, that is not nearly the hazard as a car that pulls in 50 feet ahead of the CMV that is going 10 MPH slower than the CMV. While there might come a time when affordable technology is developed to measure this, currently this requires a human observer to make a judgment as to the relative hazard of various events.

Finally, hazards caused by the presence of cars remaining in CMV's blind spots for an excessive amount of time could not be considered by the automated equipment. Here again, it is not the mere presence in the blind spot that should be deemed hazardous. Rather, it is the *lingering* in the blind spot area that creates a significant decrease in safety. This requires trained human observers to detect.

No system of evaluation is perfect, and the purpose of the discussion above was not to detract from the excellent study and methods applied by the North Carolina research team. The highest degree of automated data collection that is effective in measuring unsafe events should be applied, and the North Carolina effort is an excellent step forward in that regard.

3.1.4.2 Approach of the Alabama Example

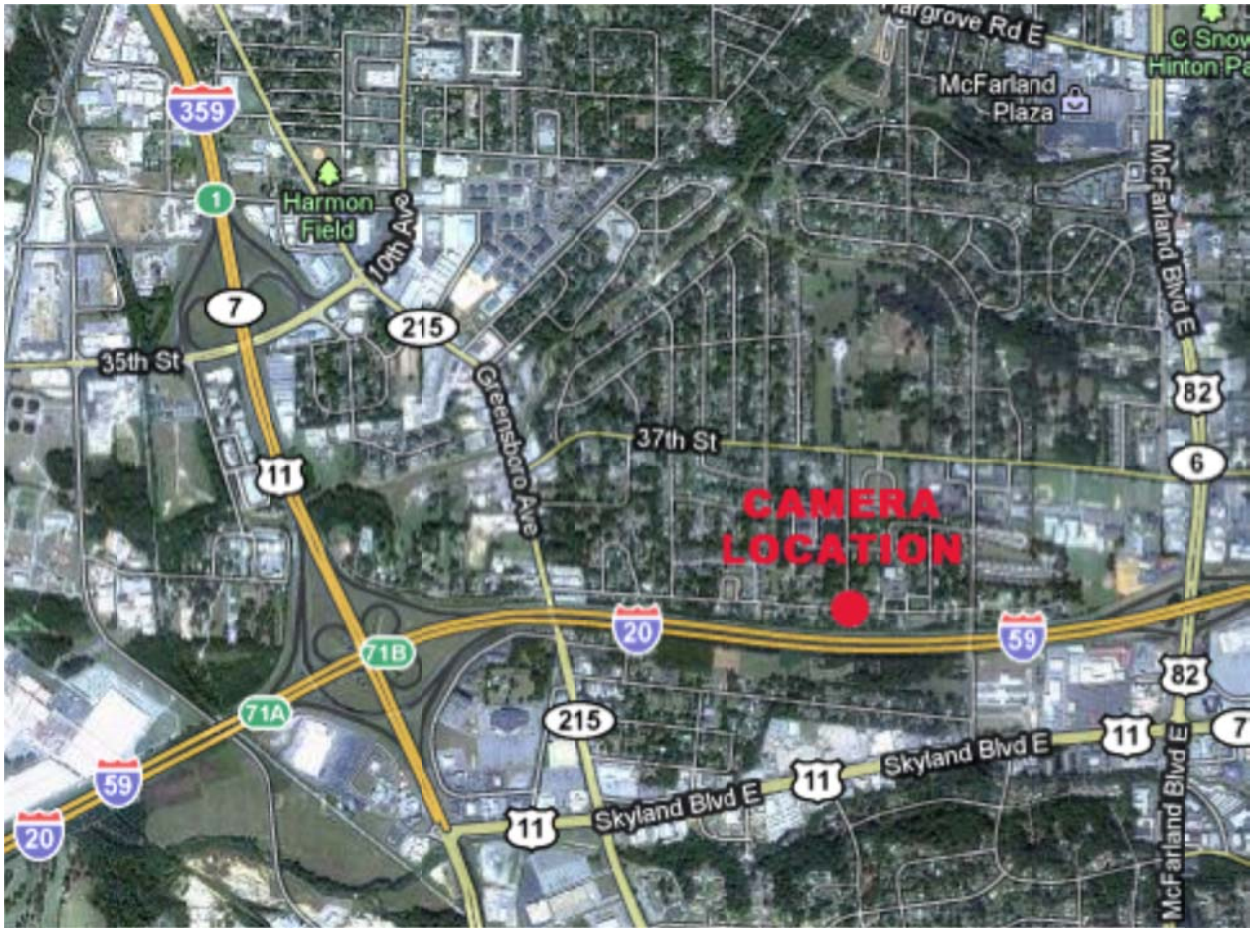
The example that is documented in this section as well as Sections 3.1.4.3 and 3.1.4.4 is motivated by the lack of any special additional equipment resources available for the evaluation, and relatively low personnel resources. The use of existing video cameras was quite efficient in that it required no new equipment purchase. It also added to the efficiency and accuracy of the evaluation in the following ways:

- It is simple and can be implemented by those of reasonable technical skills.
- A dramatically increased number of events could be captured than would ever be possible by direct observation.
- Having the events on video media enabled them to be reviewed by multiple reviewers and, if necessary, multiple times by the same reviewers.
- Markings on the roadway or environment (e.g., the roadway centerlines) can be used to gauge distances.
- Criteria were developed that placed events into very clear categories of safe and unsafe. While some events would be questionable, they could be designated as such, and the analysis could be conducted accordingly (e.g., all questionable cases could be eliminated to make the comparisons based on the clearly unsafe events, and the "middle-ground" events could be compared to see how they varied before and after or between reviewers).

3.1.4.2.1 Video Data Collection Equipment

Video data of driving behavior around trucks were collected using traffic surveillance cameras operated by the Tuscaloosa Department of Transportation (TDOT). The study camera is located on I-20/59 in the City of Tuscaloosa. Display 3.1.4.2.1 shows the location of the camera in relation to the study corridor and its environs. The camera has pan capabilities to allow different views of I-20/59. Display 3.1.4.2.1a shows screen captures of the camera views from the video data collection.

Display 3.1.4.2.1 Location of CCTV Camera for Video Data Collection



Display 3.1.4.2.1a Sample Screenshots from Video Data Collection

3.1.4.2.2 Video Data Collection Methodology

As with the survey data, the video data was collected for four study periods: *Before*, *PIE*, *PIE+Enforcement (E)* and *After*. Video data was recorded on Tuesdays, Wednesdays, and Thursdays between the hours of 7 – 9AM, 11AM – 1PM, and 4 – 6PM. The total video data collected comprised of some 38 hours of *Before*, 42 hours of *PIE*, 54 hours of *PIE+E* and 44 hours of *After* video footage. The video was recorded directly from the TDOT cameras and transferred to portable hard drives for storage, reduction and analysis.

The primary objective of the video analysis was to determine whether a measurable change in driving behavior could be observed among the different study periods. In particular, the video analysis was intended to show whether the TACT program (PI& E and enforcement) resulted in safer driving conditions.

In order to establish whether there had been a change in driving behavior, a baseline event was defined for observation within the video data. An *event* was defined as at least one truck and at least one car in the video frame within three truck lengths (approximately 180 feet) of one another. The evaluation team, in conjunction with Alabama DPS officers, developed the criteria by which unsafe events were defined. Initial video footage of various events were recorded and shown to DPS officers to allow them to identify events they deemed safe versus unsafe. After reviewing numerous events and much discussion, the following definitions of *unsafe event(s)* were used:

- *Blind Spot (BS) event*: A vehicle or truck maintaining a position in a truck's blind spot for an amount of time deemed unsafe (at least 3 seconds) without relative movement out of the blind spot. A sample screenshot showing an unsafe BS event is given in Display 3.1.4.2.2.
- *Tailgating (TG) event*: A vehicle or truck that is following the other vehicle within the average spacing for an amount of time deemed unsafe (at least 3 seconds) without relative movement away from tailgating. A sample screenshot showing an unsafe TG event is provided as Display 3.1.4.2.2a.
- *Lane Changing (LC) event*: A vehicle that pulls in front of another vehicle or truck within one truck length. A sample screenshot showing an unsafe LC event is provided as Display 3.1.4.2.2b.

A set of training videos were set aside to teach the reviewers how to identify safe versus unsafe events. The training was conducted over a one-hour period with the evaluation team and all reviewers watching the videos together. When an event occurred everyone would score it as safe or unsafe. Then all participants would share their evaluations to determine if there were any discrepancies among observers. The video would be rewound and the event would be reviewed repeatedly and discussed with the intention of developing a relatively consistent perspective among reviewers.

Display 3.4.1.2.2 Sample Screenshot Showing Unsafe Blind Spot Event

Display 3.4.1.2.2b Sample Screenshot Showing Unsafe Tailgating

Display 3.4.1.2.2c Sample Screenshot Showing Unsafe Lane Change

3.1.4.2.3 Video Analysis

Originally, a team member would watch the raw footage and clip out footage not containing an event. However, this process was deemed unnecessary because it only reduced each video by a matter of a few minutes. Rather than reducing the video, a new, simpler sampling method was developed. This was based on the concept of developing a *rate of occurrence* of unsafe events to total events. A random sample of events (as defined above) was taken from the video in one-minute intervals. Furthermore, since the camera view allowed collection of data in two directions along the study corridor, the event selected each minute was taken from alternating directions of travel.

Videos containing 6 hours of total footage were selected for each of the study periods. Each of the four sets of videos was given a name unrelated to the study period and assigned to one of the reviewers using a random number. The set of videos contained footage representing morning, midday and afternoon conditions on the study. In order to remove bias, the reviewers examined videos in sets with no knowledge from which study period the video was taken. Data from three videos from each of the four study periods were collected using the methods described in the previous section. Displays 3.1.4.2.3 and 3.14.2.3a show listing of videos for each period and the file name (indicating time-of-day, month and day). The twelve videos randomly selected for analysis are shown in *italics*.

Display 3.1.4.2.3 *Before* and *PIE* Video Files

RANDOM NUMBER	FILE NAME	RANDOM NUMBER	FILE NAME
1	Morning 3 09	20	Morning 5 25
2	*Morning 3 23*	21	Morning 5 26
3	Morning 3 24	22	Morning 5 31
4	Morning 3 30	23	Morning 6 01
5	Morning 4 05	24	Morning 6 02
6	Morning 4 06	25	Morning 6 07
7	Lunch 3 10	26	Morning 6 08
8	Lunch 3 24	*27*	*Morning 6 09*
9	*Lunch 3 29*	28	Lunch 5 25
10	Lunch 3 30	29	Lunch 5 26
11	Lunch 4 05	30	Lunch 5 31
12	Lunch 4 07	*31*	*Lunch 6 01*
13	Lunch 5 24	32	Lunch 6 02
14	Evening 3 09	33	Lunch 6 07
15	Evening 3 10	34	Evening 5 24
16	Evening 3 24	*35*	*Evening 5 25*
17	Evening 3 29	36	Evening 5 26
18	Evening 3 30	37	Evening 5 31
19	*Evening 4 05*	38	Evening 6 01
		39	Evening 6 02
		40	Evening 6 07

Display 3.1.4.2.3a *PIE&E* and *After* Video Files

RANDOM NUMBER	FILE NAME	RANDOM NUMBER	FILE NAME
41	*Morn 6 13**	68	Morn 7 08*
42	Morn 6 17*	*69*	*Even 7 08**
43	Morn 6 20*	70	Even 7 11*
44	Lunch 6 13*	71	Morning 7 05
45	Lunch 6 17*	72	Morning 7 06
46	Lunch 6 20*	*73*	*Morning 7 07*
47	Even 6 13*	74	Morning 7 12
48	Even 6 17*	75	Morning 7 13
49	Even 6 20*	76	Morning 7 14
50	Morning 6 14	77	Morning 7 19
51	Morning 6 15	78	Morning 7 20
52	Morning 6 16	79	Morning 7 21
53	Morning 6 21	*80*	*Lunch 7 05*
54	*Morning 6 22*	81	Lunch 7 06
55	Morning 6 23	82	Lunch 7 12
56	Lunch 6 14	83	Lunch 7 13
57	Lunch 6 15	84	Lunch 7 14
58	Lunch616	85	Lunch 7 19
59	Lunch 6 21	86	Lunch 7 20
60	Lunch 6 22	87	Evening 7 05
61	Lunch 6 23	88	Evening 7 06
62	Evening 6 14	89	Evening 7 07
63	Evening 6 15		
64	Evening 6 16		
65	Evening 6 21		
66	Evening 6 22		
67	Evening 6 23		

* Videos taken on a Monday or Friday during and immediately after the enforcement period

In order to simplify the procedure, it was decided that reviewers would identify 50 events from each video using the random selection method described above. Therefore, 150 events were evaluated for each of the four study periods representing traffic conditions at different times of day. Each reviewer coded the 50 videos as *safe* or *unsafe* (the type of unsafe event was coded in the comment field) in the form presented in Display 3.1.4.2.3b.

Display 3.1.4.2.3b

Event #	Time Truck Appears	Safe	Unsafe	Comment (description of event)

3.1.5 Plans for Special Emphasis Area Analyses

This report does not use the term "special emphasis areas" to refer to CMV or TACT focus violations or high crash locations (this is routine and not special). Rather special emphasis areas are intended to connote a specific driving behavior or subset of the driving population to be specifically targeted. An example of such a focus area for the recent TACT project in Alabama was the concentration on youth-caused CMV-car crashes. This was chosen because general traffic safety problem identifications for selective enforcement had shown younger drivers to be particularly problematic because of their lack of experience and inclinations to take risks. Plans to address this particular emphasis area included the assignment of additional problem identification efforts to be made so that the TACT project could be better targeted by location and time. These are shown in the related problem identification section (3.2.2) below.

3.1.6 Administrative Evaluation Plans

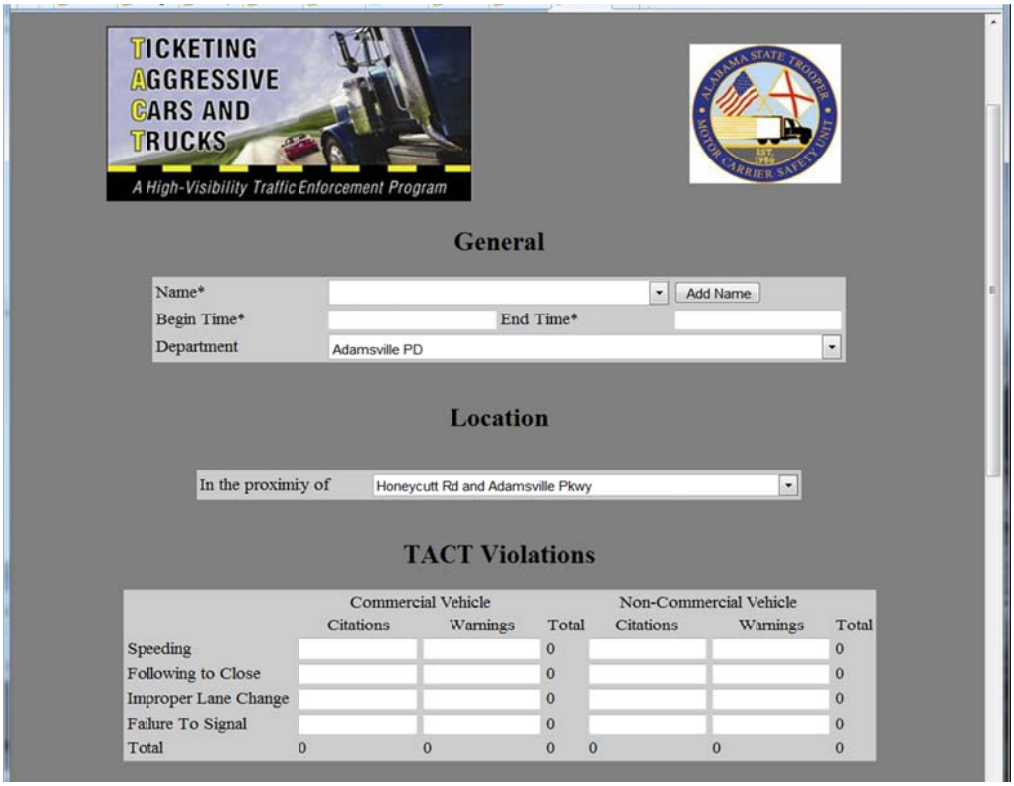
The plans for the administrative evaluation should include the development of the data collection forms and procedures for recording the relevant actions as they progress. One of the most important aspects of the administrative evaluation with respect to the effectiveness evaluation is that the administrative evaluation keep track of the times, places and activities of the project itself so that the parameters for the before-during-after citation and crash studies can be known.

This is one of the most vital (but quite often missing) information when a decision is made after the fact to perform an evaluation. There is no reason for it to be lacking if proper administrative data collection techniques are in place.

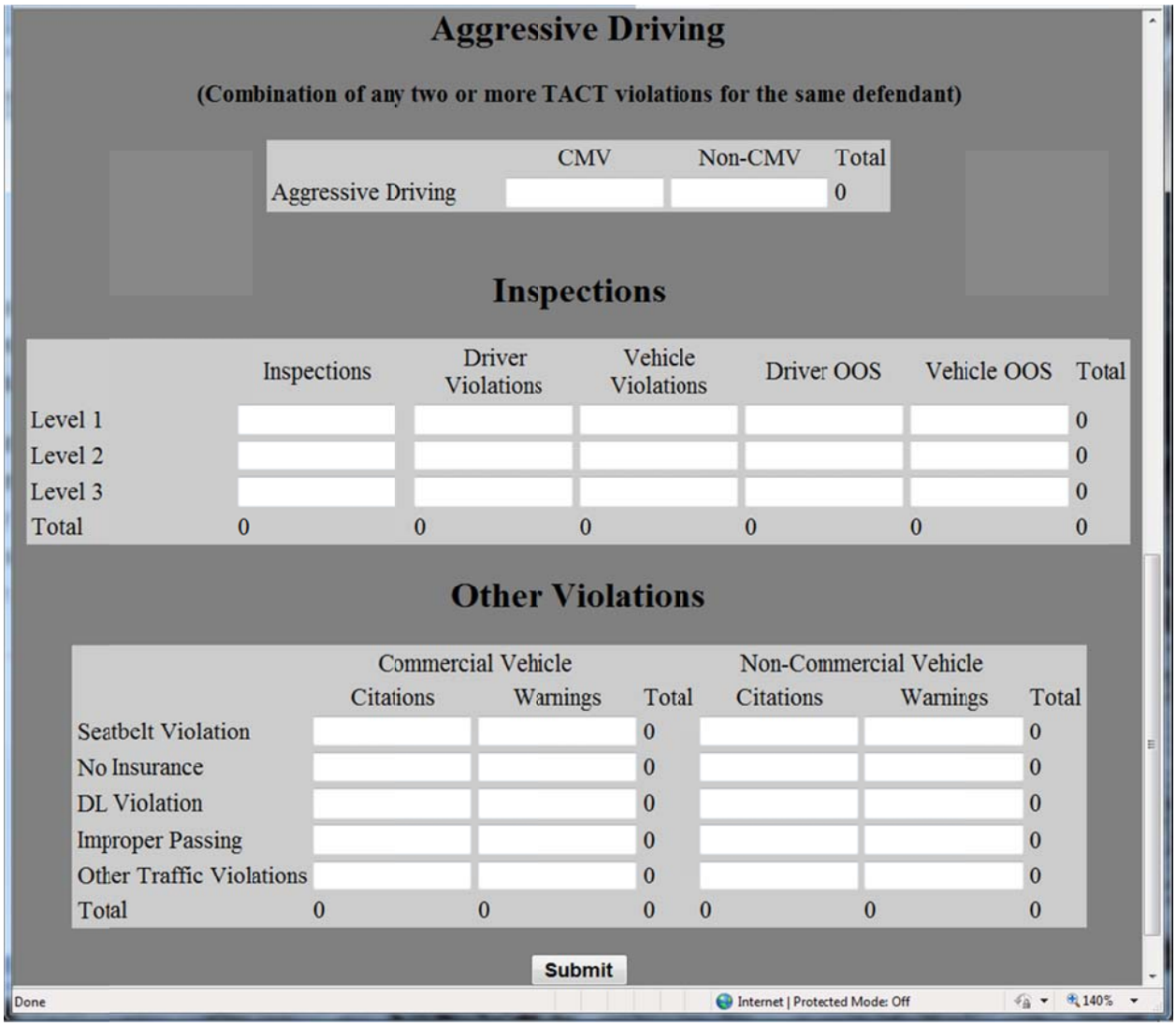
The secure online enforcement summary forms that have been used in Alabama since before their first TACT program serve to illustrate examples of the Internet-based administrative data forms and procedures. This system was developed for the direct use of participating law enforcement officers. Each officer assigned to TACT entered citation and warning summaries at this site. The summary also included the officers' names, departments, enforcement locations, and enforcement time periods. Citations that were entered were further categorized by CMV and Non-CMV. Motor carrier officers also reported CMV inspections using this same form.

Officers were required to submit a form for each separate location and time period they patrolled. Based on these data, daily, weekly, and monthly reports were automatically generated and made available on the Internet. These reports were available for the entire state or for each participating agency or DPS troop. The TACT Web site served as the mechanism for officers throughout the state to report their activities. Displays 3.1.6 and 3.1.6a show the Web-based data entry forms.

Display 3.1.6 Top Half of Officer Activity Report Data Entry

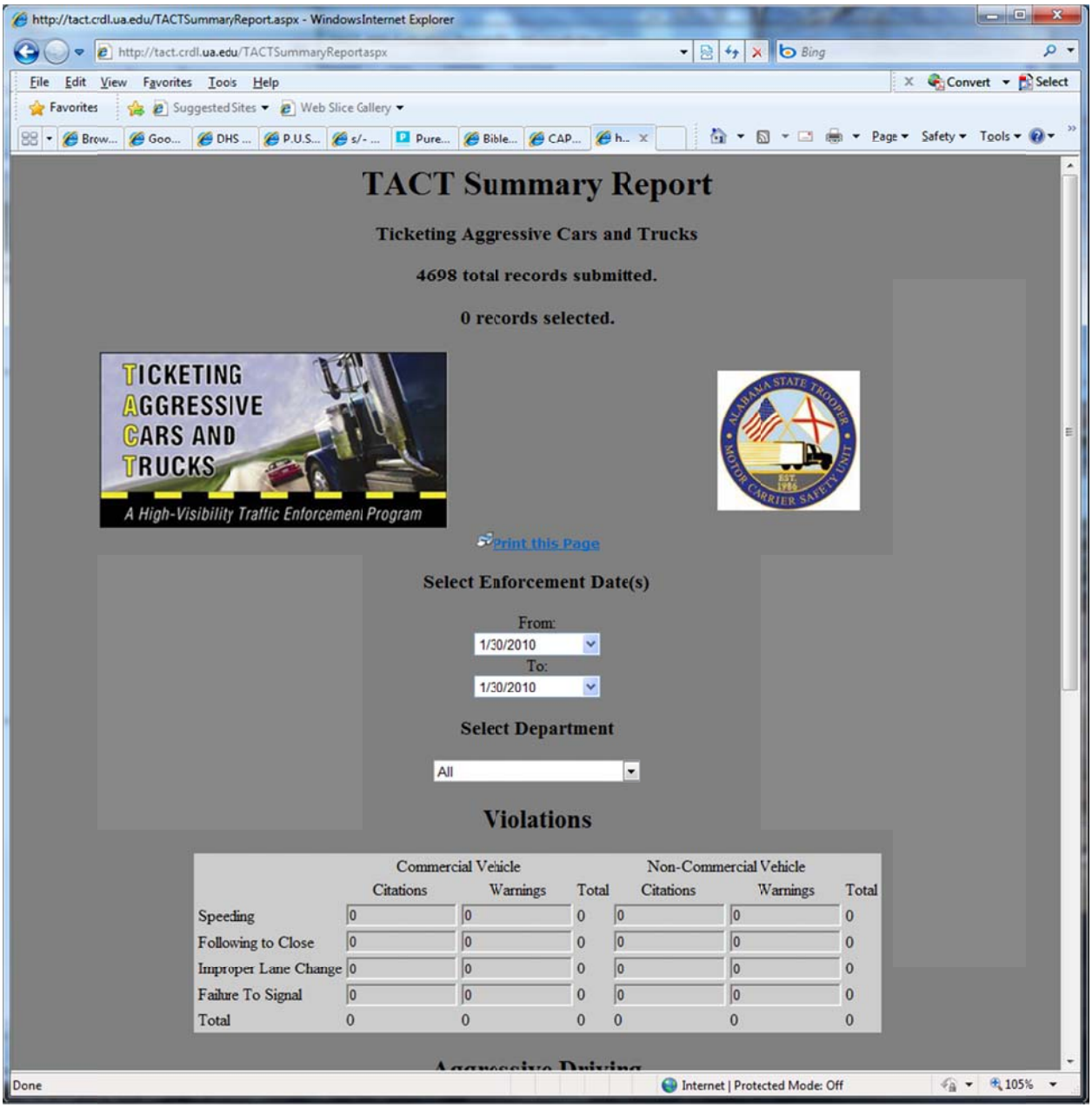


Display 3.1.6a Bottom Half of Officer Activity Report Data Entry

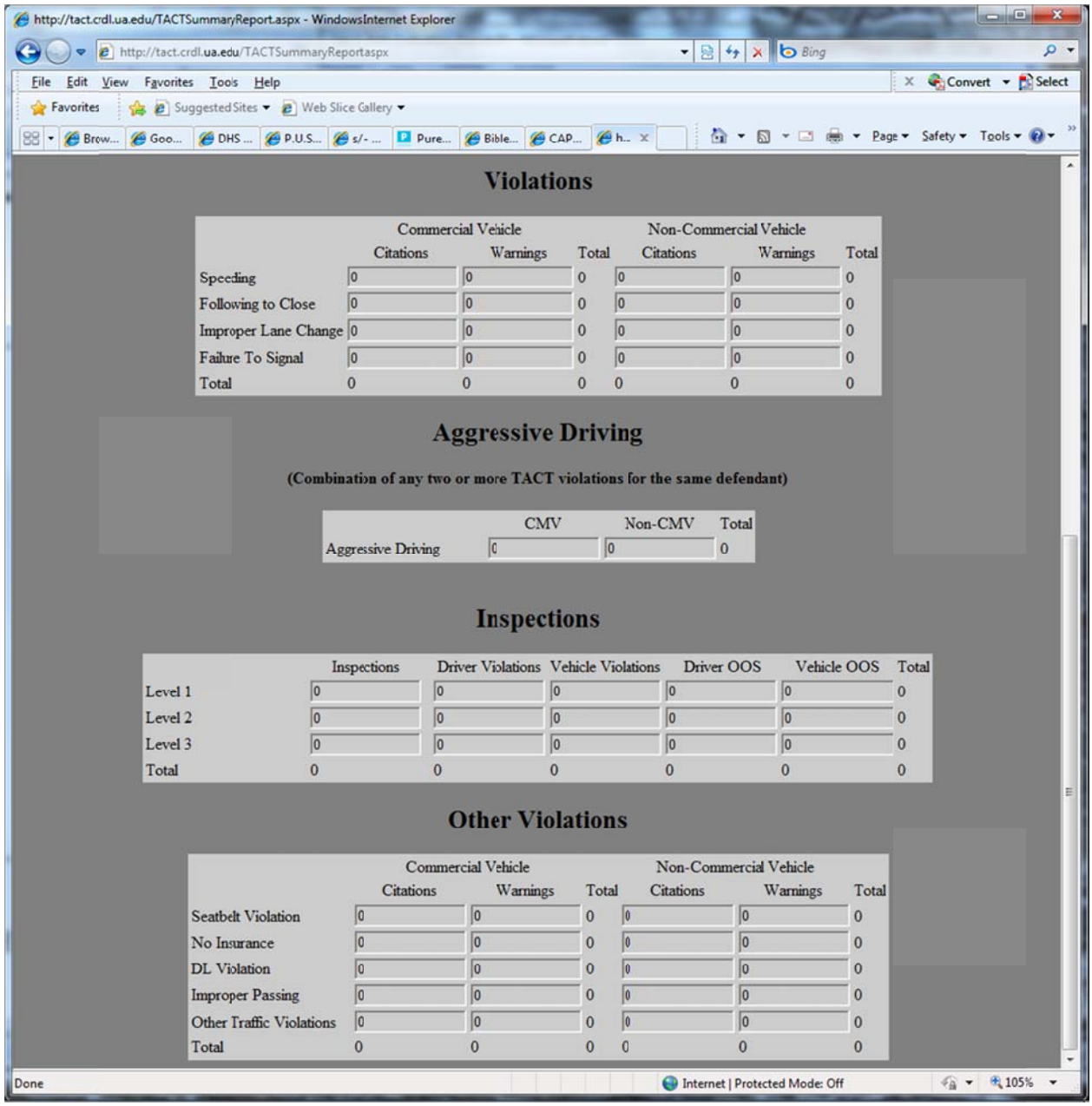


The TACT Web site also provided a summary report by which individual officers or their supervisors (collectively) could track their progress in writing citations and warnings of various types. The format of these reports is shown in Displays 3.1.6b and 3.1.6c.

Display 3.1.6b Top Half of TACT Summary Report



Display 3.1.6c Bottom Half of TACT Summary Report



3.2 Problem Identification Methods and Examples

Problem identification is a normal extension of the planning process. Once the most strategic decisions are made with regard to a project, then problem identification is used to further refine the countermeasures by this data-driven process.

At the highest level, a comparison of the data subset of those crashes involving CMVs against those that do not over all variables will surface the major factors that are over-represented in CMV crashes in general. The following is an example of the results that can be obtained from the performance of this analysis comparing CMV-involved crashes in general (i.e., independent of causation) against crashes that did not involve CMV crashes in Alabama during the 3.65 year time period of 2008 to 2011 (current through partial August):

- CMVs are involved in about 8,000 crashes per year, which is about 6.5% of all motor vehicle crashes.
- Less than 5% of CMVs carry hazardous cargo.
- The most over-represented primary contributing circumstances with regard to the potential for total crash reductions are ranked as follows (worst first): improper lane change or use, cargo fell or load shift, defective equipment, unseen object/person/vehicle, improper turn, improper backing, improper passing, and crossed the center line.
- The least over-represented primary contributing circumstances with regard to the potential for total crash reductions are ranked as follows (best first, that is, the most under-represented in CMV involved crashes): following too close, misjudge stopping distance, driver not in control, failed to yield right of way, DUI, over the speed limit, driving too fast for conditions, and failure to obey signs/signals.
- The causal driver was male in about 38% more cases CMV involved crashes than crashes that did not involve CMVs.
- The most over-represented causal driver age was 47, and the range of 33-69 years of age was generally over-represented (causal driver her could be of the CMV or a private vehicle if the crash involved two vehicles).
- The most over-represented roadway classification was Interstates, without about 21% of all crashes (as opposed to about 8% for crashes in general). Federal routes were slightly over-represented; state routes were about as expected, and county roads and city streets were under-represented.
- All hours from 5:00 AM through 3:00 PM were over-represented. Although slightly under-represented, the 3:00-3:59 PM hour had the highest frequency of CMV involved crashes, but they dropped off very quickly after that.
- The most over-represented “causal unit maneuvers” were (worst first): changing lanes, turning right, passing and merging.
- The most over-represented “cities” (rural areas of a county are worked int0 the comparison as virtual cities) were: Rural Tuscaloosa, Birmingham, Rural St. Clair, Rural

Jefferson (the county of Birmingham), followed by the rural areas of Cleburne, Sumter, Montgomery, Morgan Escambia, Cullman counties.

- Sideswipe and side impact were over-represented by at least three times their expected proportions.
- The overwhelming first harmful event was "collision with vehicle in traffic, which accounted for over 73% of the crashes. Collisions that involved running off the road were the most under-represented.
- Similarly, 78% of the CMV involved crashes were "On the Roadway" as far as the first harmful event is concerned.
- The most over-represented model years for the causal vehicles were 2005-2007.
- Four and six lane roadways were over-represented by about 18% and 34%, respectively, with all other numbers of lanes being under-represented.
- Multiple-vehicle crashes accounted for about 85% of the crashes, with two vehicle crashes being about 79%.
- About 63% of the CMV crashes did not require a vehicle to be towed as opposed to about 56% for crashes in general.
- Due to the rural nature of many of these crashes, police arrival delay was over-represented in all categories above 21 minutes from the time of the crash.
- A third of the CMV involved crashes were classified as rural, which is about 30% more than what is seen in crashes in general.
- Weather was indicted to play a part in only about 2.0% of the CMV involved crashes as opposed to 2.7% of crashes in general. Only about 9% of the CMV involved crashes occurred in the rain, as opposed to almost 13% for crashes in general.
- Work zones were involved in less than 10% of the CMV involved crashes, although this was about three times that found in the general crash population.
- The roadway junction features that were most over-represented were bridge/overpass and entrance/exit ramps.
- CMV involved crashes were over-represented in virtually all of the vehicle defect categories.
- Citations were issues in only about 10% of CMV involved crashes.
- CMV involved crashes had over twice the fatal injuries as other crashes; however, all of the other injury classifications were significantly under-represented.
- DUI played a factor in only about 2% of CMV involved crashes, which was less than half of what was recorded for other crash types, according to the officers' opinions.
- Fatigue and sleep were not recorded to be significantly different from that found in the general population of crashes.

Note once again, the results above are for all crashes involving CMVs without regard to which vehicle may have caused the crash if the crash involved a CMV and a car.

Examples of other comparisons to provide results as those listed above would be to compare the following: (1) those that involve a car and a truck and compare this subset against all other two-vehicle crashes; (2) those CMV-related two vehicle crashes that are caused by CMVs compared to CMV-related two vehicle crashes that are not caused by CMVs; and (3) those CMV-related two vehicle crashes that are caused by non-CMVs compared to non-CMV-related two vehicle crashes (obviously caused by the car driver since it does not involve a CMV). There are several others, and as they are tried certain patterns will emerge that is fairly common to most of them.

CARE is set up to do these types of analyses using its IMPACT module. See (25) and (26) for information on basic problem identification techniques. These techniques are supported by other statistical processing packages as well. Some specific findings are exemplified in the sections below in which the problem identification examples are divided into: (1) location hotspot analysis, which is mandatory for all TACT projects, and (2) supplementary problem identification, which would only apply to projects that are further targeted on a particular crash type. In addition, the following supplementary problem identification examples will be addressed:

- Causal driver age,
- Point of initial impact,
- Time of day, and
- Day of the week.

These will be covered in Section 3.2.2.

3.2.1 Site Selection – Hotspot Analysis

The word *hotspot* is used to refer to locations that are found from analytical techniques to be most fruitful for TACT intervention. Hotspots are determined from crash analysis techniques to be a segment of roadway that have significantly more than their expected number of the type of crashes that would generally be anticipated for that roadway classification and area. There are many techniques that could be employed to determine hotspots, and it is recommended that the various alternative techniques be explored in the literature. The following presents some of the most-frequently used criteria:

- Crash frequency – by far the simplest and most understood approach, the assumption being that the recent history (generally three years) of high-crash concentrations would predict the immediate future of where these crashes would continue to recur without intervention. It is suggested that unless there is some definitive reason that this assumption is in error, it should be given strong consideration, along with the severity consideration given in the next bullet. The number of locations that can be funded under the program is determined, and then those locations with the largest crash frequencies are chosen for treatment unless there is some mitigating reason to make an exception. A

"location" is a segment (e.g., a five or even ten-mile stretch) covered by the selective enforcement effort. Compromises should be made if there is not an obvious break point, i.e., locations should not be eliminated just because they do not make, for example, the top ten of the list. When it comes to selective enforcement interventions, there is no reason that several locations that fall toward the bottom of the most critical list could not be worked. Adjustments can be made in the "high crash" criteria until a reasonable number of locations are obtained.

- Crash frequency by severity – when a large enough number of crashes occur at the potential candidate locations, consideration can be restricted to a higher severity classification (usually all injury and fatal crashes). This targets the severity of crashes most apt to produce fatalities, and can actually be a better predictor of fatality locations in the future than the relatively few past fatality locations. "All injury crashes" is certainly a much better predictor of fatality crashes that all crashes regardless of severity. For example, it will be noticed immediately that hotspots that are based on all crashes are clustered in the urban areas where the severity of crashes is generally low. On the other hand, it is not recommended that just fatality frequency or number of fatalities be used as a criterion in that the locations of these crashes are highly subject to chance as opposed to the causes that the TACT program is attempting to mitigate. Any of the methods below can be qualified on severity merely by running the corresponding hotspot analyses restricted to subsets of data that only contain crashes of the severity of interest.
- Empirical Bayes – the argument for adding this element to the screening analysis is that frequency alone (regardless of the severity subset) can lead to locations where the large number of crashes is an anomaly that will be mitigated without intervention due to regression to the mean. The projected savings is thus adjusted so that only a portion of the total crashes at a given location are considered as the potential for savings. This method is not recommended under the following circumstances: (1) when the frequency at a given location is obviously stable, perhaps measured by the variance on a quarterly basis; i.e., if there have not any significant variations in the quarterly readings over the past 36 months (or 12 quarters), then the chances of the frequency being an "outlier" is extremely low; or (2) when the computations that include Empirical Bayes adjustments are obviously going to produce the same adjustment effect (proportionately speaking) for all locations considered. Adjusting all estimates by a constant will not change the locations that will ultimately be chosen for treatment, and so the more complex analysis is not justified.
- Pure rate approach. This would identify a hotspot to be where a given threshold of crash rate (as opposed to crash frequency) is high. Since average ADTs are available for most routes with heavy CMV concentrations, a rate can easily be obtained for all five or ten mile segments. A simple selection of those at the top of the rate sort would determine the locations for the enforcement. The reasoning behind this approach is that over time a certain number of crashes are expected of a given ADT just because of the sheer

numbers of vehicles (in this case CMV-car combinations) on the segment. Thus, the "most dangerous" should be surfaced by the rate, and thus performing selective enforcement on these routes would produce the greatest reductions. While the major premise in this reasoning is quite true (generally, most of the variation of crashes between locations can be accounted for by the variation in the ADT), the conclusion reached as far as total TACT impact is generally not valid. In many cases the pure rate approach will move resources from the most heavily traveled roadways to those that have very few crashes. Truism: *It is impossible to reduce more crashes from a given segment than the number of crashes that will occur there without the intervention.* The result of the pure rate approach can be to apply resources to a very few crashes due to a few mishaps that may have nothing to do with what the enforcement program is designed to control. This is not to negate the value of rates in determining potentially hazardous situations. For example, if both the rate and the frequency of crashes are high, then the location would certainly be a primary target for TACT enforcement efforts. Rates, then, provide an additional metric that help to determine if a given segment should receive consideration.

- Frequency/Quality Control. This approach uses frequencies but it takes an average and a standard deviation of them over the applicable portion of the roadway (e.g., rural Interstate roads). It then runs the high-crash software over these roadways and seeks out any that are greater than a certain number of standard deviation units from the average. Since the number of standard deviation units from the mean can be used to quantify the probability, this would seem to be an approach superior to using frequencies alone. For example, a crash count over two standard deviation units from the mean (the average taken over this and similar roadways) will occur no more than 5% of the time. This approach may not return too many locations than were found in the pure frequency method. However, it does enable a quantified approach for comparing locations that are in different category of the roadway system as long as a different mean and standard deviation is determine for each of the categories.
- Rate/Quality Control approaches. This uses the rate as opposed to the frequency in a similar approach to that discussed immediately above.
- Combinations of the above. It is strongly recommended that consideration be given to more than one of the techniques above, and that a comparison of these techniques take place to see if the more complex methods are justified. For example, while rates have the downside give above, they are extremely useful in surfacing potential problem areas. A rule might be derived that a hotspot will consist of all locations above a given rate that have at least a given crash count. As such, the benefit of the different methods can be obtained without incurring any of their deficiencies. Of course, none of these rules or methods can replace good common sense when it comes to the ultimate selection of a location, and it is highly recommended that experienced officers be involved in the selection of locations using the selected quantitative tool as a guide.

Analysts are urged to use the technique that is a combination of most accurate and that which can be understood and accepted within the culture of their organization. They should also realize that some locations might be difficult or infeasible to patrol, and that some might be so costly that they will drain resources from obtaining better crash reductions that what would be expected from a more balanced approach. For the remainder of this document the term "hotspots" will refer to locations determined to be those that have the greatest potential for crash reductions when all of these factors are considered to the extent possible.

3.2.1.1 Example from Alabama's First TACT Project

The first TACT program applied in Alabama involved virtually all of the DPS patrol force as well as several CMV-qualified agencies all implementing the program simultaneously and generally throughout the state. TACT hotspots for this project were identified for all urban and rural mileposted roadways in Alabama using 2006-2008 calendar year data. In this case the analysis was restricted to (1) past CMV crashes, i.e., those involving one or more CMVs, and (2) locations where one or more of the primary contributing circumstances given in Section 1.3.1 occurred with high frequency. This led to two lists being created that were reported out separately. Any locations that were common to both lists would indicate that the area had both a CMV crash problem and crash problems that were caused by the TACT-emphasis primary contributing circumstances. Generally those locations common to both lists were considered to be the hotspots.

Since the program was to be implemented statewide, hotspots were identified per DPS post and per county. A sliding window hotspot identification technique was developed within CARE to locate road segments with crash counts above a given threshold. In order to distribute the effort statewide, the crash count threshold was varied to assure that all trooper posts would be involved in the program. For example, road segments in a given rural county may have qualified if there were 4 crashes on a 3 mile road segment, while a more populated county may have required 7 crashes per 1 mile road segment. Hotspots were also identified for the participating municipalities for roadways in their jurisdiction. If it were, for some reason, impossible to re-allocate resources among the posts, then the method applied above would produce as good a state-wide result as could be expected. However, it is clear that if resources could be re-allocated from one post to another, then it would be best to apply statewide optimization criteria. Each state might have differing constraints in this regard.

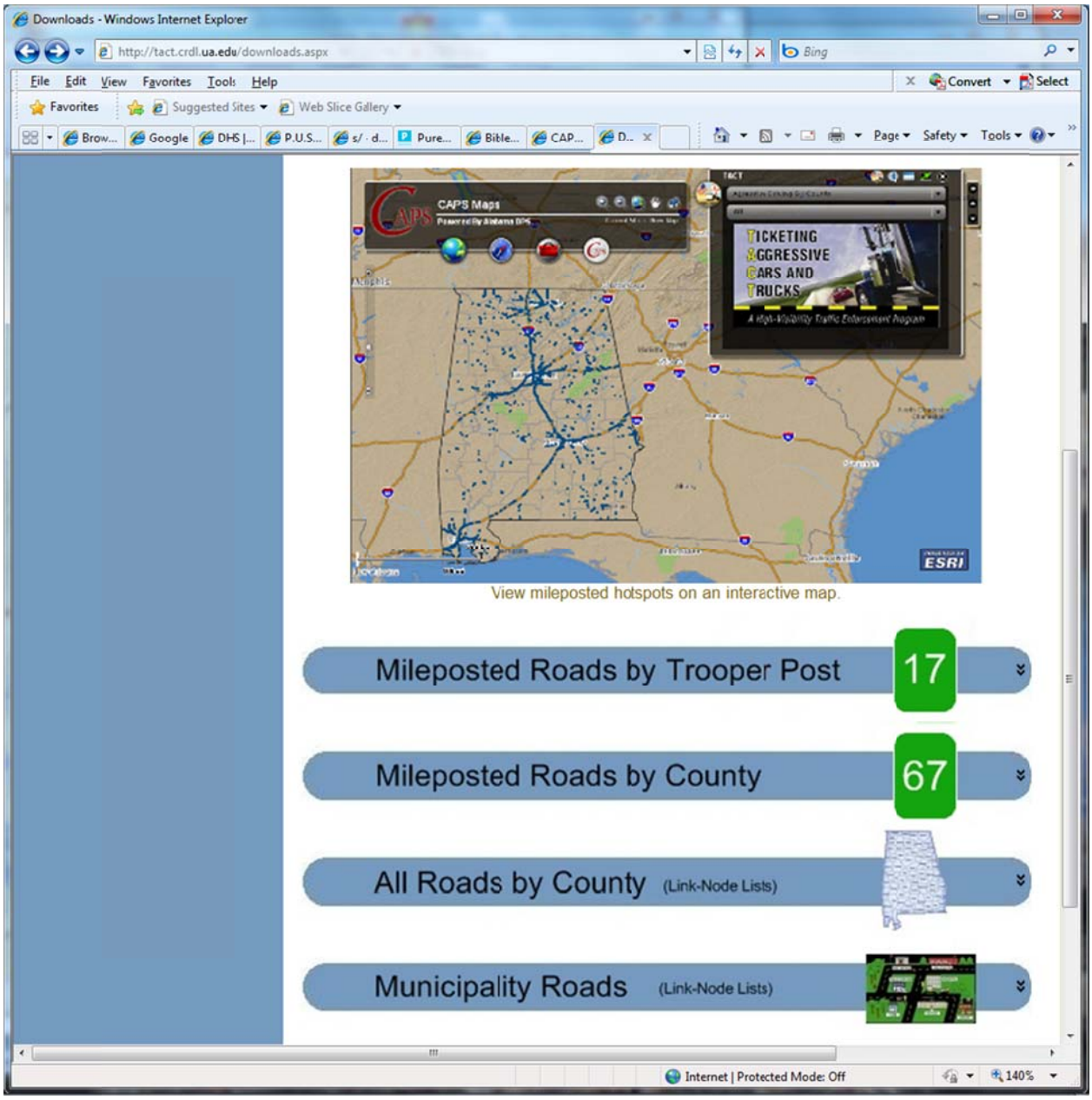
Display 3.2.1 presents the overall categorization for the hotspot results. The button under the map labeled "View mileposted hotspots on an interactive map" leads to a number of tools made available to the officers that will be discussed in Section 3.2.3. Each of the following buttons leads to the drop-down menu that lists hotspot output options:

- Mileposted Roads by Trooper Post – these are Interstate, state and federal roads that have mileposts installed, and to date, this provides the best referencing system in the state.

They are organized by trooper post to assist troopers who will generally operate within the geographical area served by their respective posts.

- Mileposted Roads by County – this lists the output options identically to that given above, but by county rather than trooper post, which are groupings of counties.
- All Roads by County (Link-Node Lists) – this includes the roadways that are not mileposted. Hotspots are determined by a different algorithm. CARE outputs the nodes (mostly intersections) and the links (defined by two nodes) in an ordering of maximum crashes at the top. This enables officers to view those nodes and links that have the greatest crash activity. The traffic record contains link-node information on many crashes that occur on mileposted roads. If so, CARE will process these crashes both by mileposted techniques and by link-node in order to generate the maximum amount of information for the officers.
- Municipal Roads (Link-Node Lists) – this is identical to that described immediately above with the exception that the lists are organized by municipality as opposed to county.

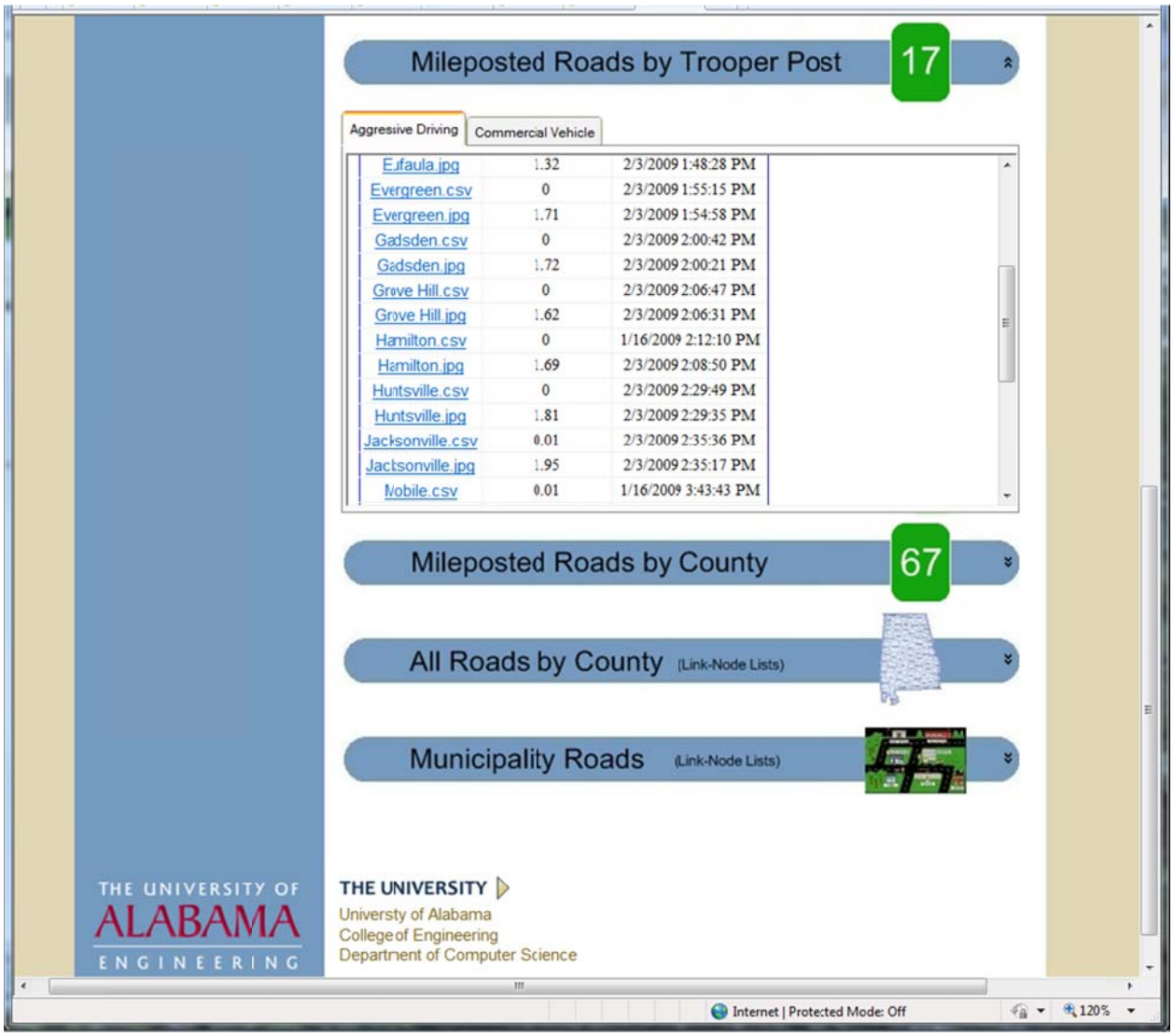
Display 3.2.1 Example Hotspot Report Selection Page



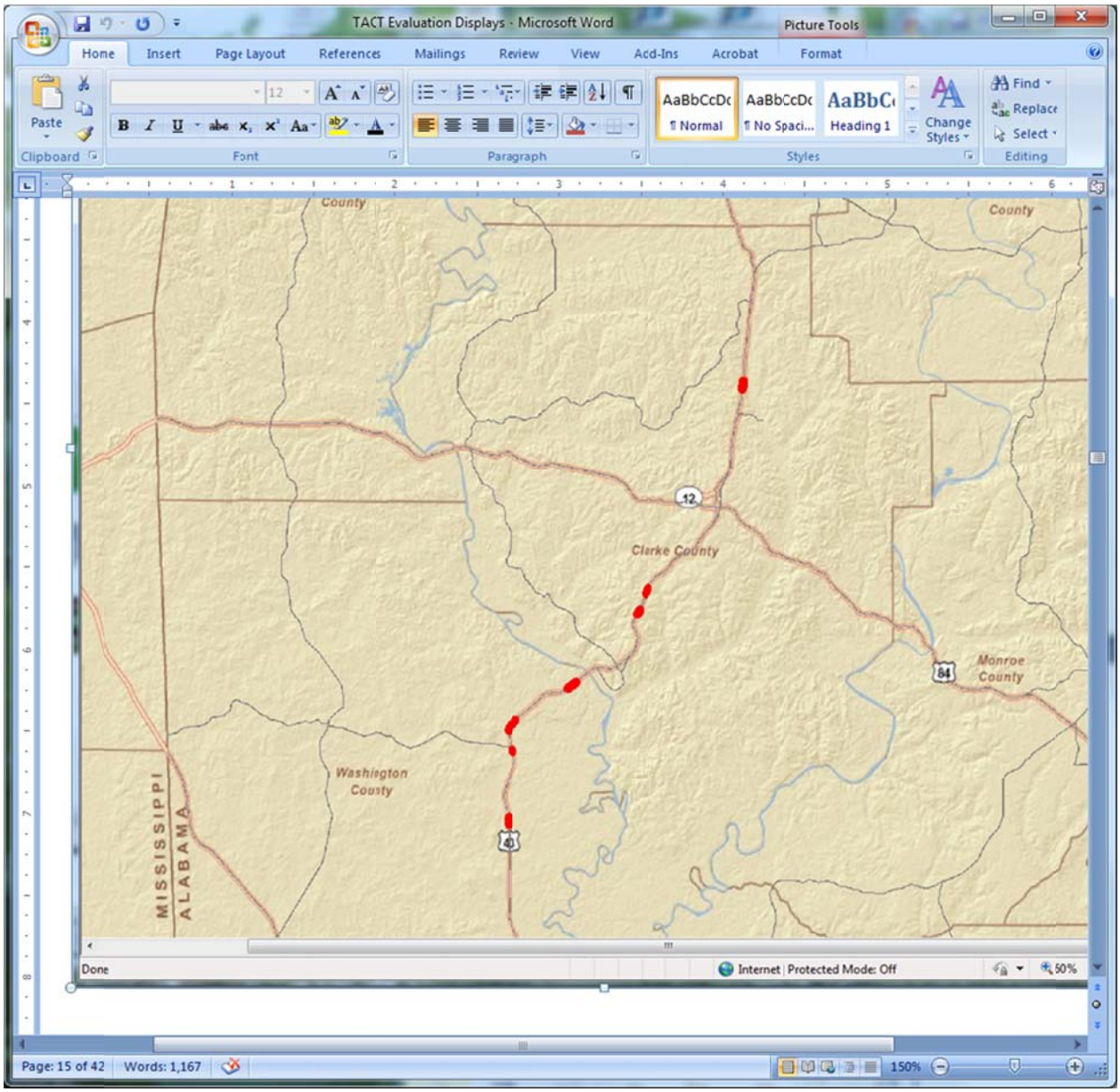
Within each of the dropdowns there are two output types – a map and a listing – both showing the hotspots that were found for the various jurisdictions. Display 3.2.1a illustrates this for the trooper post drop-down. Users can scroll to any of the 17 trooper posts. At that point there are two possible selections. The jpg download is a map of the hotspots, while the csv download is a listing of those same locations. Note also the tabs. The one opened in Display 3.2.1a is for the Aggressive Driving offenses (contributing circumstances), while the Commercial Vehicle tab would provide hotspot information based on the numbers of CMV-involved crashes. The drop-

downs for the other categories operate in the same way. Display 3.2.1b gives a typical example of a map view that is produced by downloading one of the jpg files, while Display 3.2.1c illustrates a tabular output.

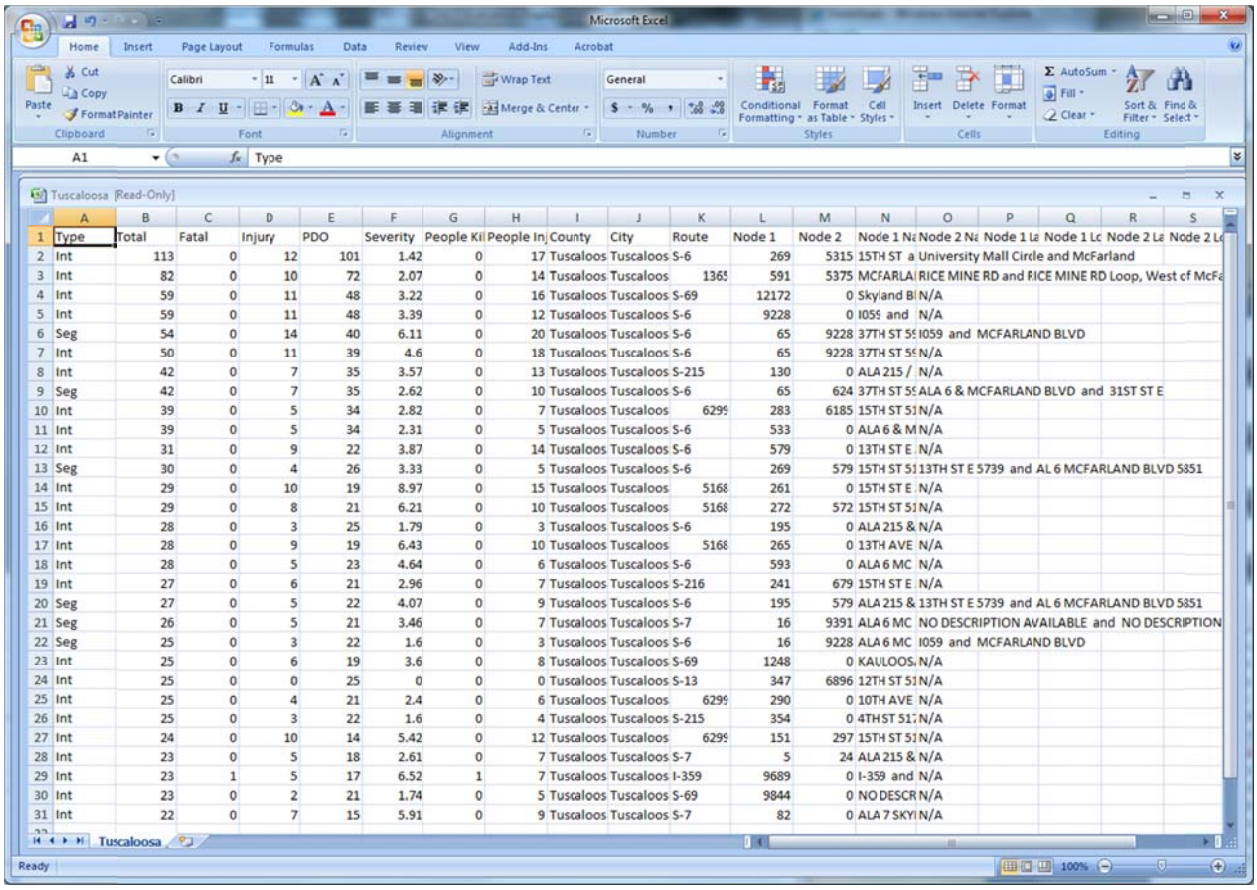
Display 3.2.1a Example Drop-Down for Mileposted Roads by Trooper Post



Display 3.2.1b Example Hotspot Map Output



Display 3.2.1c Example Hotspot Table Listing



Microsoft Excel — Tuscaloosa [Read-Only]

Type	Total	Fatal	Injury	PDO	Severity	People Kil	People In	County	City	Route	Node 1	Node 2	Node 1 Na	Node 2 Na	Node 1 La	Node 1 Lc	Node 2 La	Node 2 Lc
Int	113	0	12	101	1.42	0	17	Tuscaloos	Tuscaloos	S-6	269	5315	15TH ST	a	University Mall Circle and McFarland			
Int	82	0	10	72	2.07	0	14	Tuscaloos	Tuscaloos	136	591	5375	MCFARLA	RICE MINE RD and RICE MINE RD Loop, West of McF				
Int	59	0	11	48	3.22	0	16	Tuscaloos	Tuscaloos	S-69	12172	0	Skyland Bl	N/A				
Int	59	0	11	48	3.39	0	12	Tuscaloos	Tuscaloos	S-6	9228	0	I059 and	N/A				
Seg	54	0	14	40	6.11	0	20	Tuscaloos	Tuscaloos	S-6	65	9228	37TH ST 55	I059 and MCFARLAND BLVD				
Int	50	0	11	39	4.6	0	18	Tuscaloos	Tuscaloos	S-6	65	9228	37TH ST 55	N/A				
Int	42	0	7	35	3.57	0	13	Tuscaloos	Tuscaloos	S-215	130	0	ALA 215 /	N/A				
Seg	42	0	7	35	2.62	0	10	Tuscaloos	Tuscaloos	S-6	65	624	37TH ST 55	ALA 6 & MCFARLAND BLVD and 31ST ST E				
Int	39	0	5	34	2.82	0	7	Tuscaloos	Tuscaloos	629	283	6185	15TH ST 51	N/A				
Int	39	0	5	34	2.31	0	5	Tuscaloos	Tuscaloos	S-6	533	0	ALA 6 & M	N/A				
Int	31	0	9	22	3.87	0	14	Tuscaloos	Tuscaloos	S-6	579	0	13TH ST E	N/A				
Seg	30	0	4	26	3.33	0	5	Tuscaloos	Tuscaloos	S-6	269	579	15TH ST 51	13TH ST E 5739 and AL 6 MCFARLAND BLVD 5851				
Int	29	0	10	19	8.97	0	15	Tuscaloos	Tuscaloos	516	261	0	15TH ST E	N/A				
Int	29	0	8	21	6.21	0	10	Tuscaloos	Tuscaloos	516	272	572	15TH ST 51	N/A				
Int	28	0	3	25	1.79	0	3	Tuscaloos	Tuscaloos	S-6	195	0	ALA 215 &	N/A				
Int	28	0	9	19	6.43	0	10	Tuscaloos	Tuscaloos	516	265	0	13TH AVE	N/A				
Int	28	0	5	23	4.64	0	6	Tuscaloos	Tuscaloos	S-6	593	0	ALA 6 MC	N/A				
Int	27	0	6	21	2.96	0	7	Tuscaloos	Tuscaloos	S-216	241	679	15TH ST E	N/A				
Seg	27	0	5	22	4.07	0	9	Tuscaloos	Tuscaloos	S-6	195	579	ALA 215 &	13TH ST E 5739 and AL 6 MCFARLAND BLVD 5851				
Seg	26	0	5	21	3.46	0	7	Tuscaloos	Tuscaloos	S-7	16	9391	ALA 6 MC	NO DESCRIPTION AVAILABLE and NO DESCRIPTION				
Seg	25	0	3	22	1.6	0	3	Tuscaloos	Tuscaloos	S-6	16	9228	ALA 6 MC	I059 and MCFARLAND BLVD				
Int	25	0	6	19	3.6	0	8	Tuscaloos	Tuscaloos	S-69	1248	0	KAULOOS	N/A				
Int	25	0	0	25	0	0	0	Tuscaloos	Tuscaloos	S-13	347	6896	12TH ST 51	N/A				
Int	25	0	4	21	2.4	0	6	Tuscaloos	Tuscaloos	629	290	0	10TH AVE	N/A				
Int	25	0	3	22	1.6	0	4	Tuscaloos	Tuscaloos	S-215	354	0	4TH ST 51	N/A				
Int	24	0	10	14	5.42	0	12	Tuscaloos	Tuscaloos	629	151	297	15TH ST 51	N/A				
Int	23	0	5	18	2.61	0	7	Tuscaloos	Tuscaloos	S-7	5	24	ALA 215 &	N/A				
Int	23	1	5	17	6.52	1	7	Tuscaloos	Tuscaloos	I-359	9689	0	I-359 and	N/A				
Int	23	0	2	21	1.74	0	5	Tuscaloos	Tuscaloos	S-69	9844	0	NO DESCR	N/A				
Int	22	0	7	15	5.91	0	9	Tuscaloos	Tuscaloos	S-7	82	0	ALA 7 SKY	N/A				

3.2.1.2 Example from Alabama's June 2011 TACT Project

The recent TACT implementation in Alabama was one in which resources were quite limited compared to the original TACT program. Because of assignments to areas struck by recent tornados, only a very small force of officers could be made available. This enabled the project to exemplify projects of both the largest possible statewide coverage (illustrated above), to the smallest localized effort. The smaller effort required resources to be much more focused both in location and in the drivers targeted (i.e., in this example, the younger causal driver). Resources that were anticipate to be available over the fiscal year would support two or perhaps three waves of combined selective enforcement and PI&E with a limited number of patrol officers. The planning below reflects this anticipation.

3.2.1.2.1 Hotspot Analysis

Most states have the capability to find high crash locations across their state and Interstate systems, which often coincides with roadway segments with the heaviest truck traffic. As a first rough cut it was decided to run the high crash program using the Alabama CARE program with the segment length set to 20 miles, and to capture locations with three or more CMV crashes caused by young (16-20 year old) drivers from 3+ years of data starting in January of 2007 through most of July 2010 and about a third of August 2010. The sample was further limited to Interstate highways because these had the highest number of these types of crashes, and thus the highest potential for mitigating the problem. The filter applied to create the subset of crashes of interest was as follows: Young Causal Driver AND CMV Involved AND Interstate. A comparable run on all state and Federal highways confirmed that there were no qualified hotspots similar to those found on the Interstate highways.

The resulting list of segments is given in Display 3.2.1d. Note that the route is given in the third column, and the milepost (MP) endpoints on that route are given in the next two columns. The crash counts are given by severity next (Total Crashes, Fatal, and Injury). Finally, to get a feel for the crash rate, the Million Vehicle Miles (MVM) and the crashes per billion vehicles miles (C/BVM) are given for each 20-mile segment. Again, crashes here are those involving CMVs that were caused by 16 to 20 year old drivers over the most recent 3+ year time span of data available in Alabama at the time of the analysis that was done for planning purposes. Only locations with three or more crashes over this time span are listed. Severity did not enter into this comparison since the severity of car-truck crashes on Interstate highways is fairly stable and not location dependent.

SEE PART 2

Display 3.2.1d First Cut Hotspot Run for All Interstates in Alabama

Segment length: 20 miles
Criteria: three or more CMV crashes caused by 16-20 year old drivers
Time span: January 2007 through August 2010 (all data available)

County	City	Route	Beg MP	End MP	Crashes	Fatal	Injury	MVM	C/BVM
Mobile	Mobile	I-65	1	21	9	0	2	1598	5.63
Baldwin	Rural Baldwin	I-65	29.8	49.8	3	0	2	533	5.63
Escambia	Rural Escambia	I-65	62.3	82.3	4	0	2	560	7.14
Conecuh	Rural Conecuh	I-65	96.3	116.3	3	0	1	617	4.86
Butler	Greenville	I-65	129.9	149.9	4	1	0	760	5.27
Montgomery	**Montgomery**	**I-65**	**170**	**190**	**8**	**0**	**5**	**1378**	**5.81**
Chilton	**Rural Chilton**	**I-65**	**194.2**	**214.2**	**3**	**0**	**1**	**920**	**3.26**
Multiple	***Rural Shelby***	***I-65***	***236.1***	***256.1***	***17***	***0***	***4***	***2498***	***6.80***
Jefferson	Multiple	I-65	258	278	14	0	2	2025	6.91
Cullman	***Rural Cullman***	***I-65***	***288.2***	***308.2***	***9***	***0***	***1***	***1043***	***8.63***
Cullman	***Rural Cullman***	***I-65***	***311.3***	***331.3***	***3***	***0***	***1***	***856***	***3.50***
Morgan	***Rural Morgan***	***I-65***	***335***	***355***	***5***	***0***	***2***	***714***	***7.00***
Greene	Rural Greene	I-59	44.1	64.1	3	0	1	694	4.32
Tuscaloosa	***Rural Tuscaloosa***	***I-59***	***64.5***	***84.5***	***12***	***0***	***3***	***1127***	***10.65***
Tuscaloosa	***Rural Tuscaloosa***	***I-59***	***89.8***	***109.8***	***4***	***0***	***1***	***1388***	***2.88***
Jefferson	***Birmingham***	***I-59***	***112.8***	***132.8***	***12***	***1***	***2***	***2696***	***4.45***
Jefferson	Rural Jefferson	I-59	137.3	157.3	3	0	0	907	3.31
Saint Clair	Rural St. Clair	I-59	164.4	184.4	4	0	1	572	6.99
Mobile	***Multiple***	***I-10***	***1.3***	***21.3***	***9***	***0***	***4***	***1583***	***5.68***
Multiple	***Mobile***	***I-10***	***22***	***42***	***13***	***0***	***5***	***1589***	***8.18***
Baldwin	***Rural Baldwin***	***I-10***	***42.4***	***62.4***	***3***	***0***	***0***	***775***	***3.87***
Saint Clair	Rural St. Clair	I-20	138.1	158.1	7	0	2	1492	4.69
Multiple	Rural Talladega	I-20	168	188	10	0	2	1023	9.77
Calhoun	Rural Calhoun	I-20	188	208	5	0	0	941	5.31
Montgomery	***Montgomery***	***I-85***	***1***	***21***	***8***	***0***	***2***	***1651***	***4.85***
Macon	***Rural Macon***	***I-85***	***23.2***	***43.2***	***3***	***0***	***1***	***858***	***3.50***
Lee	***Opelika***	***I-85***	***47.6***	***67.6***	***7***	***0***	***3***	***942***	***7.43***
Jefferson	Multiple	I-459	5	25	7	1	2	2035	3.44
Jefferson	Rural Jefferson	I-459	26	46	4	0	1	1773	2.26
Madison	Athens	I-565	0.6	20.6	3	0	0	1630	1.84
Tuscaloosa	Tuscaloosa	I-359	0.1	20.1	5	0	2	1339	3.73

Bold and italics indicate those contiguous segments that had the highest crash frequencies.

There are five sets of contiguous segments that show a high number of crashes for this subset; listed in order that they occur on the list, they are:

- I-65 from 170.0 through 256.1 (about 86 miles), with 28 crashes,
- I-65 from 288.2 through 355.0 (about 67 miles), with 17 crashes,
- I-59 from 64.5 through 132.8 (about 68 miles), with 28 crashes,
- I-10 from 1.3 through 62.4 (about 60 miles) with 25 crashes, and
- I-85 from 1.0 through 67.6 (about 77 miles) with 18 crashes.

These are marked in italics and bold in the display above. The only segment that has a high crash number (14) that was excluded was on I-65 in Jefferson County; it was excluded because compared to the other included segments it was very highly urbanized and would not be comparable. This is not to say that it would not be affected inasmuch as it falls between two other segments that are being included for consideration.

3.2.1.2.2 Establishment of Test and Control Areas

The following table presents the pros and cons of selecting the particular segment for the TACT treatment:

Route; Milepost	Pros of Selection	Cons of Selection	Decision
I-65; 170-256	Connector between major cities High number of crashes	No major university	Control or treatment
I-65: 288-355	Connector between major cities	Low number of crashes	Control
I-59: 64-133	Proximal to major university Connector and high crash #		First treatment
I-10: 1-62	Not a connector	Highly out of state traffic	Potential control
I-85: 1-68	Proximal to major university Connector between major cities	Lower number of crashes	Second treatment

Because the primary target of the PI&E program was the young driver (age 16-25), the proximity to a major university was the primary consideration, given that a significantly higher number of youth-caused CMV crashes occurred on the segment with respect to the rest of the state. In this case, all of the segments qualified as high-crash segments for youth-caused CMV crashes compared to segments of similar length throughout the state.

The secondary consideration was whether the segment was a connector between two major cities (or metropolitan areas). If so, the rationale was that there would be repeated commuter type of traffic that would lead to a greater exposure to the billboards over time. The I-59 segment connects Tuscaloosa and Birmingham; the two I-65 segments connect Montgomery to Birmingham and Birmingham to Huntsville, respectively; and the I-85 segment connects

Montgomery to the Auburn-Opelika metropolitan area. All of the segments are predominantly rural and thus handling traffic of the highest speeds.

The five highest composite segments above were re-run to produce a summary for each and re-ordered by number of crashes, which is given in Display 3.2.1e. Some of the composite segments were adjusted in order to exclude some obvious urban roadway sections that tend to suffer from periodic delays due to congestion at rush hours, and thus would not be a typical section of roadway, especially for observational studies.

Display 3.2.1e Refined Location Specification

Route	Beg MP	End MP	Crashes	Fatal	Injury
I-59	64.0	133.0	28	1	6
I-65	170.0	257.0	28	0	10
I-10	1.3	62.4	25	0	10
I-85	1.0	67.7	18	0	6
I-65	288.2	355.0	17	0	4

The first three locations are not significantly different as far as their total youth-caused CMV crashes are concerned; and similarly for the bottom two. All of these locations were significantly higher than any comparable-length segments statewide.

I-59 was chosen to be the first treatment location due to its proximity to the University of Alabama and the availability of nearby video cameras.

This led to the following update to the plan for the project:

- First treatment (early in 2011): I-59 in the Tuscaloosa-Birmingham corridor due to the high crash number, the proximity of a major university and the availability of installed fixed video cameras.
- Second Treatment (about two months later): I-85, which has a major university fairly well centered and is a connector between Montgomery and the Auburn-Opelika metropolitan area.
- Third Treatment (if resources allow): I-65 in the rural area from Montgomery to Birmingham, chosen since it is a connector between major cities and also had a high number of qualifying crashes. If resources do not allow the standard SE-PI&E package to be applied, then this corridor will serve as a control throughout the project.
- Potential controls also included the I-10 segment as well as the I-65 Birmingham to Huntsville segments.

The decision as to exactly which ones to include as controls was deferred until more information about the costs and timing of the SE and PI&E details were resolved.

3.2.2 Supplementary Problem Identification

The following topics were considered for additional problem identification type of analysis:

- Causal driver age;
- Point of initial impact; and
- Time of day and day of the week,

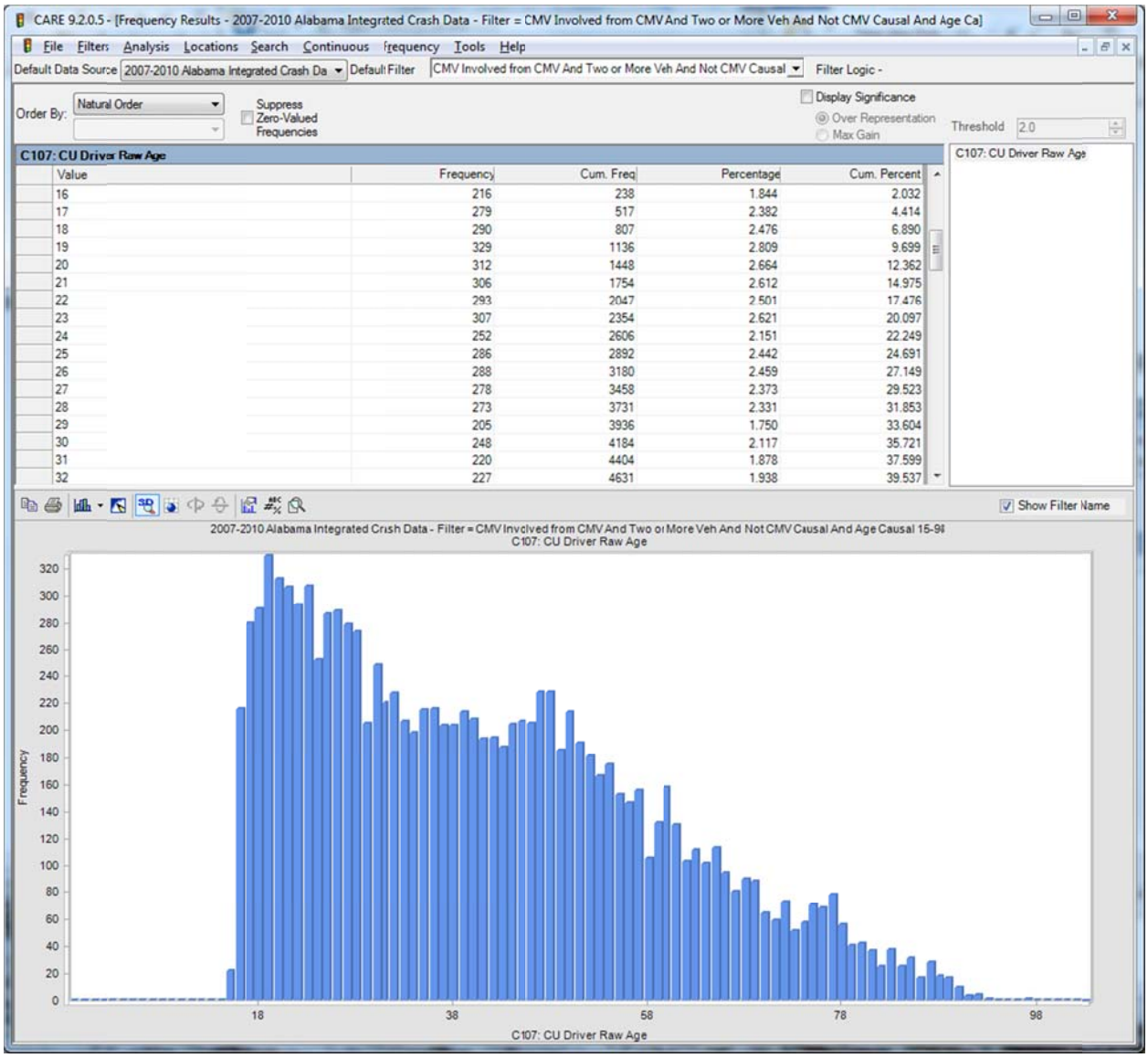
and they are considered in their respective subsections below. This is followed by a section that describes problem identification tools that are available to the patrol officer via the Internet.

3.2.2.1 Problem Identification Example 1: Causal Driver Age

Display 3.2.2.1 presents the frequency distribution for the car-driver in CMV-car crashes when the CMV driver is not at fault. All other things being equal, the expected percentage for any age is about 1.67%. That is, assuming that any one given age were equal in probability of causing this type of crash, if you were to arrive at the scene of a CMV-car crash caused by the car driver, the probability that the car causal driver is any age between 16 and 86 (as a cut-off point) the probability of any particular age would be 1/60 = 1.67%. Note that even the 16 year old driver is significantly higher in probability than this expected number despite their much lower exposure to truck traffic than would be expected of older drivers. The probabilities increase dramatically from above the age of 16, and they do not level out until the age of 31. There is a plateau at this point and a slight rise in the 47-48 years, after which the relative involvements (probabilities) drop off dramatically.

Of course, it can be argued that the exposure is higher due to the larger number of drivers at the lower ages, and it would be of interest to study this further. However, the raw number of drivers in each age group (which is fairly easy to obtain) does not tell the whole story, since the youngest drivers (16-20) probably do not put in as many miles in close proximity with CMVs as is true of the older drivers. So, to accurately quantify the over-representation of young causal drivers it would be necessary to consider their respective miles traveled in the proximity of CMVs. These data do not exist, and they would be exceedingly difficult to obtain. Further, the *reason* for the higher percentages of younger drivers is of no concern when it comes to directing TACT resources. Rather, the intent is to direct them to where they are likely to have the maximum impact. It seems quite clear that this would be focused toward drivers 28 or younger (i.e., aged 16-28 years). A filter of 16-20 years above was used in an effort to further restrict the focus to new and college-aged drivers. This is not inconsistent, and one reason for this target is that if these drivers are reached at the earlier age, the benefits will carry over into the 21-28 year ages.

Display 3.2.2.1 Age of Car Causal Driver in CMV-Car Crashes 2007-2010

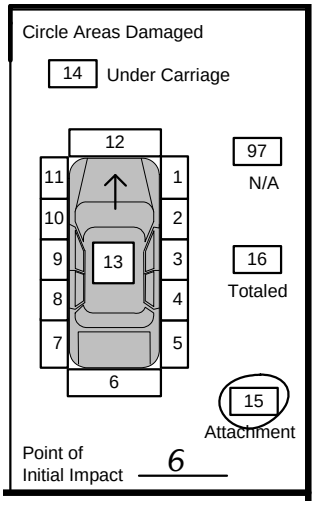


3.2.2.2 Problem Identification Example 2: Point of Initial Impact

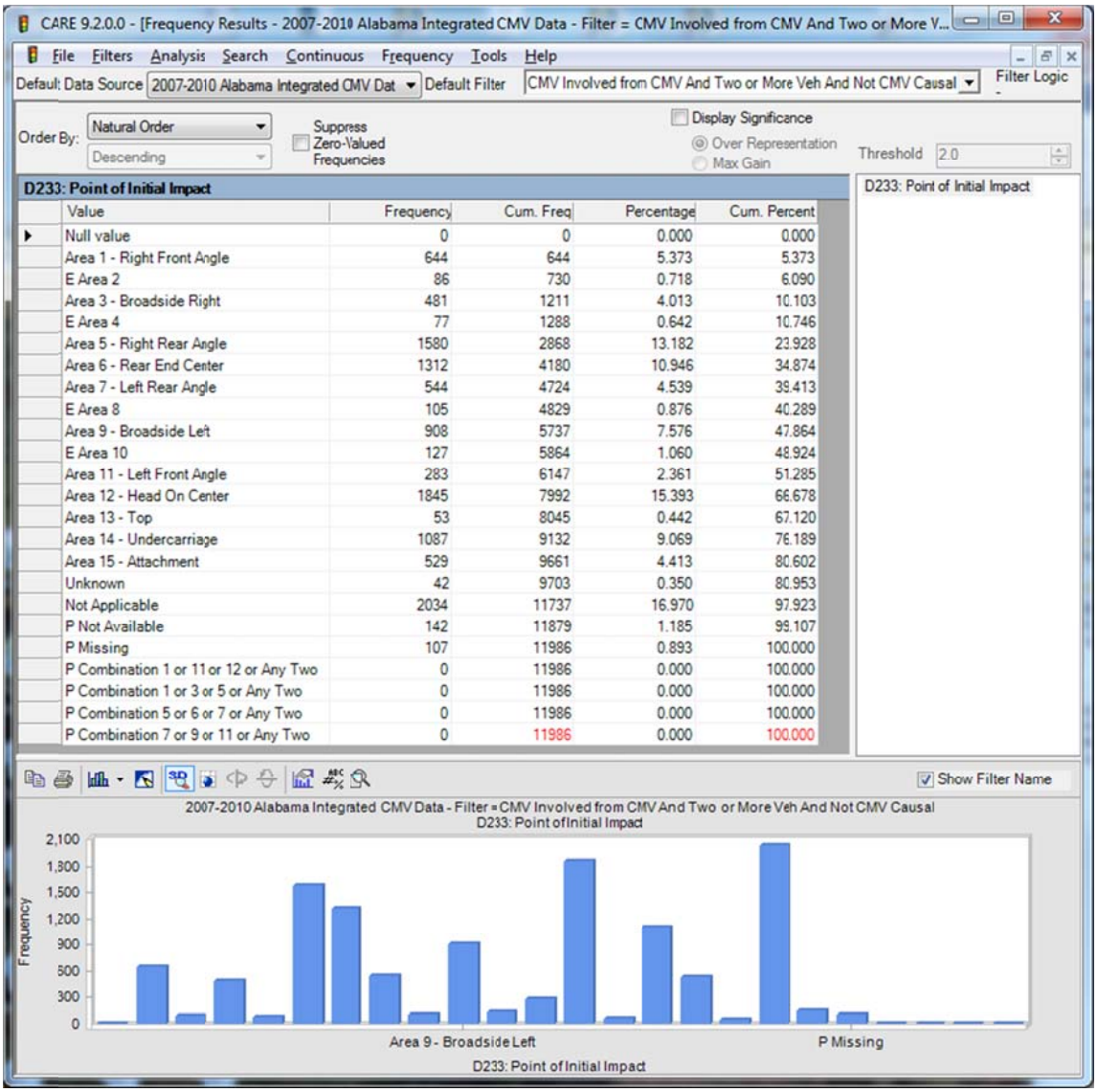
Another more detailed problem identification step that was performed for the recent Alabama project was done to support the PI&E effort. The question arose as to which of the critical areas around CMVs was experiencing more problems. The theory was that an excellent proxy could be exploited for information if a measure could be taken before and after (PI&E)) of the drivers' perceived relative importance of providing more space in one of the three following areas: (1) in front of the truck, especially after passing (the area given most consideration by most PI&E efforts in the past); (2) in the rear of the truck (tailgating); or (3) in the blind spots. The left and right blind spots were combined since the treatment for both is relatively the same, and it would be confusing to try to differentiate between them in a questionnaire.

So, the question was: Which of these three areas should be given the greatest concentration in the PI&E effort? It seemed reasonable that the area that was having the greatest crash frequency should receive greatest concentration, since this might be the area that the general driving public is not fully informed about. A variable within the Alabama crash records indicates the point of initial impact. While not a perfect indicator, this would tend to show which areas are most vulnerable in a CMV-car impact. The analysis was run on all crashes (not just youth-caused) from 2007 to 2010, on CMV involved crashes where there was a car and CMV involved, and the initial impact was on the CMV. This provided 11,986 CMVs for evaluation. The process was re-run with just youth-caused crashes with everything else the same. While this only provided 1,208 crashes, it was clear from the proportions that the overall conclusions would not be changed in any significant way, so the analysis was moved forward using all of the data (as opposed to the youth-caused subset).

Display 3.2.2.2 presents the point of initial impact on the CMV when involved in two-vehicle crashes in which the CMV was not the causal vehicle (filter: CMV Involved from CMV [dataset] AND Two or More Vehicles involved AND NOT CMV Causal Vehicle). The following is a key to the eCrash areas:



Display 3.2.2.2 Point of Initial Impact for Car-CMV Crashes



The following provides the rationale for translating the initial point of impact into an inference as to the error of the non-CMV vehicle (car) that caused the crash:

- Car was in the right blind spot: 1, 2, 4, 5.
- Car was tailgating: 6.
- Car was in the left blind spot: 7, 8, 10,11.
- Car was cutting off, slowing down or otherwise too close to the front of the CMV: 12.
- No inference can be made from any of the other categories

The following summarizes the various inferences drawn above with the most frequent listed first:

TYPE OF CAR ERROR	POINT OF IMPACT	NUMBER	PERCENT
Car in the right blind spot	1, 2, 4, 5	2387	19.9%
Car in the left blind spot	7, 8, 10, 11	1059	8.8%
Car was tailgating	6	1312	10.9%
Car too close in front of truck	12	1845	15.4%
Other (not applicable)	3, 9, 13-22	5383	44.9%

Assuming that this mapping of points of impact to errors of the automobile driver are correct, this indicates that blind spots are far more critical than tailgating or driving too close in front of a CMV (including cutting off the truck). Right blind spots are more of an issue than left blind spots; this is reasonable since passing a CMV on the right is a particularly hazardous driving maneuver. Also, it is reasonable to see more truck-hitting-car rear-end crashes than vice versa. Blind spots are approximated three times the problem of car tailgating, and about twice the problem of cars being too close in front of trucks (or truck tailgating).

The following are additional points for possible consideration:

- The relative speed of the car with respect to the truck is far more important than the distance allowed when passing. If a car is accelerating and going faster than the truck then the space between the car and the truck will continue to increase. The worst situation is when the car pulls in front of the truck and then slows down, even if it left plenty of room in pulling over ahead of the truck.
- To get out of the blind spot might require the car to either speed up or slow down. In any event the worst case situation is remaining for any length of time in the blind spot. Cars should never drive along side of trucks – they should either speed up or slow down, but not remain in the blind spot. It might be noted here that an initial recommendation to "speed up" as a countermeasure was removed from the Alabama TACT poster because law enforcement viewed it as giving car drivers a right to drive over the speed limit.
- Neither cars nor trucks should tailgate (i.e., continue to travel over an extended period of time within two semi-truck's length of the other vehicle). This can be avoided by moving into the other lane (preferably the left lane), passing the truck and maintaining a speed higher than that of the truck, or not passing but slowing down and allowing more room between the car and the truck.

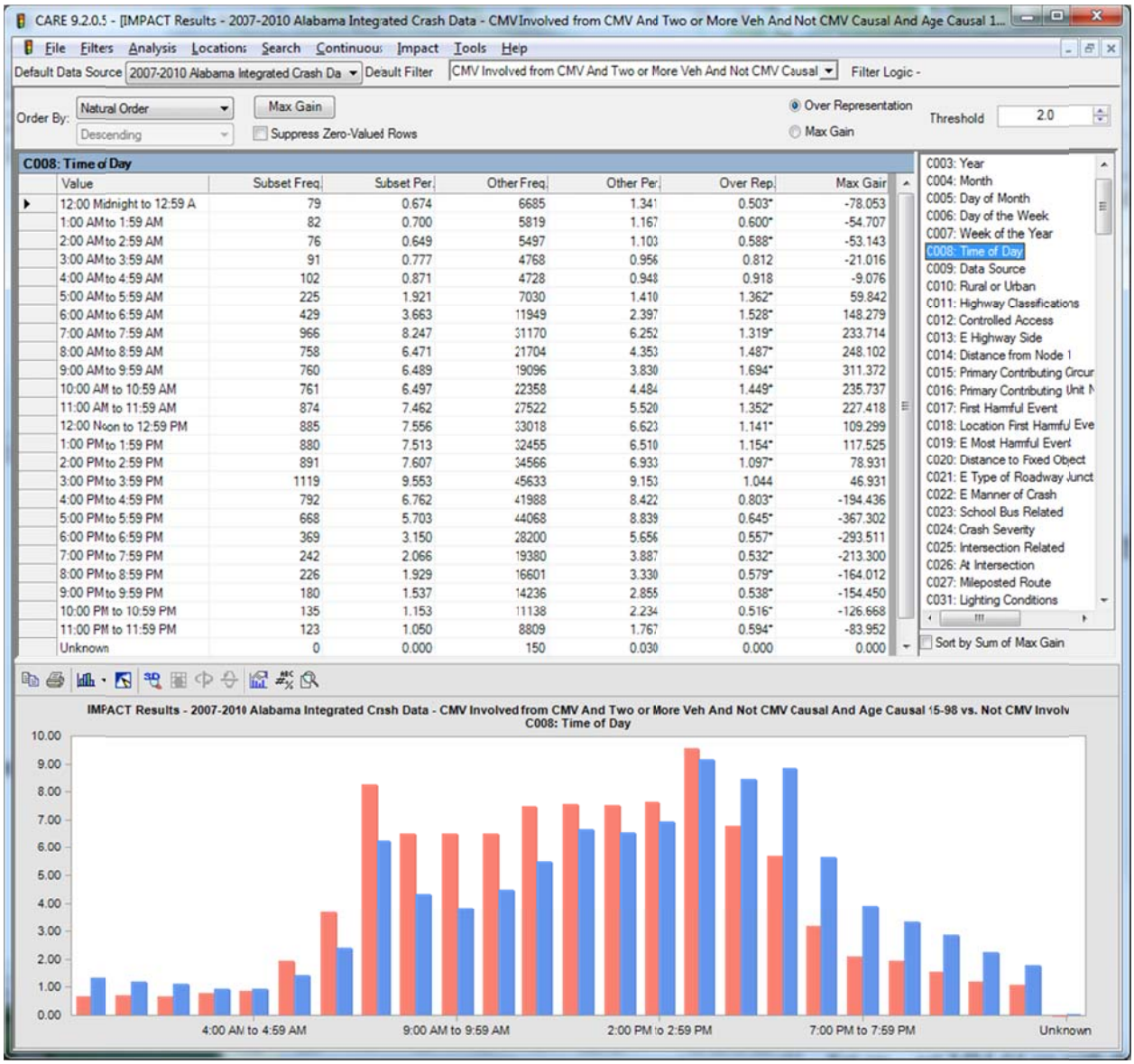
The above gives the rationale for the design of the billboard and posters used in this project to emphasize blind spots as opposed to tailgating. One of the questions in the drivers' survey had to do with the recognition of this, and it was assumed that if a change was detected between the before-during-after time periods that this would be a positive effect to either the billboard or the posters (or both).

3.2.2.3 Problem Identification Example 3: Time of Day and Day of the Week

In order to maximize the effectiveness of the TACT effort with regard to the target focus crash type under consideration, it is essential that the time of day and day of the week when most of these crashes are occurring be established and resourced be deployed accordingly. Recall that the focus crash type in this particular project was those crashes caused by younger (aged 16-28, with a special emphasis on the 16-20 year old drivers).

Time of Day

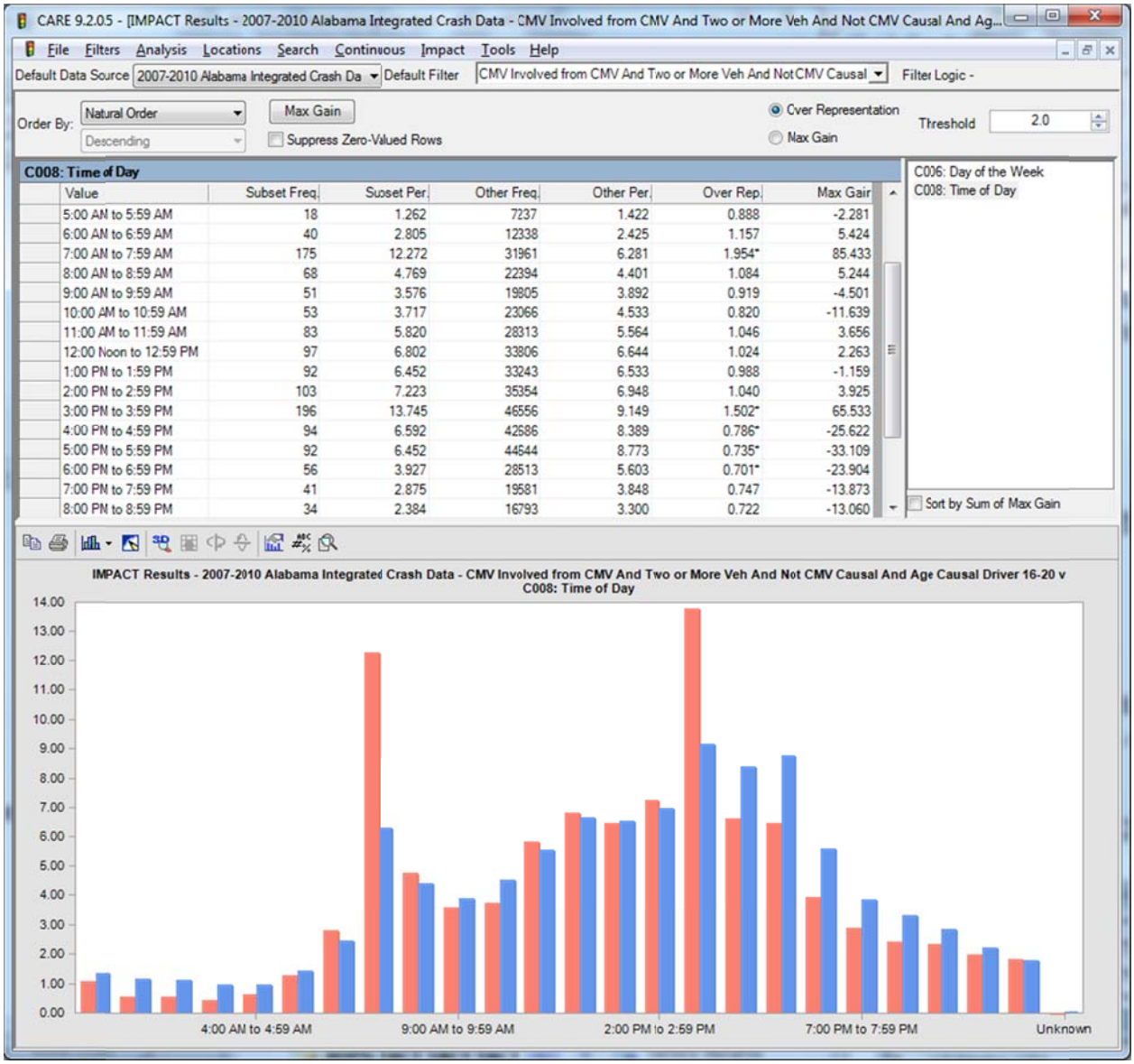
Display 3.2.2.3 Time of Day IMPACT Comparison for Focus Crash Type (All Ages)



Display 3.2.2.3 shows a comparison of CMV involved multi-vehicle crashes caused by car drivers (red bars) as compared to its complement (all other crashes – blue bars). It demonstrates that the day-time morning and early afternoon hours are those that should be given priority. The highest for both the CMV involved and non-CMV involved is 3:00-3:59 PM, which is the beginning of the afternoon rush hour. These concentration times for TACT are fortuitous in that law enforcement resources are often consumed in afternoon rush hour emergencies, and DUI enforcement during the later night-time hours.

It is interesting to compare the IMPACT run in Display 3.2.2.3, which includes causal drivers of all ages, to that given in Display 3.2.2.3a, which includes only causal drivers aged 16-20. Clearly the before and after school hours are greatly increased due to the presence of younger drivers at these times. While such a result is not expected to create a major change in the TACT approach, it is certainly be of interest to the patrol officers.

Display 3.2.2.3a Time of Day IMPACT for CMV Involved with Causal Drivers Aged 16-20

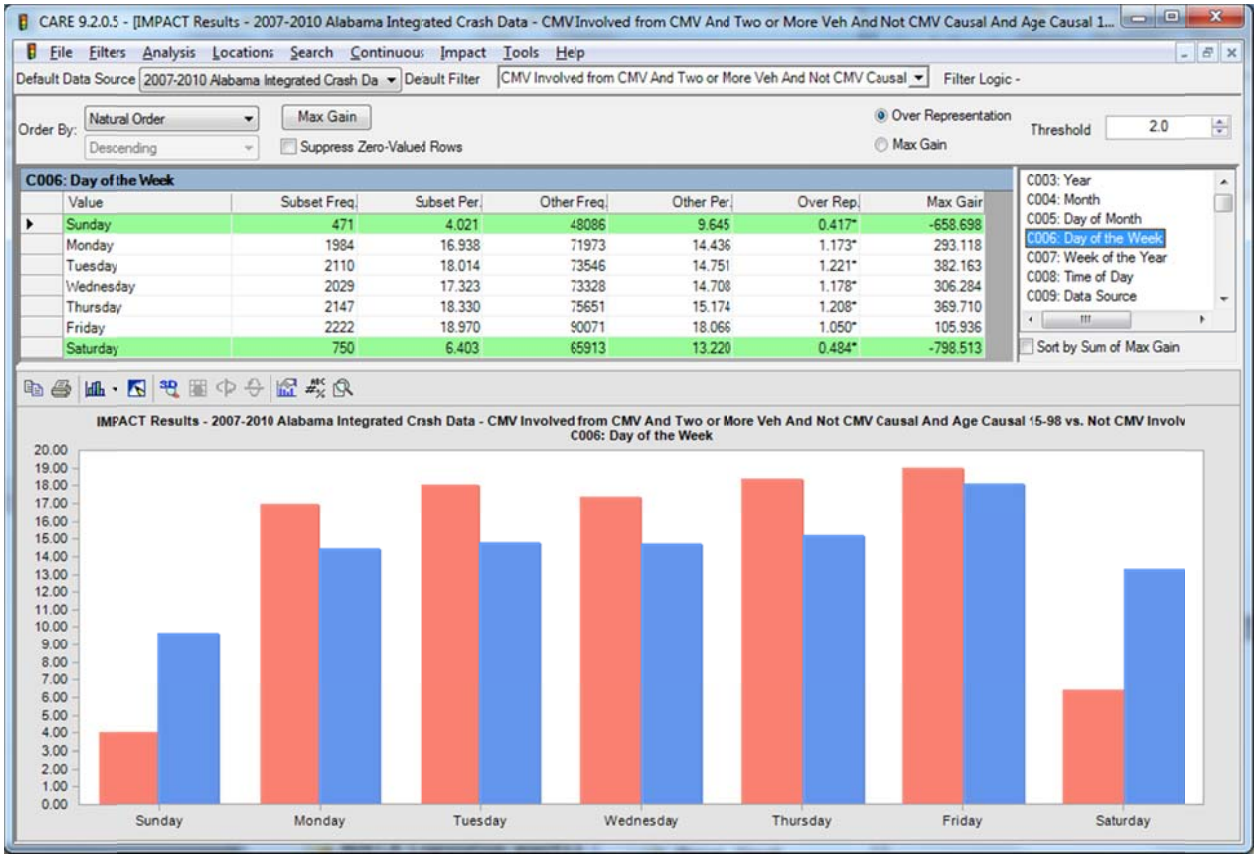


Value	Subset Freq	Subset Per	Other Freq	Other Per	Over Rep	Max Gain
5:00 AM to 5:59 AM	18	1.262	7237	1.422	0.888	-2.281
6:00 AM to 6:59 AM	40	2.805	12338	2.425	1.157	5.424
7:00 AM to 7:59 AM	175	12.272	31961	6.281	1.954*	85.433
8:00 AM to 8:59 AM	68	4.769	22394	4.401	1.084	5.244
9:00 AM to 9:59 AM	51	3.576	19805	3.892	0.919	-4.501
10:00 AM to 10:59 AM	53	3.717	23066	4.533	0.820	-11.639
11:00 AM to 11:59 AM	83	5.820	28313	5.564	1.046	3.656
12:00 Noon to 12:59 PM	97	6.802	33806	6.644	1.024	2.263
1:00 PM to 1:59 PM	92	6.452	33243	6.533	0.988	-1.159
2:00 PM to 2:59 PM	103	7.223	35354	6.948	1.040	3.925
3:00 PM to 3:59 PM	196	13.745	46556	9.149	1.502*	65.533
4:00 PM to 4:59 PM	94	6.592	42586	8.389	0.786*	-25.622
5:00 PM to 5:59 PM	92	6.452	44544	8.773	0.735*	-33.109
6:00 PM to 6:59 PM	56	3.927	28513	5.603	0.701*	-23.904
7:00 PM to 7:59 PM	41	2.875	19581	3.848	0.747	-13.873
8:00 PM to 8:59 PM	34	2.384	16793	3.300	0.722	-13.060

Day of the Week

Similar to the analysis above, a comparison of the CMV-car crashes that were caused by the car drivers were compared against all other crashes (both, in this case, for all aged causal drivers). The results are presented in Display 3.2.2.3b. This illustrated that Monday through Thursday are the prime over-represented days with the weekend days being very significantly under-represented. Friday is the highest day for both the subset and its complement, but the over-representation is not nearly as high for Friday. Law enforcement resources are usually diverted to the typical Friday PM rush as well as alcohol enforcement on the weekends, so this provides additional reasons for allocating TACT resources on Monday through Thursdays.

Display 3.2.2.3b Day of the Week IMPACT Comparison for Focus Crash Type



As was the case of the time-of-day run above, a further analysis was run that considered only those crashes caused by 16-20 year old drivers. The shape of the comparison was almost identical to that given above, however, so very little additional information could be gained from it.

A Note about Setting Specific Goals

Some federal safety programs require that effectiveness goals be set that are very specific to the particular target population. If these goals are just set arbitrarily they can be counterproductive in being summarily ignored if not met, or providing a false sense of security if they are met. Usually they are set so aggressively that they are rarely met. Thus the setting of specific quantitative goals has not been emphasized. However, if they are going to be set, the double-bar charts (as exemplified above) for over-representation can be used to assure that they are reasonable. For example, if a youth-driver proxy metric of "after school" is going to be used to set a goal, then it can be noticed that for youth aged (16-20) drivers the percentage in the 3-4 PM time slot was 13.7%, while for all drivers included it was 9.5%. It would be unreasonable to think that the 13.7% could be reduced any lower than its 9.5% base if targeting youthful drivers.

In other words, the over-representation provides a strong guide to setting reasonable goals that are addressed to specific targets. A simpler example is found in the day of the week comparison above. Discarding Friday, since it would not be an effective TACT day due to the many other distractions (and perhaps much heavier traffic), other weekdays are considered to be prime targets for TACT activities. The TACT issues on those days represent, on average, 17.6% of the TACT crashes, while the non-TACT issues represent only 14.8% of those issues. It is a reasonable (yet aggressive) goal to perform TACT on Monday-Thursday (at the appropriate over-represented hours) and expect a reduction of the 17.6% to 14.8%. However, to expect more than this would not be reasonable.

3.2.3 Problem Identification Tools Available to the Patrol Officers

While the problem identification methods and processes above are essential to providing the information for planning and guiding a TACT project, they are largely conducted by the TACT technical staff of a university or a private consultant organization. The tools presented in this section are designed to be implemented by the patrol officers themselves. The value of enabling the officers themselves to be able to access this information should be obvious:

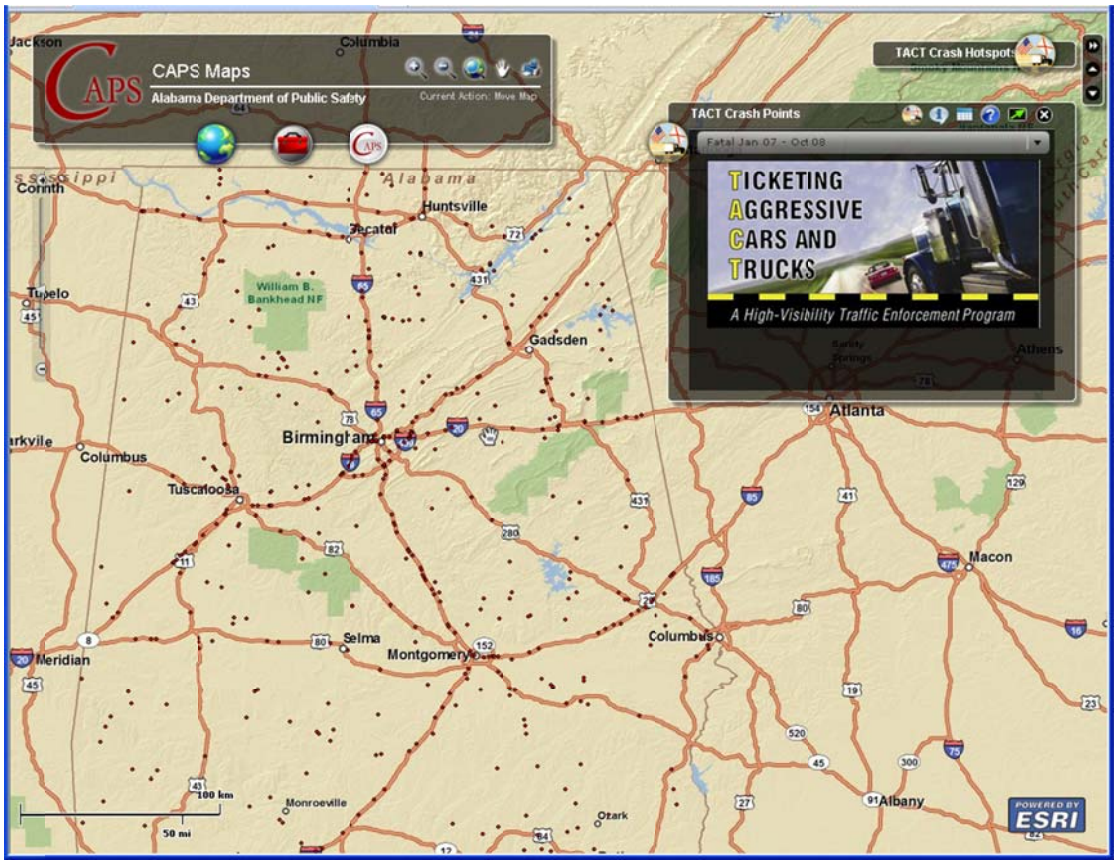
- There is an increased trust level when any individual discovers new information for himself or herself; this is basic human nature and law it applies to enforcement officers just like anyone else.
- The officer can call up information dynamically as opposed to the analysis being done weeks or months ahead of time and perhaps not targeted specifically to the officers' immediate needs.
- Perhaps most importantly, if it is recognized by the reporting officers that the data that they are generating are deficient, there will be a cultural change to improve the accuracy of the data, especially with regard to location specifications, in a way that could not otherwise be accomplished. Of course, these data are used for other traffic safety purposes as well (e.g., roadway improvements), so this provides a very important benefit.

Several tools were developed and placed on the TACT web site that could be used directly by participating law enforcement officers. This section will go through some of these tools to illustrate their value and use.

The first of these is the high-crash hotspot identification program itself, the output of which is given in Display 3.2.3. This differs from the hotspot listings and maps described in Section 3.2.1 in that the files to be downloaded there of hotspot listings were static, i.e., they had already been determined by a set criteria established by the project management. Here the criteria can be altered as can the time frame of the data. For example, the output displayed is limited to fatal crashes that occurred between January 7 and October 8, 2009 (see the second line on the pane

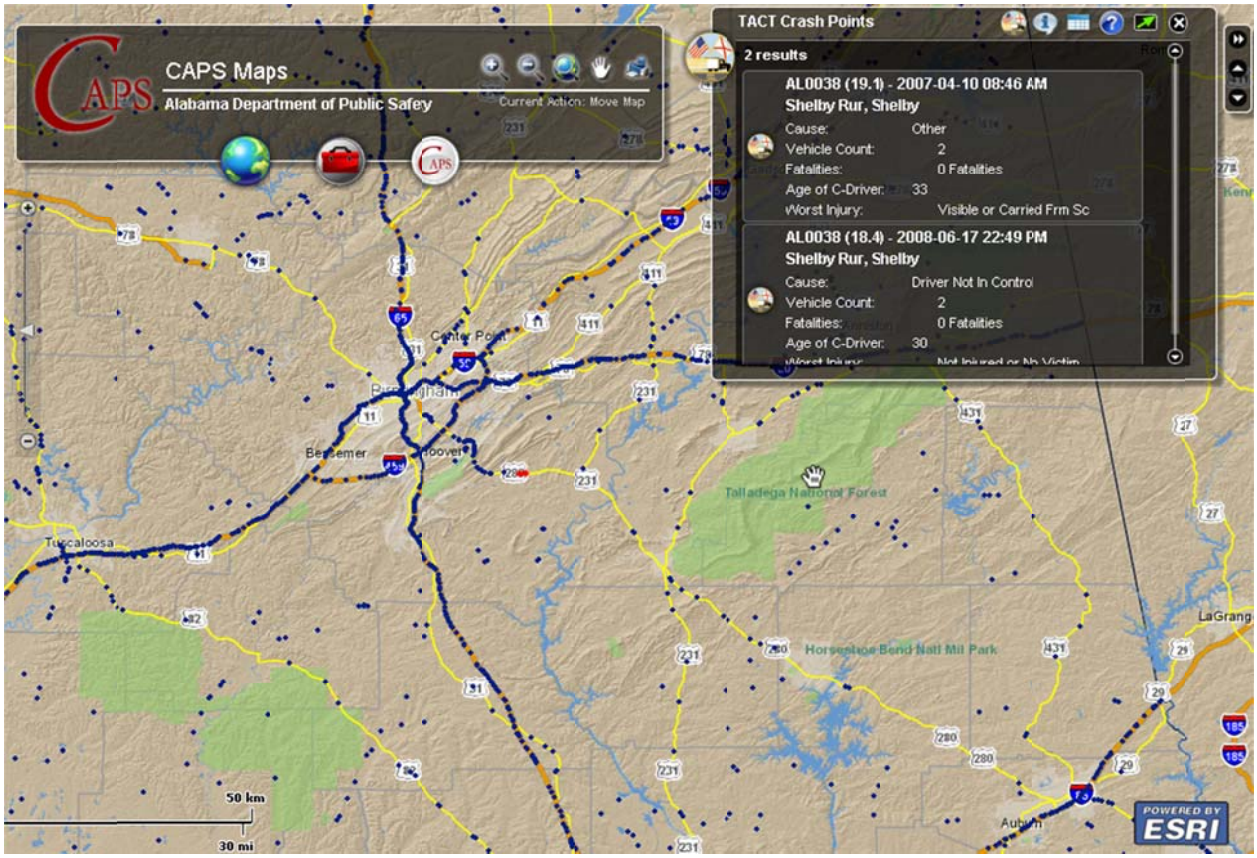
labeled “TACT Crash Points). Users can specify if the hotspots are for CMVs in general or for only the TACT violations.

Display 3.2.3 TACT Crash Hotspots Statewide for User Specified Criteria



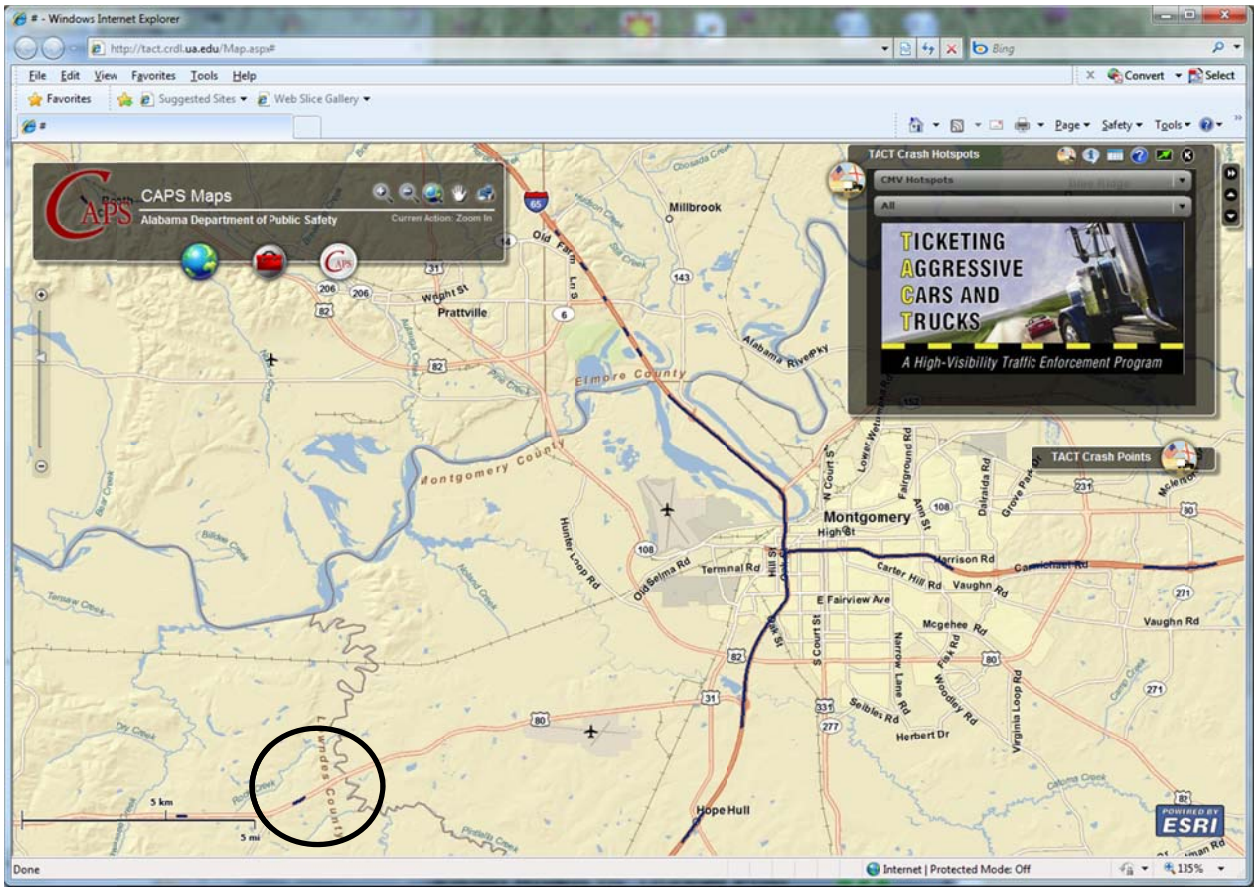
Display 3.2.3a illustrates the output when a user clicks on a hotspot. This will cause a pane to pop up that will give information on the crashes within that hotspot. This pane is scrollable if there are more than two crashes involved. The particular details that come out can be reset by parameters within this tool. The variables specified to come out for this example included the crash cause, number of vehicles in the crash, the number of fatalities, the age of the causal driver and the worst injury in the crash.

Display 3.2.3a TACT Crash Points – Result of Clicking on a Hotspot



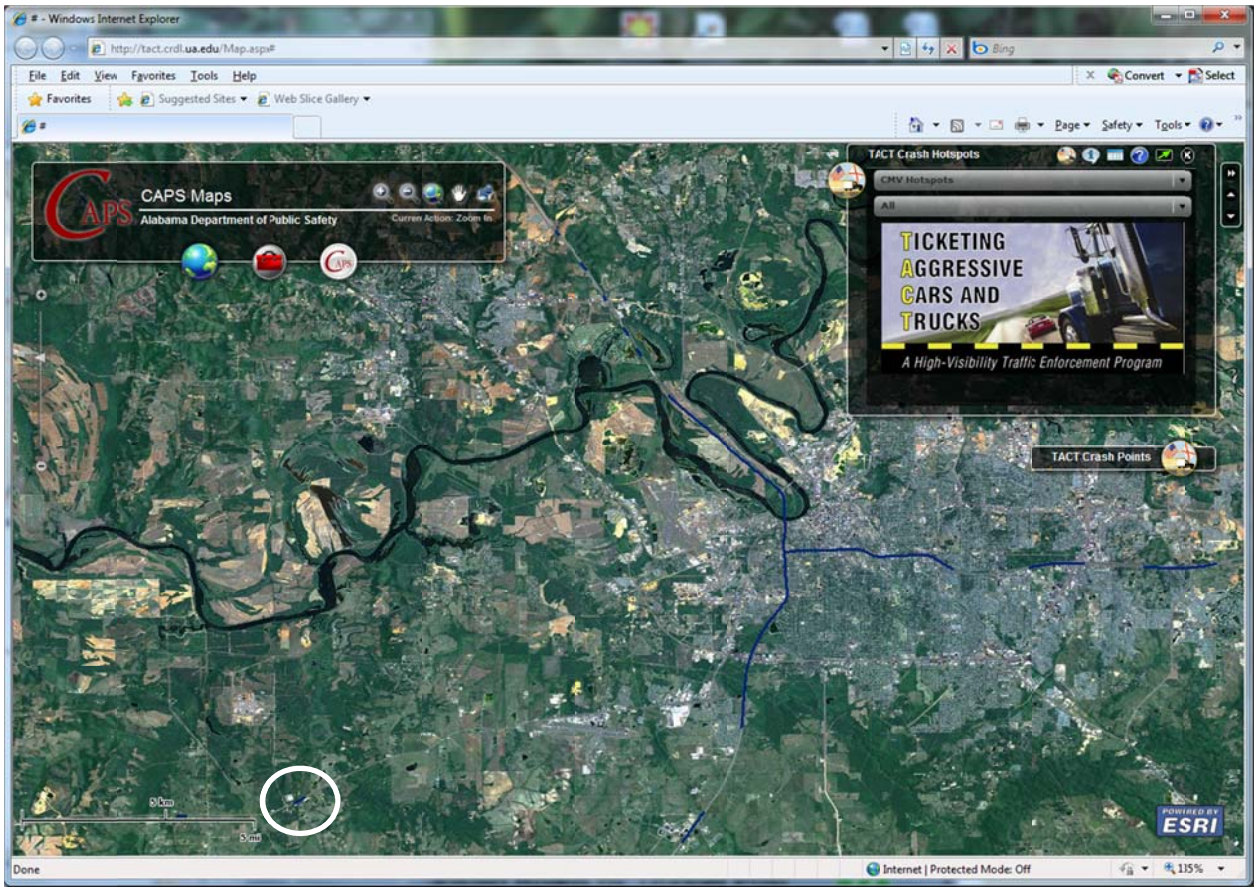
Hotspots can be represented as segments of roadway as opposed to collections of crashes. This is illustrated for the area west of Montgomery in Display 3.2.3b. Notice the second and third lines on the TACT Crash Hotspots pane, in the upper right corner of the screen. This shows that the output is for CMV clusters with no restrictions (All). These drop downs allow a number of different alternative outputs, e.g., TACT violations for injury and fatality crashes. While it is no surprise that the Interstate highways through Montgomery have high concentrations of CMV crashes, note the two hotspots near the bottom left on the map on route US-80 (the major route to Jackson Mississippi).

Display 3.2.3b Highlighted Hotspot Segments in the Montgomery Area



There are times when it is difficult to determine the location of a hotspot just from the features given on a map. Since aerial photography exists and is in the public domain for most of the state, CAPS was able to work this into its tool set. Display 3.2.3c presents the aerial imagery for the map given in Display 3.2.3b. The hotspots are still shown in this display, although they are difficult to see at this "altitude." Note the black circle at the bottom left of the screen above, which corresponds to the white circle on the imagery below. These are of the identical hotspot location that will be the focus of the next display.

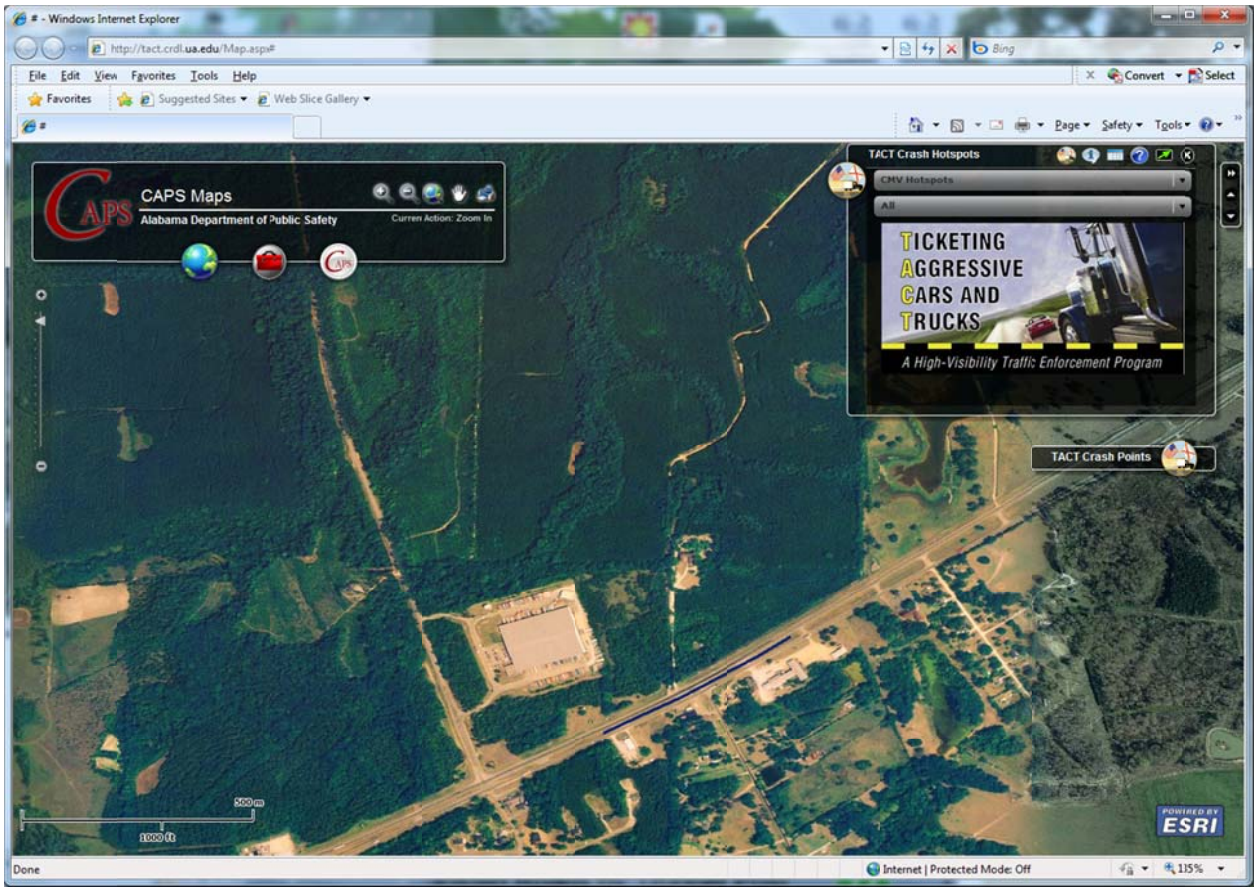
Display 3.2.3c Previous Display in Aerial Photography Imagery



Display 3.2.3d demonstrates a close-up of the area marked in the previous displays. Notice the hotspot mark on the major route (US-80). It appears that there might be industrial plants or other commercial activities in this area. The imagery can be magnified to very close up in order to see the features along the roadway that would define not only the range of the hotspot, but also some of the hazards that might have caused the crashes along this stretch of roadway. This could be quite valuable in the decision as to whether to work this hotspot or not, and, if so, the tactics that would be employed in working it.

SEE PART 3

Display 3.2.3d Close-Up of Marked area from Previous Display



Display 3.2.3e demonstrates another way that was recently developed for showing both the CMV related and the TACT contributing circumstance hotspots on the same map. In this case, according to the legend, the CMV crash hotspot segments are shown in yellow, while the aggressive driving (TACT contributing circumstances) hotspots are in red. Note that the red segment indicators are wider than the yellow indicators. This enables the areas where both criteria are met to be identified, which would generally be the most appropriate for TACT interventions.

of CMV crashes to total crashes outside of the test area. In situations like this, the question that should be asked is: are external factors apt to have the same effect on the numerator and the denominator of the fraction. For example, if economic effects will increase or decrease both the numerator and the denominator by the same relative amount, then its effect will be buffered out by the comparison of ratios as opposed to absolute numbers.

3.4. Gather "Before" Crash Data in the Target and Control Areas

The before and after crash data were effectively accumulated and retrieved from the CARE crash database at the same time in order to do the crash comparisons. This is presented in Section 5.2.

3.5. Gather "Before" Citation Data in the Target and Control Areas

The before and after citation data were effectively accumulated and retrieved from the CARE citation database at the same time in order to do the crash comparisons. This is presented in Section 5.2.

3.6 Gather "Before" Survey Data

Initial Drivers' Survey Plan

Once the problem identification was completed, updates were made to the plans for the drivers' license station surveys. Given that the segments were defined as indicated in Section 3.2.1, the driver license stations were resolved to be related to the following counties:

- I-59 – Tuscaloosa only (considering possible multiple DL stations within the county),
- I-65 – Chilton and Shelby (Montgomery to Birmingham),
- I-65 – Cullman and Morgan (Birmingham to Huntsville),
- I-10 – Mobile and Baldwin,
- I-85 – Lee and Macon

For the first round of the project the test site would be the defined I-59 corridor, and the control site would be the I-85 corridor. Other planning and implementation considerations that were resolved at this point included the following:

- There was some urgency to obtain permission for and resolve which drivers' licensing stations were to be used to implement the general public driver questionnaire.
- The driver questionnaire process was to be set up and start as soon as possible in order to assure that sufficient test and control data were available. The process would continue well after the selective enforcement details were over to measure the sustainability of the effects.
- Posters would not be displayed in the drivers' license stations where the surveys were being conducted since that would obviously bias the results.

- For this particular project PI&E was to include:
    - Billboards,
    - Posters at rest stops and at local high schools and universities,
    - News releases and news personality "ride-alongs" to assure coverage in the general area of the program implementation.
- The experimental design called for a target of 30 surveys per month to be completed at each drivers' license station.

Final Update to the Drivers' Survey Plan and Implementation

Surveys of driver awareness of the 2011 TACT program in Alabama were conducted to see if there were detectable effects on driver behavior in the study corridor as a result of the PI&E and enforcement campaigns. Paper surveys were delivered to two drivers' license renewal offices (DLROs), Tuscaloosa and Shelby Counties that were in the vicinity of the study corridor (i.e., with both PI&E and enforcement effects). For control purposes, surveys were also delivered to two offices, Lee and Macon Counties, in the I-85 control corridor where no PI&E or enforcement were conducted.

Truckers' Survey Plan

Online surveys were developed and administered to truck drivers in Alabama. The survey was available on the Safe Home Alabama page.

Officers' Survey Plan

Online surveys were developed and administered to traffic safety officers in Alabama. The survey was available on the Safe Home Alabama page.

See Sections 3.1.3.2-3.1.3.4 for additional details on the survey plans. See Section 6.3 for results obtained, which also contain details of the plan.

3.7. Gather "before" observational data

Video data were gathered beginning in March 2011 at approximately milepost 72 on the I-20/59 study corridor prior to dissemination of any PI&E materials. The details of the observational data collection were given in Section 3.1.4.

3.8. Establish Administrative Data Support

The two major purposes for administrative evaluation and the accompanying data are (1) to provide a history, e.g., for accounting and audit purposes, that the project was carried out according to plan, and (2) to provide time and location information that is essential to being able to do an effectiveness evaluation, e.g., knowing when the before-during-after periods started and ended well after the project when crash and citation data become available. One of the largest

problems in coming in after the fact and attempting to perform an evaluation is the loss of these details, especially with regard to when the various components of the project were conducted, where they were conducted and exactly what was done.

Sufficient detail as to the administrative data needs for the selective enforcement components of TACT projects was presented in terms of example web-based self-reporting tools in Section 3.1.6. In addition to this, the following is a checklist of administrative data needs with regard to the PI&E components for the most recent TACT project in Alabama:

- Billboards
    - Who was contracted to provide?
    - What was the composition?
    - When did they go into effect (fully constructed)?
    - Where were they (route and milepost)?
    - How much did they cost?
- Posters (same questions as above, with the following additions)
    - When were they deployed?
    - To whom were they deployed (location and facility type)?
- News contacts (same questions as above, with the following exceptions)
    - Who provided the interactions?
    - What was the nature of them?
    - When did they take place?

Examples of actual administrative data collected during a TACT project are given in Section 4.3.

SEE PART 4

4.0 Data Gathering During the Project

4.1 Feedback during the Project

This feedback from officers in the field and those who are monitoring the PI&E efforts is essential to making proper interpretations of the statistical results. An excellent example of this is given in Section 1.3.3, and will not be repeated here. It dealt with how the tornadoes that hit the Tuscaloosa, Alabama area during the time frame of the project delayed the project and may have caused the results to be skewed one way or the other. Generally what should be documented here should be restricted to that which has not been anticipated in the normal course of the TACT project (e.g., a sudden road closure due to weather).

4.2 Gathering Crash, Citation, Survey and Observational Data during Project

Example details documenting this data gathering have been covered above in Sections 3.4-3.7. The major point of this methodology step is that there are valuable aspects of the TACT project that should be obtained and documented throughout the project. This is especially true if there were any abnormalities encountered that would affect the interpretation of the statistical analyses.

4.3 Gather Administrative Data during the Project

4.3.1 PI&E Administrative Data

Billboards

The following presents an example of the administrative data for a small targeted PI&E effort that responds to the questions posed in Section 3.8. These examples are from the TACT project that was started with a PI&E effort in the last two weeks of April. The selective enforcement effort was initiated on Monday June 13, 2011. The PI&E efforts involving news media, billboards and posters were continued from June 13 through July1, 2011.

The vendor that provided the billboards was Lamar Texas LP, which has offices in Birmingham, Alabama and controls several billboards along this corridor and throughout the state. They provided the billboards at a cost of $8,700 for the two billboards for the duration of one month (although the billboards were allowed to stay up slightly over the one month period beginning on April 25, 2011. Billboards were installed in both the northbound and southbound directions along I-20/59 between mileposts 79 and 81. The following presents an image of one of the two identical billboards that were constructed. Display 4.3.1 illustrates the billboard presentation.

Display 4.3.1 Billboard Presentation

Posters

Posters were designed and produced within the University at nominal cost. Approximately 125 posters were produced. These were used for general publicity of the program, with the exception of the Driver's Licensing Offices where the surveys were being conducted. More specifically, these informational posters were used to compliment the billboards, and they were delivered between April 16 – 20, 2011 to drivers' education teachers for display in 11 high schools located near the test corridor to inform students of the dangers of driving in truck blind spots. The following were the high schools that were covered: Holy Spirit, Central, Paul W Bryant, Pelham, Bessemer, Hueytown, Midfield, Wenonah, A.H. Parker, George Washington Carver, Huffman, and P. D. Jackson-Olin high schools. These informational posters were also placed in student activity and recreational buildings on the Tuscaloosa and Birmingham campuses of the University of Alabama. Display 4.3.1a presents the poster demonstration.

Flyers were also placed around The University of Alabama and The University of Alabama at Birmingham. These were placed in high traffic areas on the campuses by team members.

Display 4.3.1a Image of Poster Demonstration

Display 4.3.1b TACT Project News Release

NEWS RELEASE

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June 6, 2011

Trooper Efforts on I-59 to Prevent Car-Truck Fatalities

MONTGOMERY —The Department of Public Safety is taking the steps to prevent car-truck crashes by renewing its efforts on an initiative known as TACT: Ticketing Aggressive Cars and Trucks, according to Col. Hugh B. McCall, Public Safety director. McCall said the enforcement and educational program is made possible by a grant DPS received from the Federal Motor Carrier Safety Administration.

McCall announced that this particular initiative will be conducted along the I-59 corridor between Tuscaloosa and Birmingham. It will include intensive enforcement, the use of billboards, and news media involvement.

TACT focuses on the unsafe driving behaviors that contribute to serious and fatal crashes between personal and commercial motor vehicles, said McCall. These include unsafe lane changes, following too closely, failure to signal lane changes, failure to yield the right of way, speeding, and aggressive driving, which is a combination of two or more risky driving behaviors.

Alabama state troopers have been targeting their TACT enforcement on sections of roadways identified as high-risk areas for crashes involving commercial vehicles, McCall said. He said the University of Alabama's Center for Advanced Public Safety is conducting pre- and post-initiative analysis of serious and fatal crashes involving commercial vehicles both to guide enforcement activities and to gauge their effectiveness.

Studies, both nationally and in Alabama, show that automobile driver-related causal factors are indicated for the automobile driver in more than 80 percent of the fatal crashes involving a car and a commercial motor vehicle.

The Alabama Department of Transportation and the Alabama Trucking Association have partnered with the Department o Public Safety in the TACT program, helping educate motorists about sharing the road safely through posters, electronic message boards, and displays on commercial motor vehicles.

The Federal Motor Carrier Safety Administrative initiated TACT in 2004 as a pilot program in Washington state. Based on the success of the pilot, FMCSA has encouraged other states to participate, and Alabama is now one of 15 states that have received federal funding to implement a TACT program.

End of June 6, 2011 News Release

News Media Activities

The news release for the example TACT project is given in Display 4.3.1b. It was released shortly after it was produced on June 6, 2011. This was used as the basis for several articles and TV time spots. Ride-along invitations were also sent out to the Tuscaloosa News and the Birmingham News.

The following presents a sample list of some of these presentations by the news media:

ABC 33/40: "Initiative to reduce car-truck fatalities along I-59," June 14, 2011, http://www.abc3340.com/story/14905214/initiative-to-reduce-car-truck-fatalities-along-i-59

WBRC FOX6: "Troopers cracking down on dangerous drivers along I-59 corridor ," June 14, 2011, http://westjeffersoncounty.myfoxal.com/news/news/troopers-cracking-down-dangerous-drivers-along-i-59-corridor/89299

Tuscaloosa News: "Aggressive I-20/59 drivers targeted," June 18, 2011, http://www.tuscaloosanews.com/article/20110618/NEWS/110619706/1007/news02?Title=Aggressive-I-20-59-drivers-targeted

Tuscaloosa News: "Troopers stepping up enforcement on I-20/59" (ride along), June 17, 2011, http://video.tuscaloosanews.com/video/1000721527001

Tuscaloosa News: "State Troopers stepping up enforcement on Interstate 20/59," June 17. 2011, http://www.tuscaloosanews.com/article/20110617/NEWS/110619729/1007?Title

Also given a sound spot on WVUA, the local Tuscaloosa TV station (not documented on their web site), http://www.wvua7.com/

Generally, these media spots occurred slightly before the TACT selective enforcement effort that was initiated on June 20th, which enabled some data to be gathered on just the effect of the Pi&E efforts.

4.3.2 Officer Activity Administrative Data

4.3.2.1 Officer Activity Administrative Data for First TACT Project

This section will first cover the details of officer activity and the citations issued during the TACT project. Descriptive narratives and tables illustrate the administrative information that was collected. The example given is from the first Alabama TACT project.

The selective enforcement (SE) component of the first TACT project was conducted by the Alabama Department of Public Safety and 12 local police agencies, all of which have commercial motor vehicle (CMV) certification. TACT efforts generally followed the basic pattern of most patrol selective enforcement programs with the emphasis in this case being on the types of offenses outlined above. Both marked and unmarked cars were used in the effort; of the 280 DPS vehicles employed, approximately 80 (close to 30%) were unmarked.

Unmarked vehicles were also used in the three CMV ride-along details that took place on September 10th, October 28th, and November 17th, 2009 as part of the overall TACT effort. This involved a trooper riding in the CMV in radio contact with a number (3, 5 and 4, respectively) of unmarked cars following the CMV. Violations observed by the riding trooper were relayed to the unmarked patrol units which then stopped the violator and issued the citation. This effort resulted in a total of 180 contacts of which 16 were classified as aggressive drivers (evidence of multiple offenses caused by negative driver attitude).

Concurrent with the public information and educational component, the SE component was conducted in three phases over the following dates:

PHASE	DURATION (2009)
1	September 6th – 12th
2	October 4th – 17th
3	November 15th – December 12th

Each of the police agencies that participated were required to submit a report for each time that each person participated, including the location, time and types of citations given.

A *submission* to the TACT officer activity database is defined to be one group of data on activity by a given individual officer. There are generally several contacts for any given submission.

The following gives a listing of the number of these submissions for the eight DPS troops and the 12 local law enforcement agencies that participated.

AGENCY OR TROOP	**SUBMISSIONS**
Arab PD	3
Baldwin County Sherriff	18
Birmingham PD	56
Decatur PD	2
DPS - Troop A	231
DPS - Troop B	889
DPS - Troop C	146
DPS - Troop D	509
DPS - Troop E	726
DPS - Troop G	537
DPS - Troop I	1053
DPS - Troop K	45
Guntersville PD	1
Hoover PD	7
Mark Neilson	6
MCSU North*	137
MCSU South*	181
Oneonta PD	11
Pelham PD	20
Vestavia Hills PD	3
TOTAL	**4,582**

* MCSU = Motor Carrier Safety Unit, a unit within the Department of Public Safety (DPS).

The total SE effort consisted of 19,224 hours, making the average duration per submission to be about 4.2 hours per submission (ranging from a few minutes to 24 hours per submission). There were 26,137 citations issued over the 19,224 hours, which is about 1.4 citations per hour. The total of 29,823 contacts, nearly all of which resulted in issued citations or warnings, in the total of 19,224 hours of effort, or about 1.5 contacts per hour. About 2,249 hours were funded by overtime which was used to supplement the effort statewide. A total of 30,557 citations and warnings were issued as part of the TACT program. Of these, the vast majority (94%) were issued to private motorists and only about 10% of the contacts resulted in warnings as opposed to citations.

In Display 4.3.2.1 the violation types are generally subdivided four ways: (1) citations given to a commercial motor vehicle (CMV); (2) warnings given to a CMV; (3) citations given to a non-

CMV; and (4) warnings given to a non-CMV. These are indicated under the Violation Type column heading. The numbers under the Contacts heading indicate either the number of citations or the number of warnings given. The Average column gives the average number of contacts given per submission (recall that submissions may vary dramatically in their durations – from a few minutes to 24 hours). The final column (Maximum) contains the maximum number of contacts of the indicated type for any submission. The minimum number of submissions for all of the violation categories was universally zero.

Display 4.3.2.1 Summary of Citations Issued

VIOLATION TYPE	CONTACTS	AVERAGE	MAXIMUM
CMV Speeding Citation	730	0.16	20
CMV Speeding Warning	104	0.02	4
CMV Following Too Close C	43	0.01	4
CMV Following Too Close W	12	0.00	1
CMV Improper Lane Change C	11	0.00	1
CMV Improper Lane Change W	11	0.00	2
CMV Failure To Signal Citation	6	0.00	1
CMV Failure To Signal Warning	5	0.00	1
CMV Aggressive Driving Cit	53	0.01	4
CMV Seatbelt Citation	228	0.05	10
CMV Seatbelt Warning	4	0.00	1
CMV No Insurance Citation	141	0.03	8
CMV No Insurance Warning	6	0.00	1
CMV DL Citation	82	0.02	3
CMV DL Warning	5	0.00	2
CMV Improper Passing Citation	2	0.00	1
CMV Improper Passing Warning	2	0.00	2
NonCMV Speeding Citation	11591	2.53	28
NonCMV Speeding Warning	1525	0.33	11
NonCMV Following Too Close C	375	0.08	6
NonCMV Following TooClose W	165	0.04	6
NonCMVImproperLaneChangeC	220	0.05	4
NonCMVImproperLaneChangeW	158	0.03	8
NonCMV Failure To Signal C	120	0.03	3
NonCMV Failure To Signal W	129	0.03	5
NonCMV Aggressive Driving C	772	0.17	12
NonCMV Seatbelt Citation	3022	0.66	13

Display 4.3.2.1 Summary of Citations Issued, continued

NonCMV Seatbelt Warning	49	0.01	4
NonCMV No Insurance Citation	2948	0.64	9
NonCMV No Insurance Warning	174	0.04	6
NonCMV DL Citation	1287	0.28	7
NonCMV DL Warning	165	0.04	8
NonCMV Improper Passing C	61	0.01	3
NonCMV Improper Passing W	21	0.00	4
Level 1 Driver Violation Cit	18	0.00	6
Level 2 Driver Violation Cit	302	0.07	14
Level 3 Driver Violation Cit	320	0.07	10
Level 1 Vehicle Violation Cit	32	0.01	13
Level 2 Vehicle Violation Cit	1079	0.24	32
Level 3 Vehicle Violation Cit	31	0.01	9
Level 1 Driver Out of Service	2	0.00	1
Level 2 Driver Out of Service	39	0.01	2
Level 3 Driver Out of Service	34	0.01	2
Level 1 Vehicle Out of Service	3	0.00	2
Level 2 Vehicle Out of Service	105	0.02	3
Level 3 Vehicle Out of Service	3	0.00	1
CMV Other Citation	314	0.07	6
CMV Other Warning	98	0.02	6
Non CMV Other Citation	2349	0.51	15
Non CMV Other Warning	867	0.19	10
TOTAL	**29,823**		

Display 4.3.2.1a gives a more elaborate description of each of the violations noted above.

Display 4.3.2.1a Explanation of Contact Descriptors

DESCRIPTOR	FURTHER DESCRIPTION
Level 1 Driver Violation	Violations from the lowest level of driver investigation, considering things such violations as irregularities in the driver's license, absence of medical examiner's certificate, improperly kept record of duty status, etc.
Level 2 Driver Violation	Violations from the middle level of driver investigation, considering most of the same violations as in Level 1 but in a much more intensive way.
Level 3 Driver Violation	Violations from the highest level of driver investigation.
Level 1 Vehicle Violation	Violations from the lowest level of vehicle inspection, considering things such as lights, windshield wipers, tire pressure, air and electrical lines, exhaust system and fuel tanks, steering and brakes.
Level 2 Vehicle Violation	Violations from the middle level of vehicle investigation, considering most of the same violations as in Level 1 but in a much more intensive way.
Level 3 Vehicle Violation	Violations from the highest level of vehicle investigation.
Level 1 Driver Out of Service	Driver not allowed to continue with the trip due to a Level 1 driver violation.
Level 2 Driver Out of Service	Driver not allowed to continue with the trip due to a Level 2 driver violation.
Level 3 Driver Out of Service	Driver not allowed to continue with the trip due to a Level 3 driver violation.
Level 1 Vehicle Out of Service	Vehicle not allowed to continue with the trip due to a Level 1 vehicle violation.
Level 2 Vehicle Out of Service	Vehicle not allowed to continue with the trip due to a Level 2 vehicle violation.
Level 3 Vehicle Out of Service	Vehicle not allowed to continue with the trip due to a Level 3 vehicle violation.
CMV Other Citation	Citation not covered above to a CMV.
CMV Other Warning	Warning not covered above to a CMV.
Non CMV Other Citation	Citation not covered above to a non-CMV.
Non CMV Other Warning	Warning not covered above to a non-CMV.

4.3.2.2 Officer Activity Administrative Data for the recent TACT Project

The details for the most recent TACT Project did not need to be nearly as extensive as the original since it was a project that was greatly restricted in scope, involving only a few officers for less than two weeks. This provides an example of a much smaller and highly-targeted TACT project. It covered only one roadway segment (I20/59 between milepost 63 and 73). This was specified because it was found to be a high CMV crash area, but also to facilitate the evaluation project. The selective enforcement component of the project involved three officers working during their normal hours (Monday through Friday) over a period of time from June 20 through July 1, 2011. This involved one officer who is assigned to Tuscaloosa County and two officers from other counties who were brought in just for this project.

5.0 Data Gathering After the Project

5.1 Use of Data Gathering After the Project

This section in the Methodology Manual emphasized the importance of using the data gathered for such things as determining the length of any "halo effect," and determining the size and duration of selective enforcement "waves." This type of research is beyond the scope of the current project, and no examples were produced. However, all available data and analyses should be applied to make the best possible judgments as to resolving these tactics for future programs. The idea of "thinking outside of the box" is encouraged along with trying new and different approaches as opposed to working future projects according to traditionally established guidelines.

5.2 Gather Crash, Citation, Survey and Observational Data after Project

Examples are presented in Section 6.

5.3 Gathering and Summarizing Administrative Data after Project

Examples are presented in Section 4.3.2.

6.0 Analytical Techniques and Statistical Analysis

To compare numbers without the use of statistical analytical tools is often quite misleading. Sometimes, for example if there is a 100% increase or decrease, the results might seem so obvious that statistical analyses are not necessary. However, such huge increases or decreases are extremely suspect, since they are not typical of any traffic safety countermeasures, especially those involving driver behaviors. Those who are informed on this subject will have an immediate negative reaction to extravagant claims. In addition, while a major obvious increase or decrease probably does not need statistical analysis to determine its validity, analytical techniques are required to estimate the extent of the expected gain or loss. It is not enough to say – this countermeasure works, since most all countermeasures work to some extent. It is essential that the extent to which an individual countermeasure works be determined (i.e., to answer the question: how many crashes were reduced and how does this project into future reductions of fatalities and injuries?). The concept that "if we saved one life it was all worth it" may not be valid because the project could have consumed valuable limited resources that could have been employed on alternative countermeasures. Optimal safety policies depend upon being able to compare alternative countermeasures, and that can only be done by estimating the degree of benefit (e.g., lives saved and injuries reduced).

The above paragraph is not intended to discourage those who are not statistical experts from performing evaluations. There are a variety of ways that a law enforcement staff might move forward with the statistical analyses; among those that should be considered, in order of in-house expertise:

- Assuming that an in-house capability exists, perform the analyses with existing staff;
- If some minimal capability exists, perform the analysis in-house with the techniques recommended below, with the possibility of having it checked by a statistical expert either from an outside consultant or from a sister agency of government (minimal involvement);
- If no capability exists, consider training a staff member who is interested and has some mathematical ability and interests, and then apply the alternative directly above;
- Retain a consultant of expertise from a sister governmental agency to handle the analysis.

In the sections that follow a special effort is made to keep the analyses as simple as possible while maintaining their validity. A few analytical techniques will be used to keep the analysis methodology simple. These procedures are given in the Methodology Manual, and only the results illustrating the use of these techniques will be presented here.

The evaluation of the Alabama TACT programs were conducted in four parts: (1) crash data comparisons, (2) electronic citation issuance comparisons, (3) officer, trucker and driver surveys, and (4) observational data comparisons. These are covered in the following sections.

6.1 Crash Data Analysis

This section (6.1) presents two crash data analysis examples; from the first Alabama TACT project (6.1.1), and from the more recent project (6.1.2).

6.1.1 Example from Alabama First TACT Project

The purpose of this section is to provide an example crash data analysis of a TACT project evaluation. The results provide insight as to the potential effect of TACT upon CMV-involved crashes in general and CMV-car crashes in particular. Generally, it is important to establish the best possible control areas so that the comparison can provide meaningful information. However, since this implementation of TACT was statewide there was no way that a meaningful control area could be established. The only comparison that could be made was to past crash data.

CMV-involved crashes declined dramatically in Alabama in 2008 from its average in 2006 and 2007 of 3,189 to 2,696 (over 15% reduction). Fatal crashes declined from their 2006-7 average of 93 to 76 (over 18% reduction). A major cause of these reductions was the economy. While clearly there was not a 15-18% reduction in miles traveled, those who are first and most affected by a downturn in the economy tend to be the most crash-prone drivers (e.g., younger ages). So, although this has not be well documented to date as to the exact cause and relationships, the data support the intuition that minor shifts in the economy affect crash outcomes.

Clearly it would be unfair to expect that a TACT program would further diminish the crash numbers of 2008, especially in a rebounding economic situation. (The degree and effect of any rebound is beyond the scope of this report, but there tends to be an immediate over-reaction to most down-turns, which must be followed by a replenishment of inventories, so the CMV rebound might well be greater than that measured in the economy itself.) At this point there seemed to be three alternatives for defining the (before) control time:

- Skip 2008 and use 2006 and 2007 as the before period;
- Go back even further and use, for example, the past five years to buffer out the 2008 effect; or
- Use the 2006-2008 time period.

The first of these would not take into consideration the fact that the recession was not over at that point, and so this would not make a fair comparison. The second of these had the same problem, and past studies have determined that three years is the optimal amount of time for forecasting location hotspots in the succeeding year. Thus, the third alternative was felt to be best in mixing two back years with a recent economic downturn year to provide a fair comparison. Note that this third alternative places the heaviest burden of proof on TACT. It should be clear that if

significant differences are found when comparing the TACT months to comparable months in 2006-8, then these differences would be even more pronounced when comparing to 2006-7 or 2004-2008.

Alabama uses the Critical Analysis Reporting Environment (CARE) for obtaining data summaries from the crash database. In order to make these comparisons, 12 CARE runs were required to accommodate the following combinations:

- Two crash types (all CMVs; CMV-personal vehicle crashes);
- Three severity levels (all crashes, injury-fatality crashes, and fatal crashes); and
- Two runs for each of the above to accommodate the before and during periods.

Of these, the first is the only one that warrants further explanation. It was determined that the following two crash types should be run to get as much insight into the crash effects as possible:

- *All* crashes that involved a CMV *in any way*. Since the TACT program specifically involved CMVs, it was felt that there would be an impact on all CMV crashes. This would include single vehicle CMV, CMV-CMV, and all multi-vehicle crashes that involved a CMV regardless of causal vehicle or other involved vehicle.
- All two-vehicle crashes that involved *both* a CMV and a personal vehicle (car). Which of the two involved vehicles was causal is irrelevant to this particular study. So the combination can either be CMV causal and car=Vehicle 2, or car causal and CMV=Vehicle 2. Multiple vehicle crashes above two vehicles were excluded since the CMV might just have been a victim vehicle in these crashes (i.e., neither the CMV nor any interaction with it had anything to do with the cause of the crash).

The months that the TACT projects of this example were in effect included September through December of 2009. While CARE could have gone down to a week by week, or day by day, comparison for the specific times that the program was in effect, it is clear that the goals of the program were not to reduce crashes *only* during the times that officers were performing selective enforcement. The goal included spill-over effects from the combined public education and selective enforcement that should have at least covered the four months that the program was in effect. Finally, only DPS-reported crashes were considered for these analyses. The vast majority of CMV crashes are investigated by DPS, resulting in a consistent sample size that is more than adequate for evaluating the program.

This led to the CARE analyses given in the table that follows:

CRASH TYPES	SEVERITIES	TIME FRAMES
CMV-Involved Crashes Reported by DPS	All Crashes	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009
	Injury and Fatal Crashes	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009
	Fatal Crashes Only	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009
CMV-Car Two-Vehicle Crashes Reported by DPS	All Crashes	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009
	Injury and Fatal Crashes	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009
	Fatal Crashes Only	Before: Sep.-Dec. 2006-2008
		During: Sep.-Dec. 2009

The results of these analyses will be presented in the following sections.

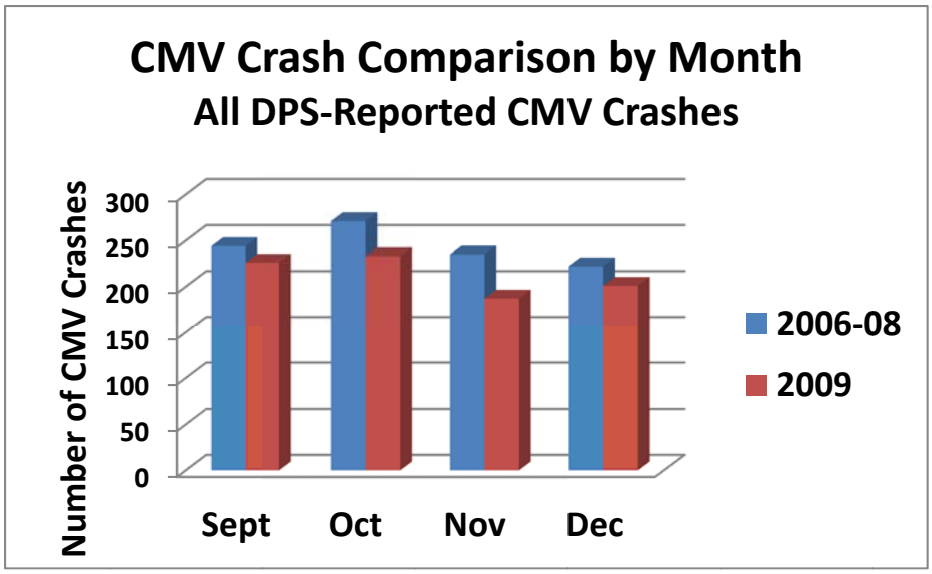
6.1.1.1 CMV Involved Crashes

A standard Student's-t test was performed for all of the analyses to compare the monthly number of crashes in the before control period against those in the during test period (i.e., during which the TACT program was in effect). The "level of significance" that will be reported is the alpha level of a single-tail test, or in other words, the probability of concluding that there is a significant reduction in the two subsets of data when in fact, the two are either equal, or the test is larger than the control. The various subsets of data upon which these tests were run are given in the table above, and they will be documented in the following subsections in that same ordering.

6.1.1.1.1 Example 1: All Crashes

The average number of crashes per month of this type in the before months was 243.25 crashes per month. The number observed in the "TACT" months was 211.75. This comparison found a difference of 31.50, which was significant at the 0.031 level. The estimate of the number of this type of crashes that were reduced monthly during the term of the project (i.e., September through December, 2009) is 31.5 crashes per month. The following bar chart shows the data graphically, where the before bar height was calculated as the average of the corresponding months over the three years (2006-2008), and the 2009 bar height is just the number of crashes during the duration of the TACT program.

Display 6.1.1.1



Detailed Method for the Excel "TTEST" Analysis. (The information in this section is included in the Methodology Manual (6.1), and is repeated here for convenience.) The data for comparing the 12-months (Sep-Oct over three years 2006-2008) to the comparable "during" period (Sep-Oct 2009) is given below:

Before	**During**	
278	226	
289	233	
264	187	
256	201	
229		
292		
255		
209		
226		
233		
187		
201		
243.25	211.75	Averages
0.030629		Probability of Difference due to Chance

Of interest here is the method for computing the probability that the difference between the two averages ("before" and "during") are merely due to chance. These raw numbers were in an Excel spreadsheet in the following rows and columns:

- D3-D14 for the 12 monthly "before" crash frequency numbers.
- E3-E6 for the four "during" crash frequency numbers.

The Excel function applied to obtain the Student's t-test probability was:

=TTEST(D3:D14,E3:E6,1,3)

where:

D3:D14,E3:E14 are the data ranges explained above,

1 = number of tails = the specification for a one-tailed test, and

3 = type = the type of test that has two samples with unequal variances

Alternatives for number of tails. A two-tailed test would be used when the analysis is not concerned with which of the two (in the case the "before" and "during") samples is the larger, only with whether they are different. In most traffic safety comparisons, the objective is to establish whether the "during" (or "after") sample is strictly *less than* the "before" sample, and therefore a one-tailed test is most appropriate.

Alternatives for type. There are three alternatives for type, as follow:

1. Used for a "paired" t-test, when there are the same number of samples in the two sets of data being compared.
2. Used for two (generally unequally numbered) samples with the assumption that the variance of the two samples is equal.
3. Used for two (generally unequally numbered) samples with the assumption that the variance of the two samples is not equal.

A Type specification 3 was used since there were unequal sample sizes and no basis on which to make any assumption about the underlying population variances.

The above procedure was applied in all cases in the analyses that follow where it is stated that a Student's t-test was applied.

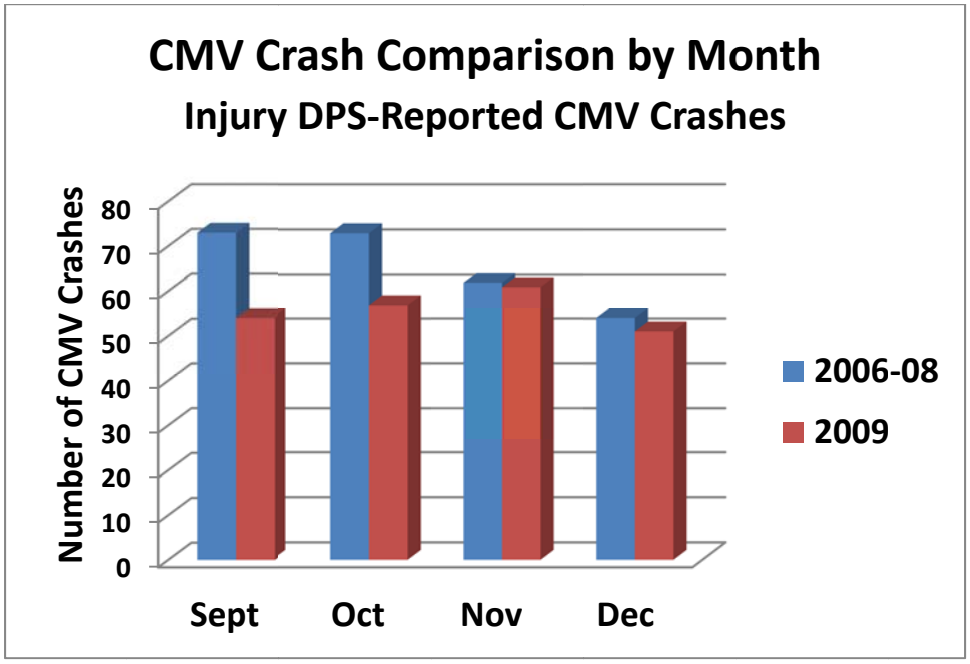
6.1.1.1.2 Example 2: Injury and Fatal Crashes

Overall crashes are just an initial indicator, and they should not be as instrumental in determining policy as injury and fatal crashes. This subsection considers this metric. The next subsection considers only fatal crashes. Generally injury crashes, and especially the more severe classification of injury crashes, are as effective in predicting fatal crashes as are fatal crashes,

especially when it comes to determining crash locations. The reason for this is the low sample size and the many other factors that affect fatalities.

The average number of crashes per month of this type in the before months was 65.50 crashes per month. The number observed in the "during" months was 55.75. This comparison found a difference of 9.75, which was significant at the 0.035 level. The estimate of the number of this type of crashes that were reduced monthly during the term of the project (i.e., September through December, 2009) is 9.75 crashes per month. The following bar chart shows the data graphically, where the before bar height was calculated as the average of the corresponding months over the three years (2006-2008), and the 2009 bar height is just the number of crashes during the duration of the TACT program.

Display 6.1.1.1a



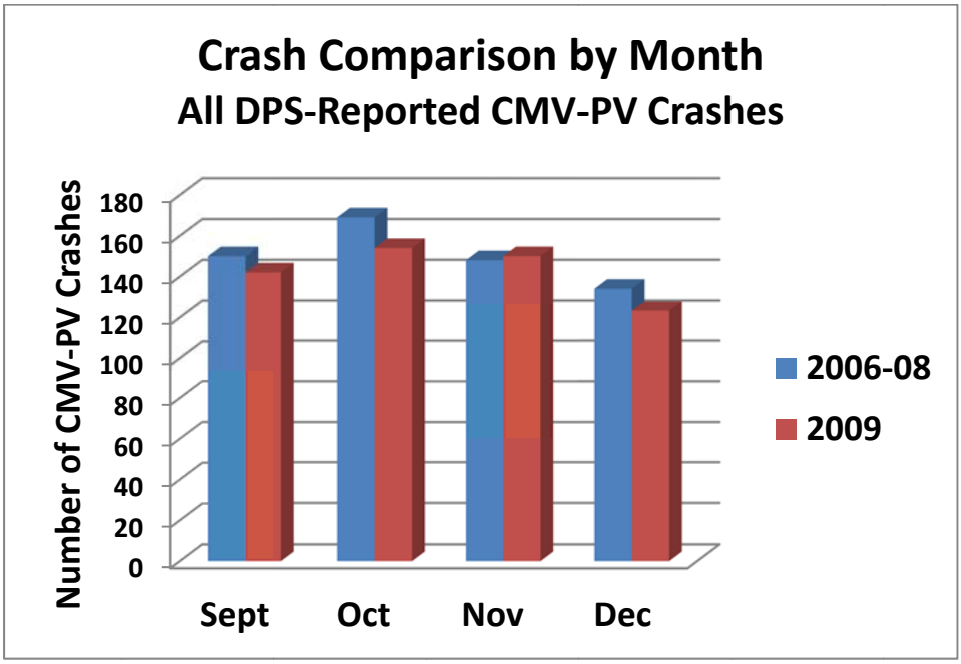
6.1.1.2 CMV-Car Two-Vehicle Crashes

6.1.1.2.1 Example 1 All Crashes

The average number of crashes per month of this type in the before months was 150.50 crashes per month. The number observed in the "during" months was 142.25. This comparison found a difference of 8.25, which was significant at the 0.220 level (not considered to be highly significant). The estimate of the number of this type of crashes that were reduced monthly during the term of the project (i.e., September through December, 2009) is 8.25 crashes per month. The following bar chart shows the data graphically, where the before bar height was

calculated as the average of the corresponding months over the three years (2006-2008), and the 2009 bar height is just the number of crashes during the duration of the TACT program.

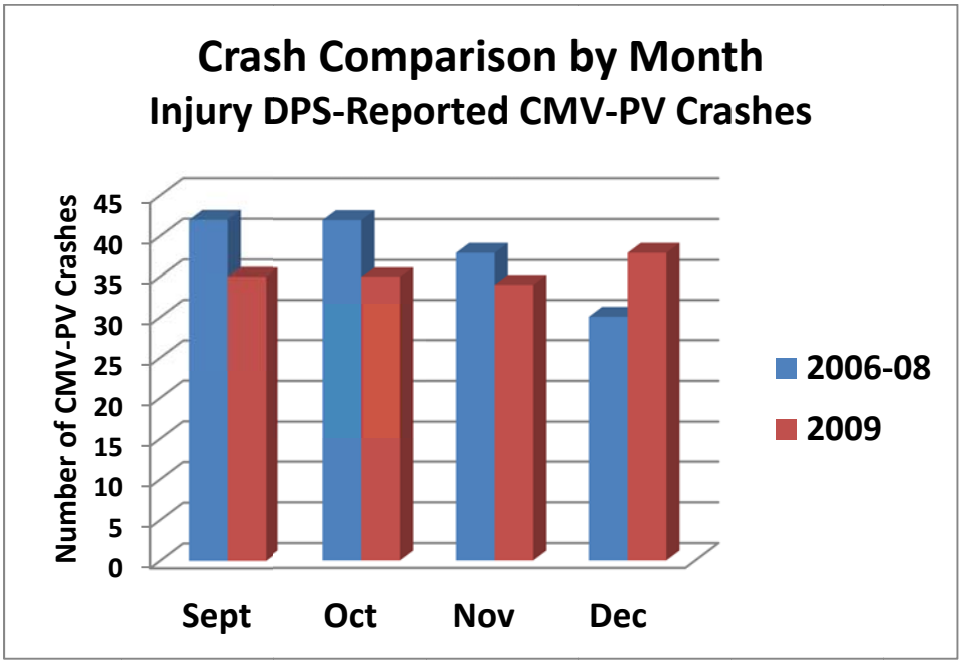
Display 6.1.1.2.1



6.1.1.2.2 Example 2: Injury and Fatal Crashes

The average number of crashes per month of this type in the before months was 38.00 crashes per month. The number observed in the "during" months was 35.50. This comparison found a difference of 2.5, which was significant at the 0.235 level (not considered highly significant). The estimate of the number of this type of crashes that were reduced monthly during the term of the project (i.e., September through December, 2009) is 2.5 crashes per month. The following bar chart shows the data graphically, where the before bar height was calculated as the average of the corresponding months over the three years (2006-2008), and the 2009 bar height is just the number of crashes during the duration of the TACT program.

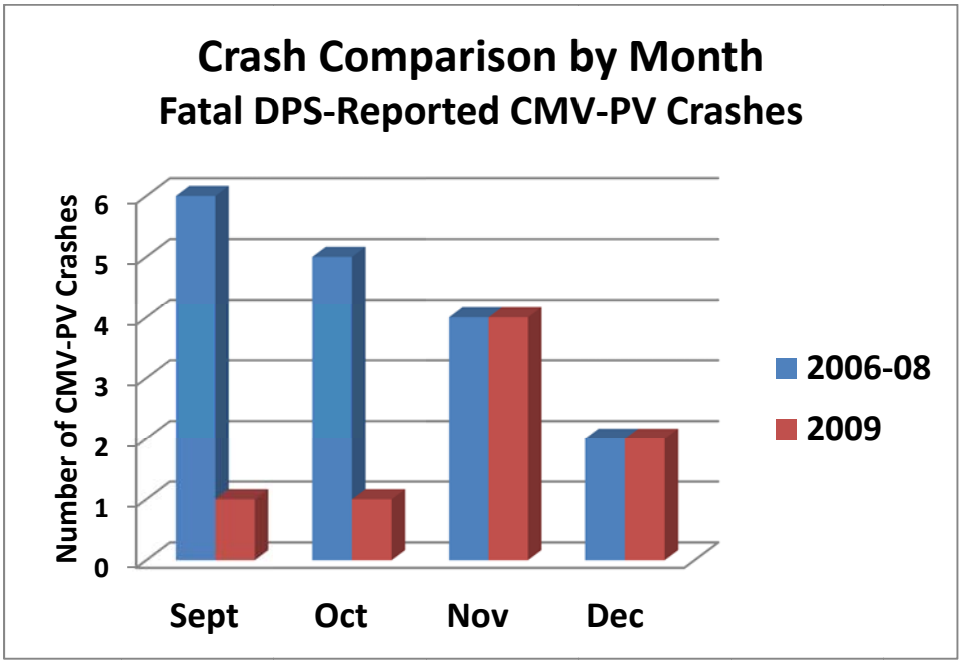
Display 6.1.1.2.2



6.1.1.2.3 Example 3: Fatal Crashes

The average number of crashes per month of this type in the before months was 4.25 crashes per month. The number observed in the "during" months was 2.00. This comparison found a difference of 2.25, which was significant at the 0.021 level. The estimate of the number of this type of crashes that were reduced monthly during the term of the project (i.e., September through December, 2009) is 2.25 crashes per month. The following bar chart shows the data graphically, where the before bar height was calculated as the average of the corresponding months over the three years (2006-2008), and the 2009 bar height is just the number of crashes during the duration of the TACT program.

Display 6.1.1.2.3



6.1.1.3 Summary and Discussion of Results from Alabama First TACT Evaluation

Comparing the analyses of the two types of crashes, it is clear that more significant findings were in the overall CMV crashes than in the two vehicle case where a CMV and a car were involved. This is a reasonable result in that the awareness of the program to CMV drivers would be much higher than that of the general public. In all cases a reduction in crashes was found. The following table presents a summary of the crash-reduction results and an averaging of the two, which might provide a more reasonable overall reduction estimate.

Display 6.1.1.3 Estimates of Crash Savings per Month for TACT Program Months

SEVERITY	CMV-INVOLVED	CMV-car	AVERAGE
All Crashes	31.50	8.25*	19.88
Injury and Fatal	9.75	2.50*	6.13
Fatal Only	3.33	2.25	2.79

* Not highly significant

As a final potential metric of effectiveness, it might be beneficial to compare crashes during the TACT period as opposed to some other comparable period of time. Alabama is somewhat limited in the amount of data that can be compared here because of the change in its reporting system to eCrash as of June 1, 2009. In order to assure that the two subsets of data were using the same reporting system, the June-August time period was compared to the October-December

time period, both in 2009. A three month "during" time period was chosen to make the number of months comparable for a more intuitive comparison. It was also reasoned that the program would have a greater effectiveness once it was a month in operation rather than to expect any changes on day one.

The particular type of crashes that were compared had the following further restrictions:

- They had to involve at least one CMV;
- They had to be two-vehicle crashes – this was to avoid the CMV just being a victim vehicle and irrelevant to the crash causation; and
- They had to be reported by DPS – DPS started 100% reporting in eCrash on June 1, 2009 but only a relatively few local crash reporting agencies did the same – many of them were added during the rest of the year. Without restricting to DPS these additional reports would be included and the results would not be comparable.

Display 6.1.1.3a produces a comparison of the crashes that had all of these characteristics using a CARE IMPACT analysis.

IMPACT can be used to compare any two subsets of data and it is very easy to run all variables in the dataset to mine out the most significant findings. IMPACT takes into account the differential in the number of reports between the various subsets, in this case time intervals. An explanation of the numeric columns of Display 6.1.1.3a follows:

- Number – the number of crashes recorded during the corresponding time interval;
- % – the percentage that the Number is of the total (see total at the bottom of the table);
- Odds Ratio – the before time period percentage divided by the "during" percentage; this provides a measure of the difference between the percentages; since each percentage is a probability of occurrence in the given time period, then each could be called the "odds" of any given crash having that characteristic (e.g., Crossed Centerline) in that time period; hence the term "odds ratio."
- Max Gain – this is the maximum number of crashes that would be eliminated if the percentage in the before period were reduced to the percentage in the "during" period; it is based on the differential in the percentages and the size of the Number in the before period. The unit of this metric is "potential crashes saved," since the countermeasure (in this case TACT) is in effect in the "during" period (Oct.-Dec., 2009).

Note that because these last two columns are looking at over-representations and not absolute numbers of crashes, there will be a balancing effect. For the combined over-representations there have to be a comparable combined under-representation in other attributes. Since the table is arranged by maximum potential gain, the attributes at the bottom of the table have negative values assigned. This indicates that, proportionately speaking, more of these types of crashes occurred in the "during" period than in the "before" period.

Display 6.1.1.3a Comparison of CMV Crash History for Before and During TACT Months (Primary Contributing Circumstance Comparison)

C015: Primary Contributing Circumstance	June-August 2009		Oct-Dec 2009		Odds	Max
Value of Primary Contrib Circumstance	Number	%	Number	%	Ratio	Gain
Crossed Centerline	20	5.22%	9	2.11%	2.48	11.93
Improper Lane Change/Use	49	12.79%	47	11.01%	1.16	6.84
DUI	19	4.96%	14	3.28%	1.51	6.44
Other Distraction Inside the Vehicle	10	2.61%	5	1.17%	2.23	5.52
Defective Equipment	22	5.74%	19	4.45%	1.29	4.96
Improper Backing	11	2.87%	7	1.64%	1.75	4.72
Ran Traffic Signal	6	1.57%	2	0.47%	3.34	4.21
Failed to Yield Right-of-Way - Left or U-Turn	14	3.66%	11	2.58%	1.42	4.13
Improper Passing	12	3.13%	9	2.11%	1.49	3.93
Wrong Side of Road	3	0.78%	0	0%	0.00	3.00
Unseen Object/Person/Vehicle	19	4.96%	18	4.22%	1.18	2.85
Distracted by Use of Electronic Comm Device	4	1.04%	2	0.47%	2.23	2.21
Distracted by Use of Other Electronic Device	4	1.04%	2	0.47%	2.23	2.21
Swerved to Avoid Vehicle	10	2.61%	10	2.34%	1.11	1.03
Improper or No Signal	1	0.26%	0	0%	0.00	1.00
Other Distraction Outside the Vehicle	5	1.31%	5	1.17%	1.11	0.52
Other - No Improper Driving	4	1.04%	4	0.94%	1.11	0.41
Other Improper Action	5	1.31%	6	1.41%	0.93	-0.38
Vision Obstructed	3	0.78%	4	0.94%	0.84	-0.59
Traveling Wrong Way/Wrong Side	9	2.35%	11	2.58%	0.91	-0.87
Failed to Yield Right-of-Way from Driveway	7	1.83%	9	2.11%	0.87	-1.07
Other Failed to Yield	7	1.83%	10	2.34%	0.78	-1.97
Made Improper Turn	11	2.87%	15	3.51%	0.82	-2.45
Failed to Yield Right-of-Way Making Right Turn	1	0.26%	4	0.94%	0.28	-2.59
Cargo Fell or Load Shift	16	4.18%	21	4.92%	0.85	-2.84
Over Speed Limit	7	1.83%	11	2.58%	0.71	-2.87
Aggressive Operation	1	0.26%	5	1.17%	0.22	-3.48
Driving too Fast for Conditions	10	2.61%	17	3.98%	0.66	-5.25
Fatigued/Asleep	9	2.35%	16	3.75%	0.63	-5.35
Followed too Close	25	6.53%	34	7.96%	0.82	-5.50
Ran Stop Sign	1	0.26%	8	1.87%	0.14	-6.18
Failed to Yield Right-of-Way from Stop Sign	15	3.92%	24	5.62%	0.70	-6.53
Misjudge Stopping Distance	15	3.92%	30	7.03%	0.56	-11.91
TOTALS	**355**		**389**			

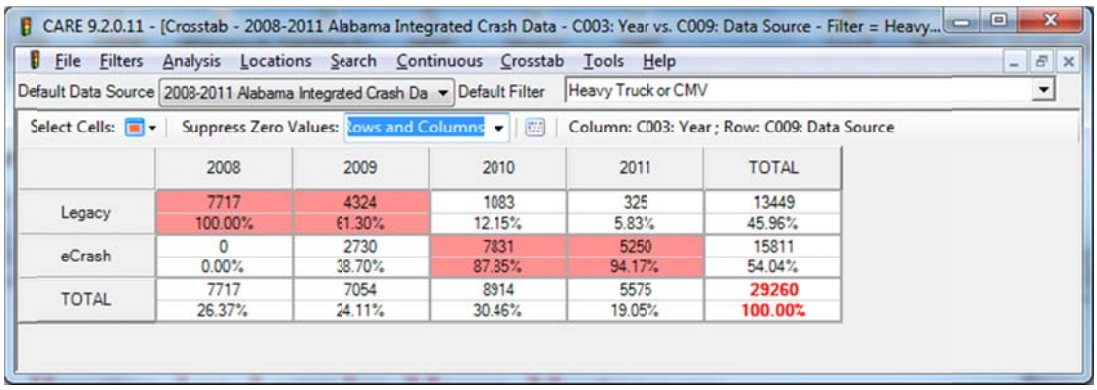
To further exemplify how IMPACT works, consider the Improper Lane Change attribute in Display 6.1.1.3a. See the Max Gain in the right column of about 7 crashes. In addition, the Odds Ratio indicates a 16% reduction in the proportions (12.79%/11.01% = 1.16), or in other words, 12.79 exceeds 11.01 by a factor or 1.16 or about 16%. Note that the totals at the bottom of the table indicate that the "during" number of crashes is about 10% higher than the before (389-355 = 34, which is about 10% of 355). If this 10% is applied to adjust the "during" number of crashes (47), this produces an adjustment of about 47-5 = 42. The raw difference between the before number of 49 and 42 is 7, which is close to the Max Gain (6.84). These approximations are stated to give a feel for the interpretation of the IMPACT output.

None of the differences given in Display 6.1.1.3a were statistically significant even at the 10% level, mainly because of the low probabilities and the low sample sizes. However, they do provide the best indicators that are available and thus have practical if not statistical significance. The following are potential explanations for the findings with regard to the TACT attributes (those given with a yellow background in Display 6.1.1.3a):

- Improper Lane Change/Use – this was the most successful reduction found, with nearly seven crashes saved by the 16% proportional reduction. There is a good chance that this attribute was the most effective of the TACT program because it is easily detected and something that personal vehicle drivers can easily perceive of and control.
- Improper Passing – this showed a reduction of close to four crashes by a 49% reduction in the proportion of these crashes.
- Improper or No Signal – there was only one crash caused by this factor in the before period. Due to these low numbers, no conclusions should be drawn concerning this attribute.
- Speed – there are two speed causal indicators in the table: Over the Speed Limit and Driving too Fast for Conditions. Neither of these had many crashes either in the before or "during" periods. It is reasonable to conclude that the effect of the TACT program upon speed caused crashes would be minimal due to the large number of vehicles on the roadways that are exceeding the speed limits.
- Aggressive Operations – this is defined in the eCrash Data Element Manual to be the presence of at least two offences that would lead the officer to believe that there was an attitude problem on the part of the driver. The very few occurrences of crashes from this cause in both the before and during periods would lead us to see these findings as inconclusive.
- Following too Close – relatively speaking this offense is the least likely to have been affected by the TACT program, leading perhaps to a greater (or different) emphasis on it in the future. While the change in the numbers was not statistically significant, the raw numbers in both the before and during periods is indicative that this is a continuing issue with regard to CMV-private vehicle collisions.

6.1.2 Example Crash Analysis from Alabama Interim TACT Projects

"Interim" in this context is January 2010 through May 2011. The original TACT program was evaluated using crashes on a before-and-after basis. This was not possible for the interim period because of a major change in the way that CMV crashes were recorded in the new Alabama electronic crash reporting system (eCrash). The actual implementation of eCrash was on June 1, 2009. The following illustrates how the transition to eCrash affected CMV reporting.



	2008	2009	2010	2011	TOTAL
Legacy	7717 100.00%	4324 61.30%	1083 12.15%	325 5.83%	13449 45.96%
eCrash	0 0.00%	2730 38.70%	7831 87.85%	5250 94.17%	15811 54.04%
TOTAL	7717 26.37%	7054 24.11%	8914 30.46%	5575 19.05%	29260 100.00%

While all of DPS went to eCrash in June 2009, all state reporting did not go to eCrash at once. The ramp-up is clear from the cross tabulation above. Note also the significant increase in CMV reporting between 2009 and 2010. There was over a 26% increase in the number of reported heavy trucks reported. Clearly this does not reflect the reality of the CMV crashes since there would be no reason to expect any cause other than the change in the reporting procedures to cause such an increase. While a discussion of the reporting procedures are outside of our scope, one major difference that is present with eCrash that was not in effect in the paper-based "Legacy" data is the fact that eCrash determines for the officer whether or not a crash now qualifies as a CMV based on other data that the officer enters.

Several attempts were made to adjust the data for this change in reporting, but none could be supported from the point of view of analytical integrity. At that point the best that could be done was to compare the "TACT months" during the interim period with the "Non-TACT" months. This will be further defined in the next section.

Finally, the best crash metric to use in this evaluation was determined to be statewide CMV crashes. The reasons for this are as follow:

- The counties and particular corridors that were worked in the various months had considerable variation.
- The attempts to look at specific areas cut the data so thin as to make the determination of statistical significance all but impossible.

- The TACT implementations were primarily enforcement based, and the enforcement was performed on corridors considered to be hotspots by the problem identification methods documented above; as such, they represented fairly heavy traffic areas.
- The effects of the TACT enforcement at this hotspots was not intended to be localized to just that location; while there is no way to determine how far this influence would extend, it was determined that a statewide analysis of the data would, if anything, provide a conservative estimate of the effects.

For these reasons crashes in the TACT and non-TACT months were compared on a statewide basis.

6.1.2.1 Interim CMV Crash Analysis

For the time period January 2010 through May 2011 the number of TACT enforcement hours worked are shown in Display 6.1.2.1, along with the number of CMV crashes statewide. Two approaches to the statistical analysis are presented. The first approach is to do a simple correlation of the TACT hours vs. the CMV crashes. The second approach is to break the months into two categories for the purposes of statistical analysis. A month is considered a "TACT Month" if there were 100 or more TACT enforcement hours worked during that month and is considered a "non-TACT Month" otherwise.

Display 6.1.2.1 Comparison of TACT Hours Worked and CMV Crashes

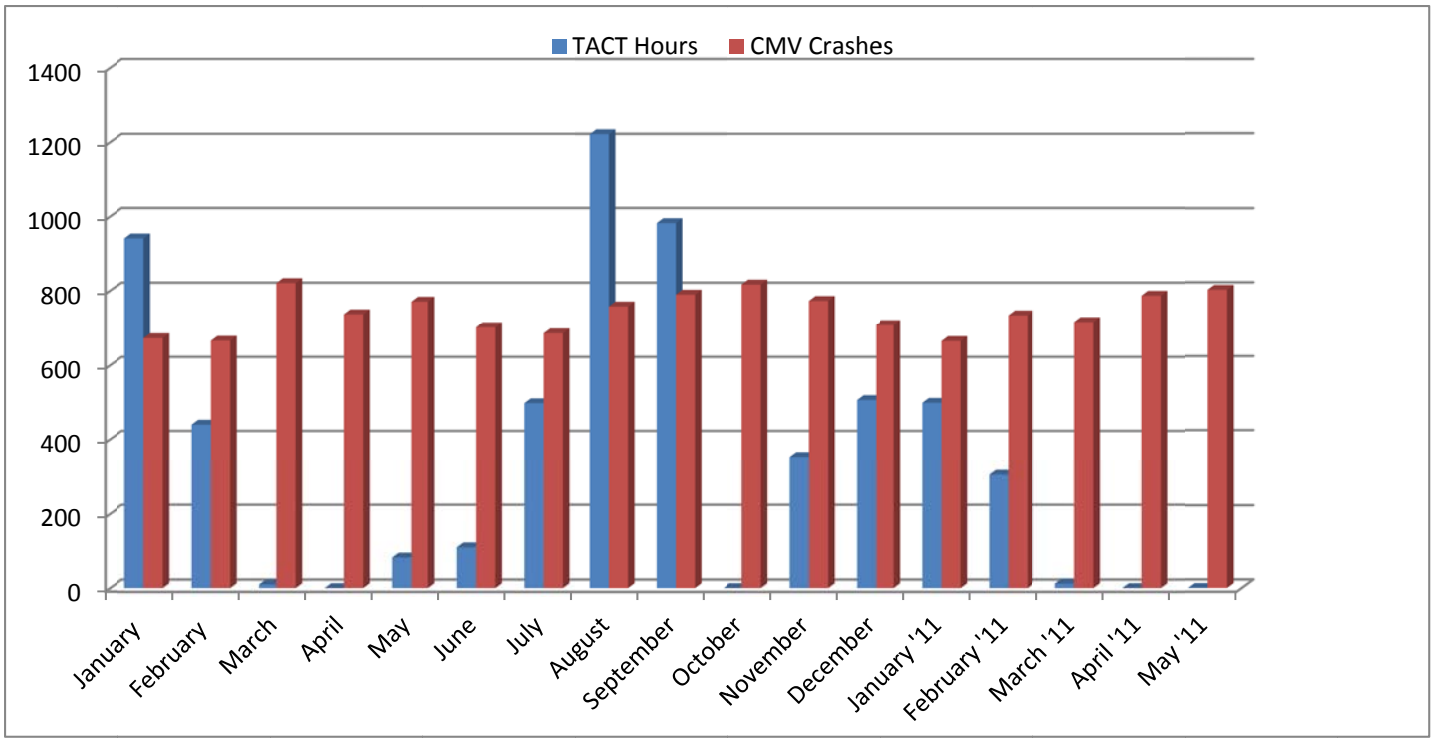
Month	TACT Hours	CMV Crashes	TACT Month	Non-TACT Month
January 2010	942	674	✓	
February 2010	440	667	✓	
March 2010	10	822		✓
April 2010	0	738		✓
May 2010	83	772		✓
June 2010	110	703	✓	
July 2010	498	687	✓	
August 2010	1222	759	✓	
September 2010	983	791	✓	
October 2010	0	818		✓
November 2010	353	774	✓	
December 2010	507	709	✓	
January 2011	499	666	✓	
February 2011	304	735	✓	
March 2011	12	717		✓
April 2011	0	788		✓
May 2011	0	803		✓

Using the data from this table, the Excel function *CORREL* can be applied to the two columns, TACT Hours and CMV Crashes. In this particular case, the *CORREL* function returns a coefficient of -0.32. This indicates a moderate correlation of the two columns such that when the number of TACT Hours increases, the number of CMV crashes decreases.

For the second type of statistical test, the TACT months were compared to the Non-TACT months. The partition of the months above was used to split the months into two subsets, 10 TACT months and 7 Non-TACT months. Each month is considered as a sample. The average number of CMV crashes for the TACT months is 727 and the average for the Non-TACT months is 780. This amounts to an average difference of 53 crashes per month. When the *TTEST* Excel function is applied to the two sets of samples, using parameters giving a single tailed, two-sample equal variance test (homoscedastic) test, a *p* value of .005 is computed. This indicates a very strong likelihood (99.5%) that the two subsets have different mean values for reasons other than chance.

Display 6.1.2.1a presents a graphical comparison of the hours and crash data given above.

Display 6.1.2.1a Comparison of TACT Hours Worked and Crashes per Month



Given that a statistically significant difference was found between the TACT and non-TACT months, it is possible to estimate an average per-month reduction.

The severity of crashes is shown below for all CMV-involved crashes during the interim period:

Crash Severity	Percentage
Fatal	1.13%
Injury	32.5%
PDO	66.4%

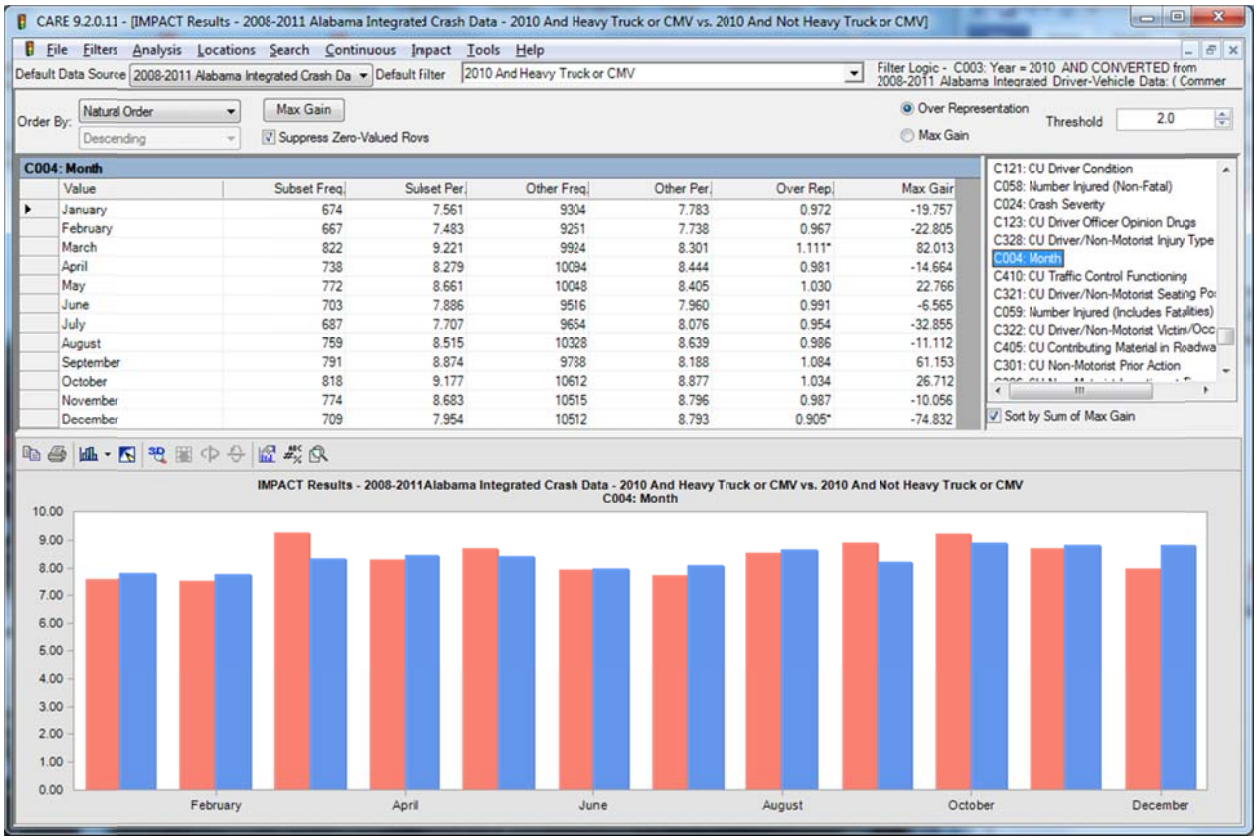
When this distribution is applied to the average reduction of 53 crashes per month, the number of crashes prevented by the TACT program by severity can be predicted:

Severity	Percentage	Crashes Saved per Month	Saving Total TACT Interim Period
Fatal	1.13%	0.6	6
Injury	32.5%	17	170
PDO	76.4%	35	350

6.1.2.2 Further Analysis of the Interim Crash Data

Recall that in addition to assessing the effectiveness of a TACT project in terms of crash reduction, one of the major goals of evaluation is that of continuous improvement. This section will consider some other data from the interim period that could be used to this effect. In a sense this can be considered as follow-on to the problem identification examples given above. Problem identification is not a one-time process; it should be continued and some of the same key reports replicated to assure that the changes are for the better. While dramatic changes are not often seen in traffic safety data, and especially crash data, even subtle changes can indicate the onset of improvement or degradation. Consider Display 6.1.2.2 as an example.

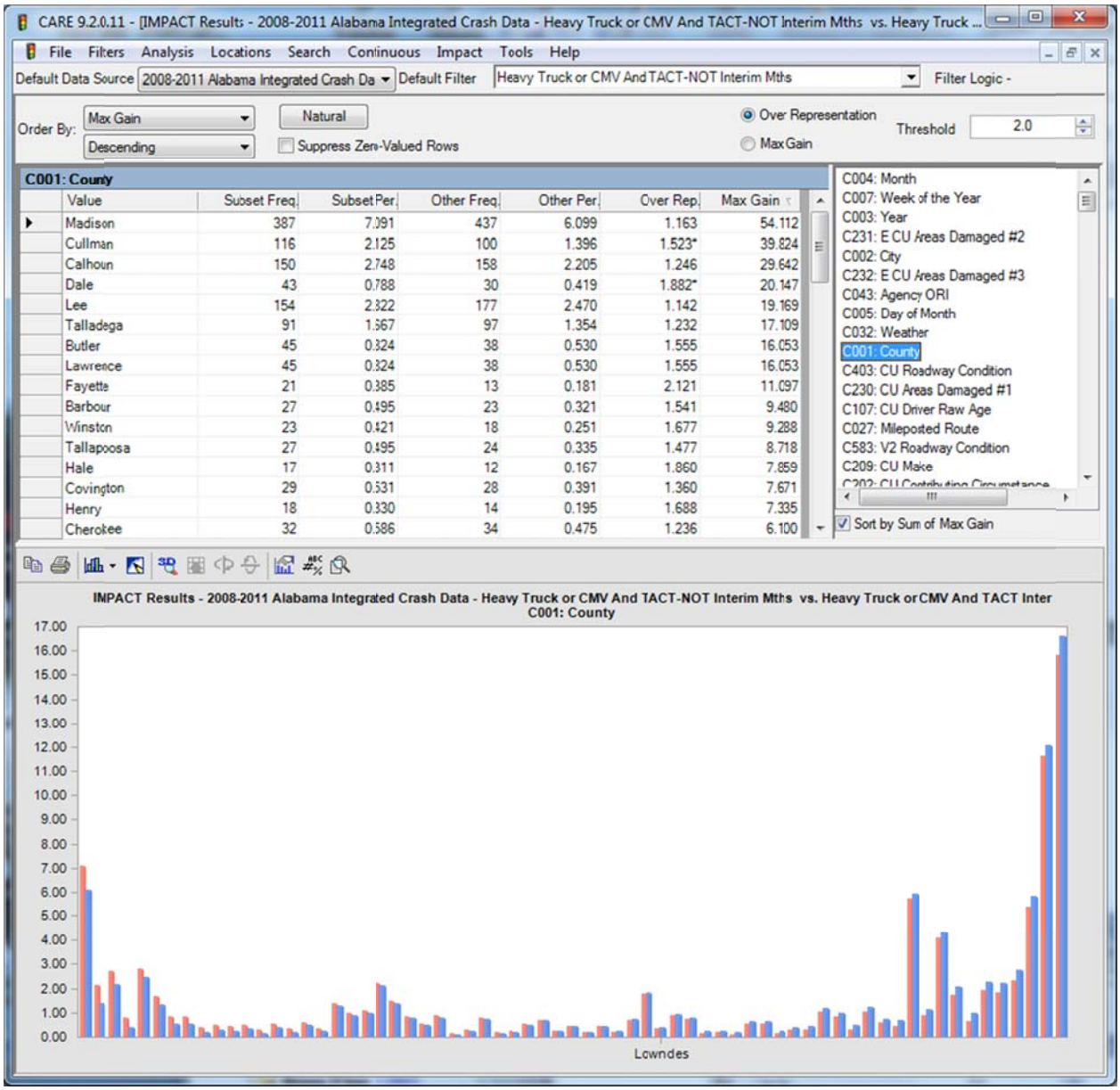
Display 6.1.2.2 Comparison of CMV vs. Non-CMV by Month in the 2010 Interim Period



The interpretation of the various columns was given in Section 6.1.1.3 in conjunction with Display 6.1.1.3a, and it will not be repeated here. The "Subset" here (red bars) are CMV involved crashes, and the "Other" are non-CMV crashes. The ratio of these two subset numbers would tend to buffer out things that affect them both (such as number of days in a month or even common economic factors). Generally it would not be expected that there to be anything but random differences between the ratio of CMV to non-CMV crashes if there were no other factors involved. However in this case, note that there is one significant over-representation for CMV-involved (March 2010) and another significant under-representation (December 2010).

Comparing this with the appropriate table in the previous section will show that the significant over-representation occurred during a non-TACT month, and the under-representation occurred during a TACT month. This output was generated prior to the comparison of TACT and non-TACT months given above, and it was instrumental in motivating that analysis. This is an example of where these types of "problem identification" analyses after the fact can surface information that might not have been considered relevant.

Display 6.1.2.2a CMV Crash Comparison for TACT vs. NonTACT Months

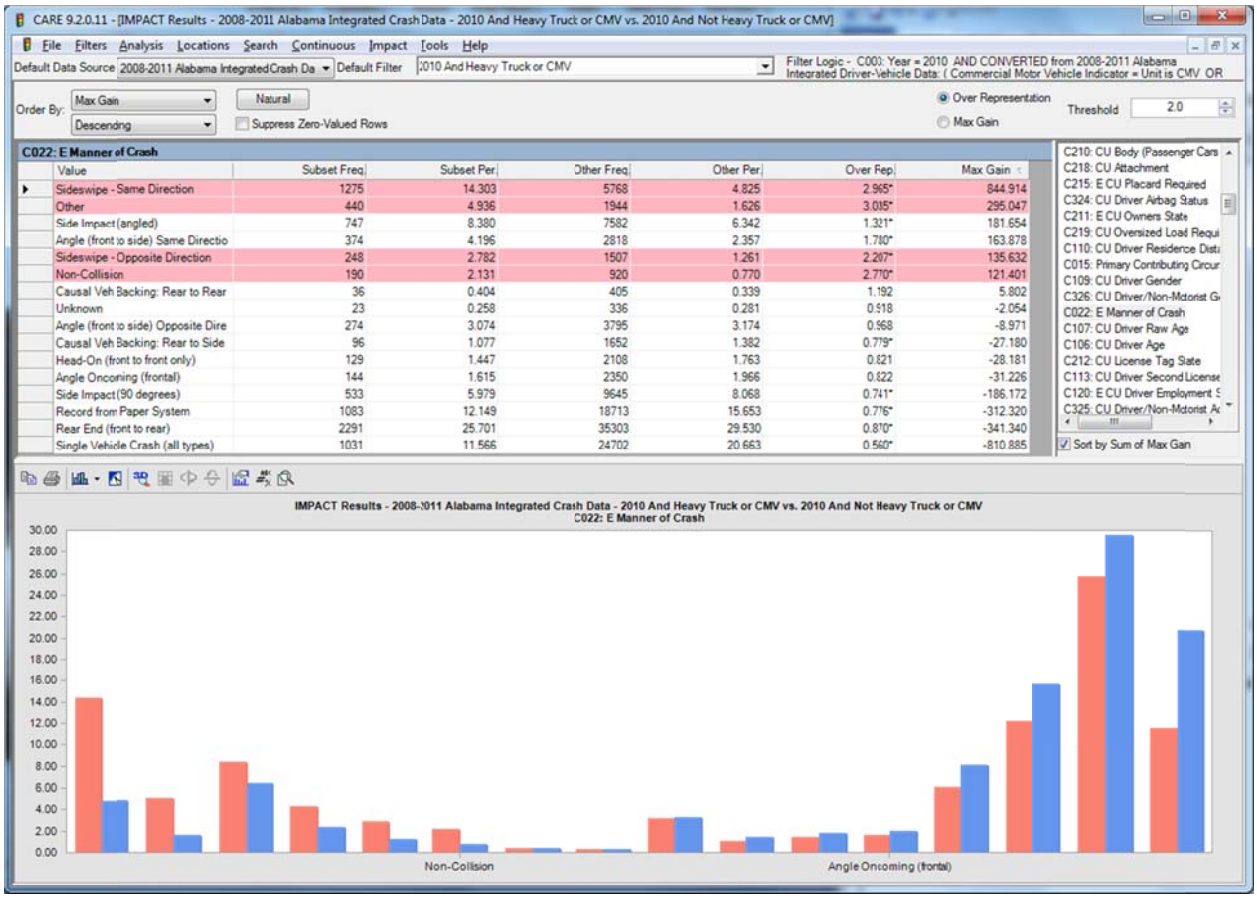


Display 6.1.2.2a is a very much different comparison. It is useful to compare the TACT months and the non-TACT months to see if there are any significant variables here that might be of use. County is given in this illustration, with those counties at the top for which there is the highest "max gain" (the gain that would be obtained if the over-representation were eliminated). The asterisk in the Over Rep (Odds Ratio) column indicates a high level of statistical significance. While Madison shows the highest max gain, the odds ratio is not high enough to be statistically significant (i.e., it cannot be concluded by this statistical test that this was anything but random variation, the large max gain being generated just from the sheer size of the number of crashes that occur in Madison County). On the other hand Cullman and Dale counties both show significant differences, indicating that their changes (proportionately speaking) between the TACT and non-TACT months were significant. These results might cause decision-makers to inquire as to what was done in these two counties to make such a difference. Conversely, the other end of the table (not shown) can surface those counties that actually had a worse CMV crash record in the TACT months than in the non-TACT months, which might be even more in line for inquiry.

The following examples are comparable to Display 6.1.2.2 above, in that they all compare CMV-involved (not necessarily caused by the CMV) against all other crashes, i.e., that did not involve a CMV. These were run over the 2010 (part of the interim) in order to answer the question: How are CMV-involved crashes different from crashes that do not involve a CMV. Many results are intuitively obvious, but in looking at all available attributes within the data, usually some attributes will produce new and unexpected information. Further, as these results change from year to year, they establish trends of either where programs have been effective, or else where the programs need to be strengthened to deal with a particular issue. Since 2011 was only a partial year of data, it was decided to run these analyses over 2010.

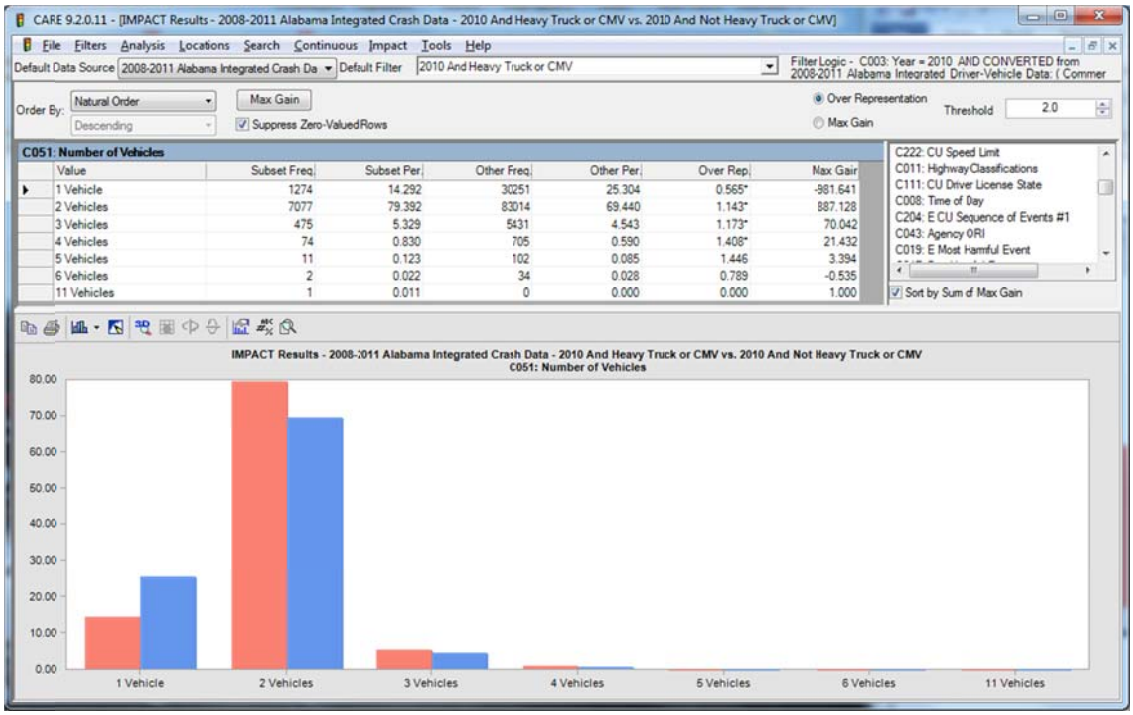
Display 6.1.2.2b is an example of the Manner of Crash variable. The "Subset" (red bars) represent the CMV-involved crashes and the "Other" (blue bars) represent the non-CMV crashes with the same Manner of Crash code. The red highlighting indicates those codes that had over twice their expected values, and the asterisk indicates that the odds ratio is statistically significant from a high level. This table captures all of the codes, so the under-represented can be seen as well as the over-represented. This is of interest as blind-spot types of crash causes are near the top, while the rear-end crashes are significantly under-represented.

Display 6.1.2.2b CMV vs. NonCMV Comparison by Manner of Crash

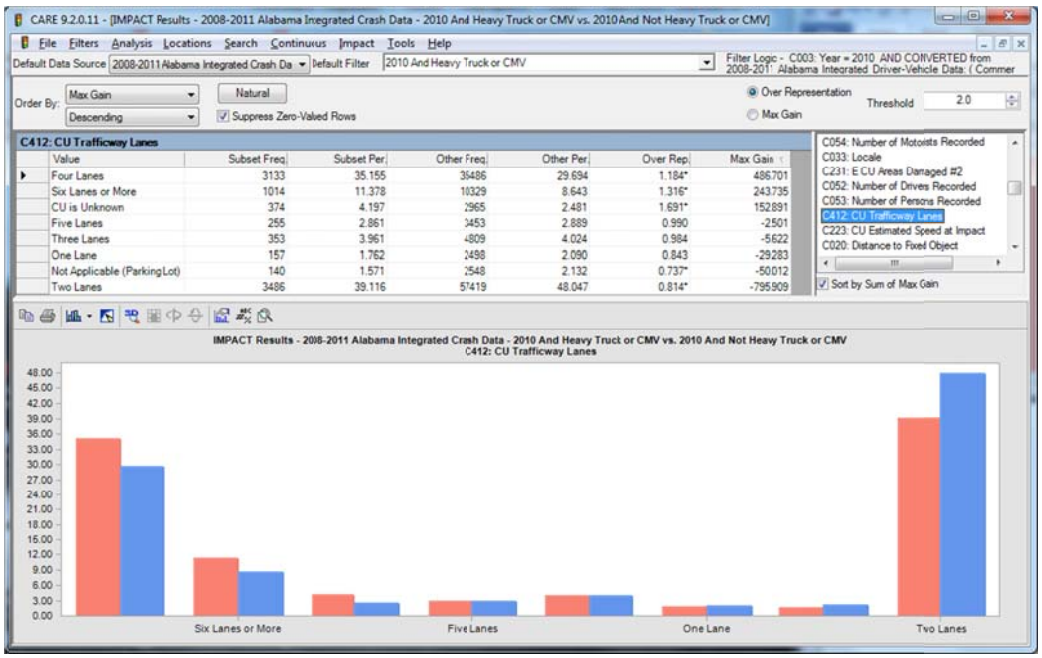


Display 6.1.2.2c compares the number of vehicles involved in CMV-involved crashes with those that are not CMV-involved. The table in this display is not in Max Gain order – it has been rearranged from that default to its natural ordering. Notice that single vehicle crashes are under-represented with a little over half of what would be expected if the CMV-involved crashes were distributed as the non-CMV crashes are. This correlates heavily with the types of roadways CMVs typically use as well as a general absence of drugs and alcohol causation, both of which typify single vehicle crashes. Two-, three- and four-vehicle crashes are all over- represented for the CMV-involved crashes.

Display 6.1.2.2c CMV vs. NonCMV Comparison by Number of Vehicles Involved



Display 6.1.2.2d CMV vs. NonCMV Comparison by Number of Lanes



Display 6.1.2.2d shows the number of lanes. This is presented to qualify the statement made above about the number of lanes. As expected, CMV crashes are significantly over-represented on four lane roadways, and they are significantly under-represented on two lane roadways. While this is good information to know, the chart under the table shows that even while the CMV-involved crashes (represented by the red bars) are under-represented, the crash number on two lane roads is higher than on any other single roadway classification by lanes. How can this be the case? It is because for non-CMV crashes there are even more – significantly more crashes, proportionately speaking. The lesson here is that over-representations do not tell the whole story. Specifically for this example, two-lane roadways need consideration, and the particular type of countermeasures that might be applicable to CMV-involved crashes on two-lane roadways is probably quite different from that of countermeasures on four-lanes and greater.

As a final example, Display 6.1.2.2e presents a similar comparison (CMV-involved against those crashes that did not involve a CMV) by Primary Contributing Circumstance (PCC), which is probably the variable that gets closest to causation. One deficiency of Alabama's eCrash reporting system is the PCC variable, which literally has nearly 100 different codes within it. It is structured to guide the officer into the correct code, but in retrospect, it would have been much better if all of its codes were mutually exclusive. While such structural issues can be annoying, they do not prevent useful information from being obtained, since our comparison method can legitimately claim that any error caused by such structural issues will appear equally as frequently (relatively speaking) in the test as it does the control subset. In this case, the test subset is CMV involved in the crash, and the control subset is CMV not involved. The table has been cut down for illustrative purposes to only include those PCCs that either had a significant over-representation or a significant under-representation for CMV-involved crashes.

Recall that what all of these last few comparisons tell us is the difference between CMV-involved crashes and non-CMV-involved crashes. For example, the PCC with the highest impact is Improper Lane Change/Use. This confirms several other outputs. Some of the over-represented PCCs are certainly intuitively obvious since they do not occur that often in crashes that do not involve CMVs; e.g., defective equipment and cargo falling. Others tend to confirm the types of circumstances that typically cause a CMV crash. There is a commonality between them and in some cases might be just saying the same thing in different ways. On the other end of the spectrum, PCCs, where CMV crashes are under-represented, are also typically what would be expected when from experienced professional drivers. Again, note the most under-represented is "Following too Close," which correlates to rear-end crashes above. This information most certainly should move patrol officers away from tailgating and toward blind spots as the major goal of deterrence.

Display 6.1.2.2e CMV vs. NonCMV Comparison by Primary Contributing Circumstance

C015: Primary Contributing Circumstance	CMV Involved	CMV Involved	CMV Not Involved	CMV Not Involved	Statistically	Odds	
Value	Frequency	Percentage	Frequency	Percentage	Significant	Ratio	Max Gain
CMVs Significantly Over-Represented							
Improper Lane Change/Use	828	9.29%	4181	3.50%	TRUE	2.66	516.25
Defective Equipment	365	4.09%	1798	1.50%	TRUE	2.72	230.93
Made Improper Turn	325	3.65%	1852	1.55%	TRUE	2.35	186.91
Cargo Fell or Load Shift	194	2.18%	279	0.23%	TRUE	9.33	173.20
Unseen Object/Person/Vehicle	818	9.18%	9182	7.68%	TRUE	1.19	133.35
E Crossed Centerline	204	2.29%	977	0.82%	TRUE	2.80	131.15
Improper Passing	172	1.93%	977	0.82%	TRUE	2.36	99.15
Improper Backing	295	3.31%	2775	2.32%	TRUE	1.43	88.08
CMVs Significantly Under-Represented							
E Failed to Yield Right-of-Way from Stop Sign	290	3.25%	4982	4.17%	TRUE	0.78	-81.48
Over Speed Limit	103	1.16%	2563	2.14%	TRUE	0.54	-88.11
E Ran off Road	100	1.12%	2670	2.23%	TRUE	0.50	-99.09
E Failed to Yield Right-of-Way Making Left or U-Turn	221	2.48%	4348	3.64%	TRUE	0.68	-103.21
P Driver Not in Control	82	0.92%	2732	2.29%	TRUE	0.40	-121.71
Driving too Fast for Conditions	219	2.46%	4620	3.86%	TRUE	0.64	-125.49
DUI	158	1.77%	4631	3.87%	TRUE	0.46	-187.31
Misjudge Stopping Distance	607	6.81%	11996	10.03%	TRUE	0.68	-287.47
Followed too Close	874	9.80%	16401	13.72%	TRUE	0.71	-348.93

In concluding this section, two important factors deserve further emphasis. First of all, the specific outputs given above are strictly examples. A good assessment will look at all of the variables that are available within the database. Sometimes those that would seem not to contain any useful information can be quite informative. A second factor to emphasize is that it is the *change* in such outputs over time that is as important as the immediate results. Replicating the problem identification on a regular basis not only provides information for moving forward, but it also provides a metric by which the areas of success and failure can be gauged. Numbers do not become information until they are compared with other numbers. In this case the comparison is one of how these various metrics are changing over time.

6.1.3 Discussion of Crash Analysis from Alabama Recent TACT Project

The most recent TACT effort took place in one study corridor (I-59 in Tuscaloosa county), focused mainly on the short stretch of roadway in the study area described for the observational studies (see Section 3.1.4.2.1), with only a few patrol officers added to the normal DPS detail in that area. This is a good example of an extremely small project which cannot be evaluated in terms of reduced crashes. This is not to say that the particular detail did not in and of itself reduce crashes, both by its immediate and residual effects. However, the number of CMV crashes in this very limited area would not allow for any meaningful statistical test of significance. Small projects like this one that introduce new innovations (e.g., in this case the presence of billboards in the vicinity of the enforcement) are best evaluated by observational studies and considered to be pilot projects. If the observational studies prove positive (as this one did – see Section 6.4), then the innovation might be extended statewide depending on its cost and benefit relative to other traffic safety countermeasures.

6.2 Citation Data Analysis

6.2.1 Citation Analysis of Alabama First TACT Project

The first Alabama TACT project citation comparison used data available from the state's electronic issuance system (eCite). Data from 2009 were compared for the four-month period before the TACT program and the four months during the program (Sept.-Dec. 2009). The comparison was for the purpose of determining the extent to which the program had increased the *proportion* of citations in the TACT categories. Generally, the number of all citations written decreased by about 18% between the before and during periods. Thus, an overall adjustment was made by this factor to make the raw frequency numbers comparable so that they could be compared directly as far as their representative proportions are concerned.

The reason for looking at the entire September through December 2009 time frame is because it was desirable to measure not just the citations issued during the selective enforcement program, but any spill-over effects that may have come out of the program. The tables in Section 4.3.2 above present how many citations of each type were issued with the program waves, it is obvious that since this concentration was on these types of citations that there would be a larger number issued. What is not so obvious, and what is being measured here is the comprehensive effect of the program over the entire four month period. Display 6.2.1 presents these changes with regard to the TACT violation types specified above.

Display 6.2.1 Changes in Citations Issued

VIOLATION TYPE	May-Aug 2009*	Sep-Dec 2009	% Inc (+)/Dec (-)
Speeding	60,730	61,928	+2.0%**
Following Too Close	1,847	1,966	+6.4%**
Improper Lane Change	901	1,258	+39.6%**
Failure To Signal	443	628	+41.9%
No Seatbelt	28,941	25,589	-11.6%**
No Insurance	15,401	16,062	+4.3%**
Drivers License	10,599	11,432	+7.9%**
Improper Passing	262	260	-0.8%

* Adjusted to make the two four-month periods are comparable.
** Statistically significant increases at alpha less than 0.01.

All of the violation type categories showed statistical significant increases or decreases at the alpha level of 0.01 or less with the exception of Failure to Signal and Improper Passing. The following presents some potential reasons for the findings:

- Speeding – there was only a relative increase in speeding citations of 2.0%, but because of the large sample sizes, this turned out to be a significant increase.
- Following Too Close and Improper Lane Change – these were significant despite their low sample sizes due to the large increases. It is clear that the TACT program may have had a significant effect in increasing the numbers of these types of citations.
- Failure to Signal – this increase was significant at the 0.13 alpha level, and it had the largest percentage increase. Its counts, however, were quite low, which accounts for the relatively low level of significance.
- No Seatbelt – this was the only TACT offense that had a significant reduction. It would be reasonable that if officers are looking for private vehicle offenses around CMVs, and CMV offenses interacting with passenger vehicles, that they would not be as likely as they generally are to detect seatbelt violations.
- No Insurance and Driver's License – these offences had large sample sizes and so their percentage increases did not need to be as high in order for them to be considered as statistically significant. Both of these offenses are typically secondary offenses, i.e., they are issued in conjunction with another (usually moving) offence.
- Improper Passing – there was virtually no change in this category.

Generally it can be concluded that most of the citation types associated with the TACT program increased in the four months in which the TACT program was conducted.

The measure of increased citations during the TACT program implementation is more of an administrative evaluation metric than an effectiveness metric. It has been noted in the literature that the mere increase in citations does not infer anything about safety. The question that must be answered is: does this increase in citation issuance translate into a modification of driver behavior? The effectiveness metrics discussed in this document are essential to answering that question. However, it is essential to the proper interpretation of the effectiveness metric results that the qualitative and quantitative aspects of the selective enforcement component of the project be thoroughly documented.

6.3 Survey Results

Examples of two sets of surveys will be presented in this overall section: (1) the most recent TACT effort, which involved a small area in Tuscaloosa County over a short time frame, and (2) the first TACT effort performed in Alabama, which involved the entire state. The most recent will be presented first since it exemplifies test and control areas before and after the PI&E effort. However, some useful information was derived from the first round of surveys, and they are included for this reason. The following lists the subject headings for the subsections within this part of the report:

- 6.3.1.1 – Recent Law Enforcement Officer Survey
- 6.3.1.2 – Recent Trucker Surveys
- 6.3.1.3 – Recent Driver Survey
- 6.3.2.1 – Original Officer Survey
- 6.3.2.2 – Original Trucker Survey

See Sections 3.1.3.2 through 3.1.3.4 for details of the survey plans.

6.3.1 Surveys from Most Recent TACT Effort

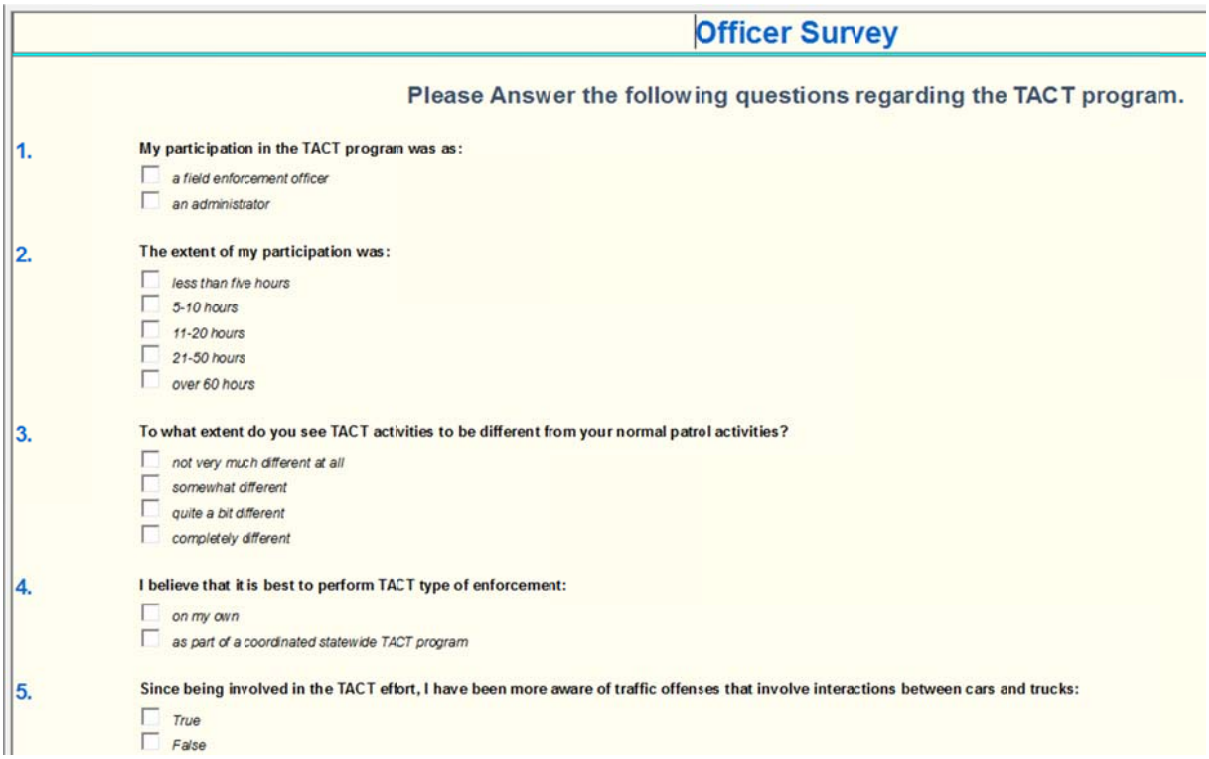
The examples within the next three sections will present the results of the surveys that accompanied the most recent TACT project.

6.3.1.1 Recent Law Enforcement Officer Survey

Alabama DPS officers involved in the TACT program were invited to participate in an internet-based survey. The survey was posted on the Safe Home Alabama website and officers were directed to it via an e-mail from a commanding officer in charge of the TACT program. The Participation in the survey was completely voluntary and totally anonymous. Display 6.3.1.1 is a screenshot of the website where the surveys were housed online. Display 6.3.1.1a shows a screenshot of the Officer online survey.

Display 6.3.1.1 Safe Home Alabama TACT Survey Web Page

Display 6.3.1.1a Screenshot of Officer Survey



Officer Survey

Please Answer the following questions regarding the TACT program.

1. My participation in the TACT program was as:
   - ☐ a field enforcement officer
   - ☐ an administiator

2. The extent of my participation was:
   - ☐ less than five hours
   - ☐ 5-10 hours
   - ☐ 11-20 hours
   - ☐ 21-50 hours
   - ☐ over 60 hours

3. To what extent do you see TACT activities to be different from your normal patrol activities?
   - ☐ not very much different at all
   - ☐ somewhat different
   - ☐ quite a bit different
   - ☐ completely different

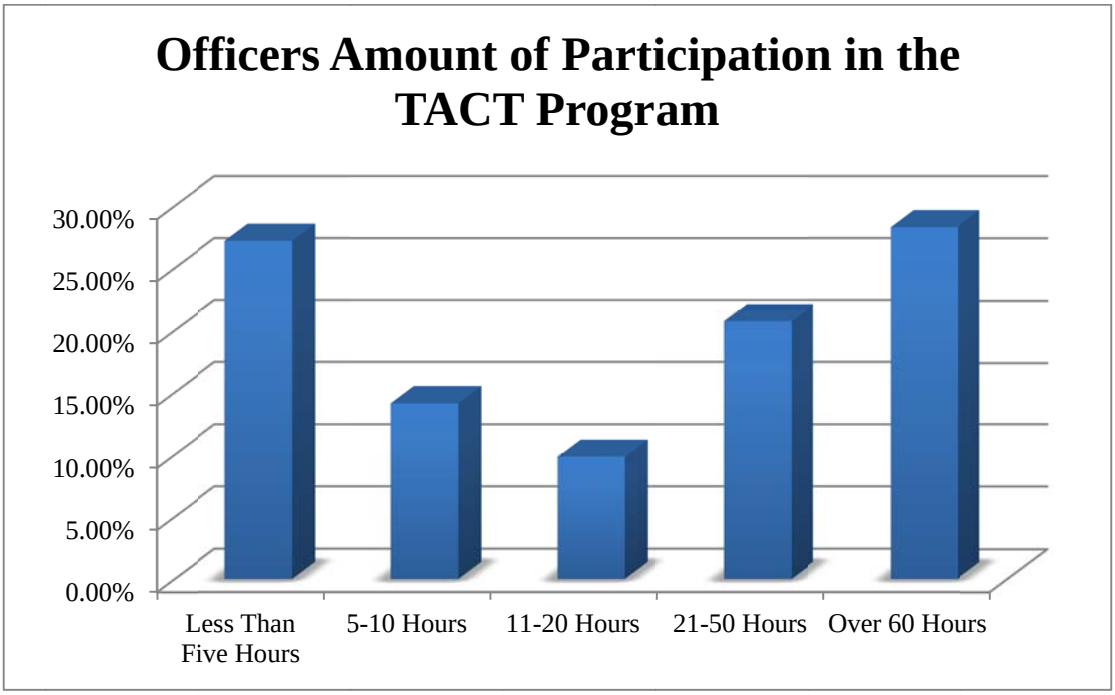
4. I believe that it is best to perform TACT type of enforcement:
   - ☐ on my own
   - ☐ as part of a coordinated statewide TACT program

5. Since being involved in the TACT effort, I have been more aware of traffic offenses that involve interactions between cars and trucks:
   - ☐ True
   - ☐ False

SEE PART 5

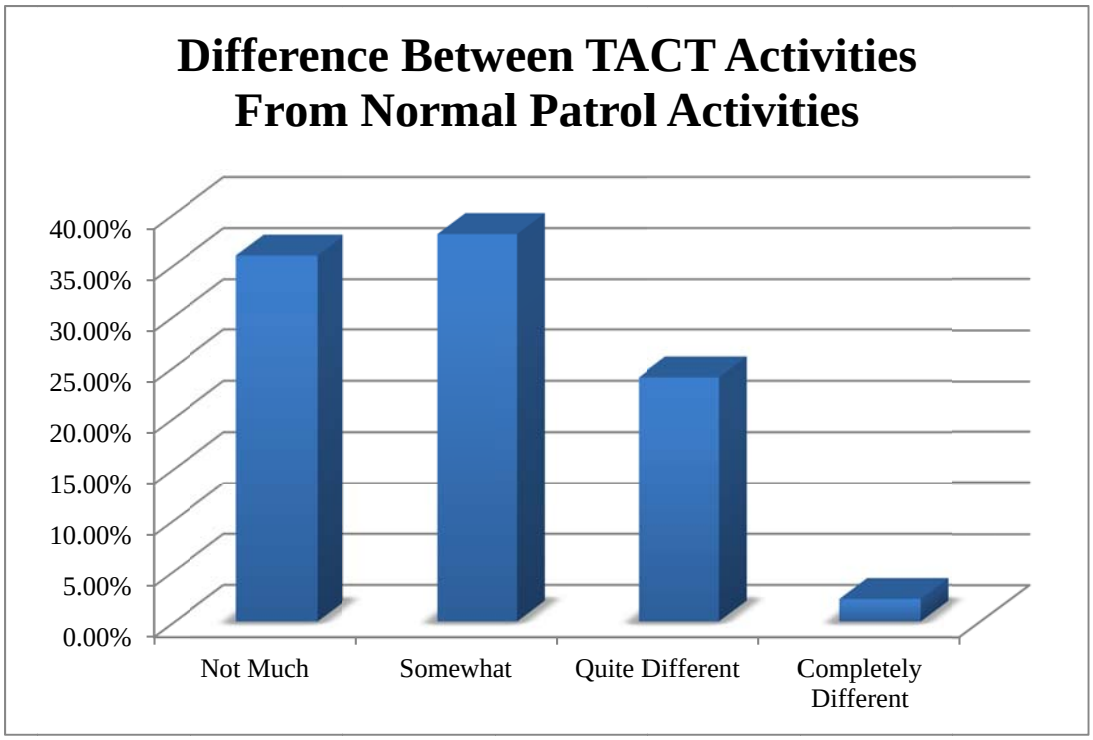
A total of 100 officers responded to the survey. The respondents comprised 92 officers and 8 law enforcement administrators. Display 6.3.1.1b shows a breakdown of the level of involvement (measured in hours) in the TACT program among the responding officers.

Display 6.3.1.1b



Officers were asked whether TACT-related activities were different form their normal patrol activities. According to the summary presented in Display 6.3.1.1c, the majority of officers indicated that TACT-related duties were not too dissimilar form their normal patrol duties.

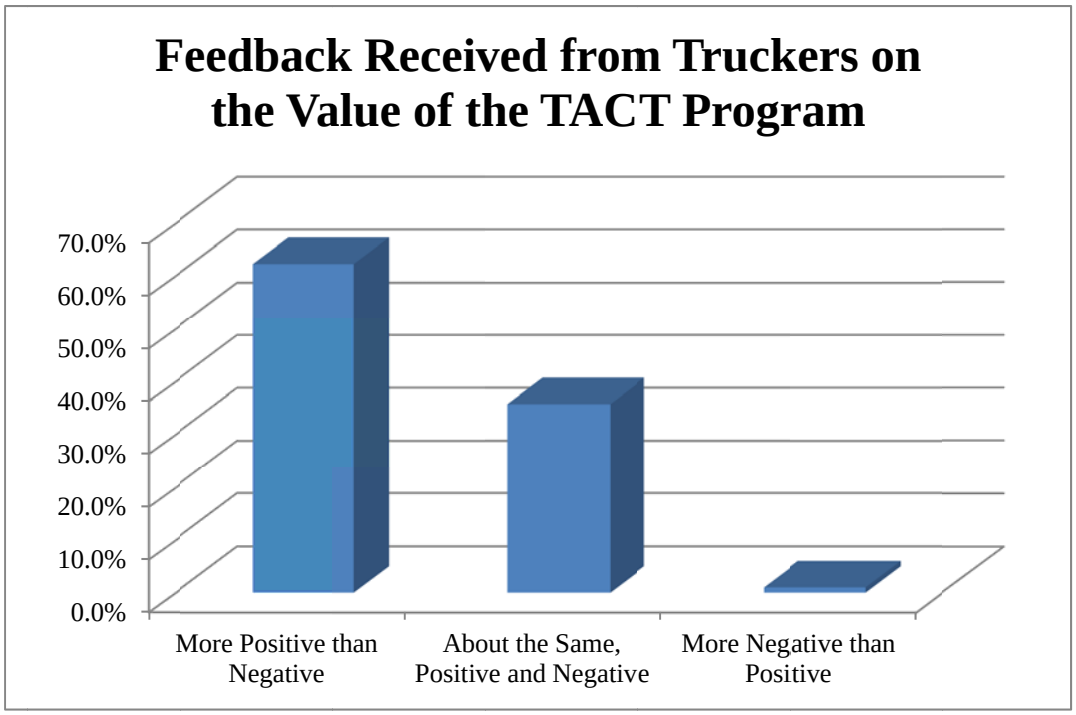
Display 6.3.1.1.c



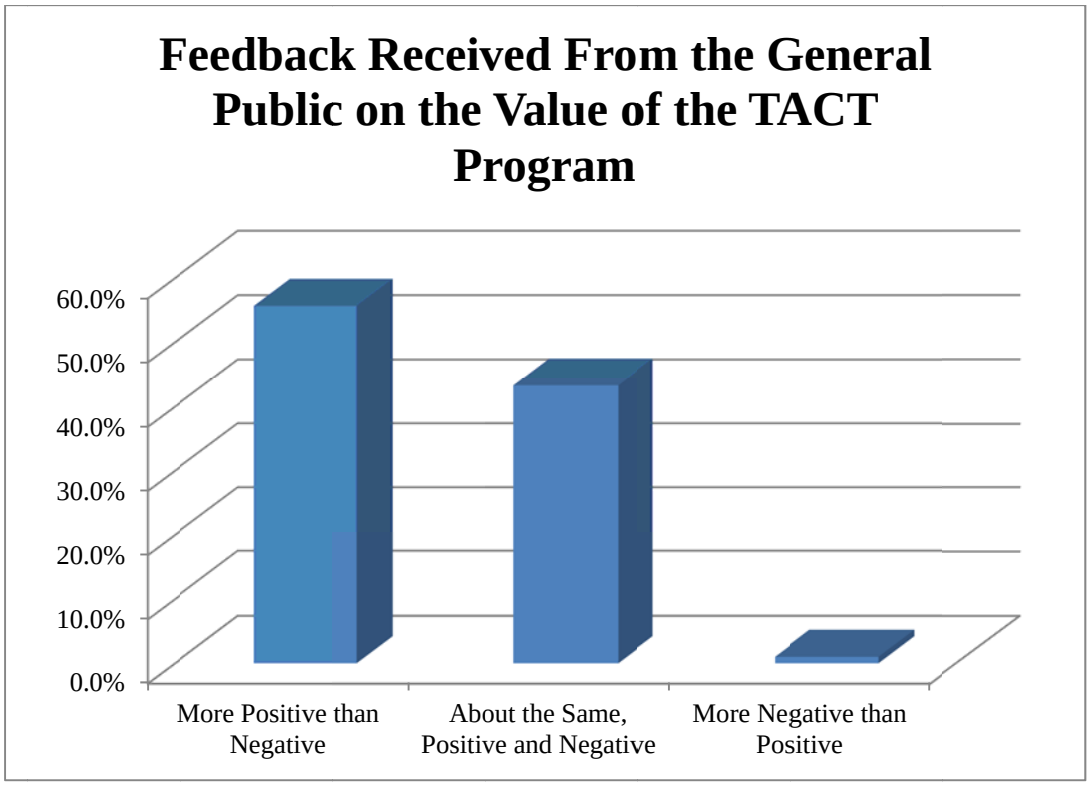
Interestingly, the majority (60%) of responding officers indicated that TACT type enforcement is best performed at the discretion of individual officers as opposed to being conducted as part of a Statewide TACT program.

Respondents were asked about their opinion of the feedback they received from both truck drivers and the general public regarding the TACT program. The results are summarized in Display 6.3.1.1d and 6.3.1.1e, respectively.

Display 6.3.1.1d



Display 6.3.1.1e

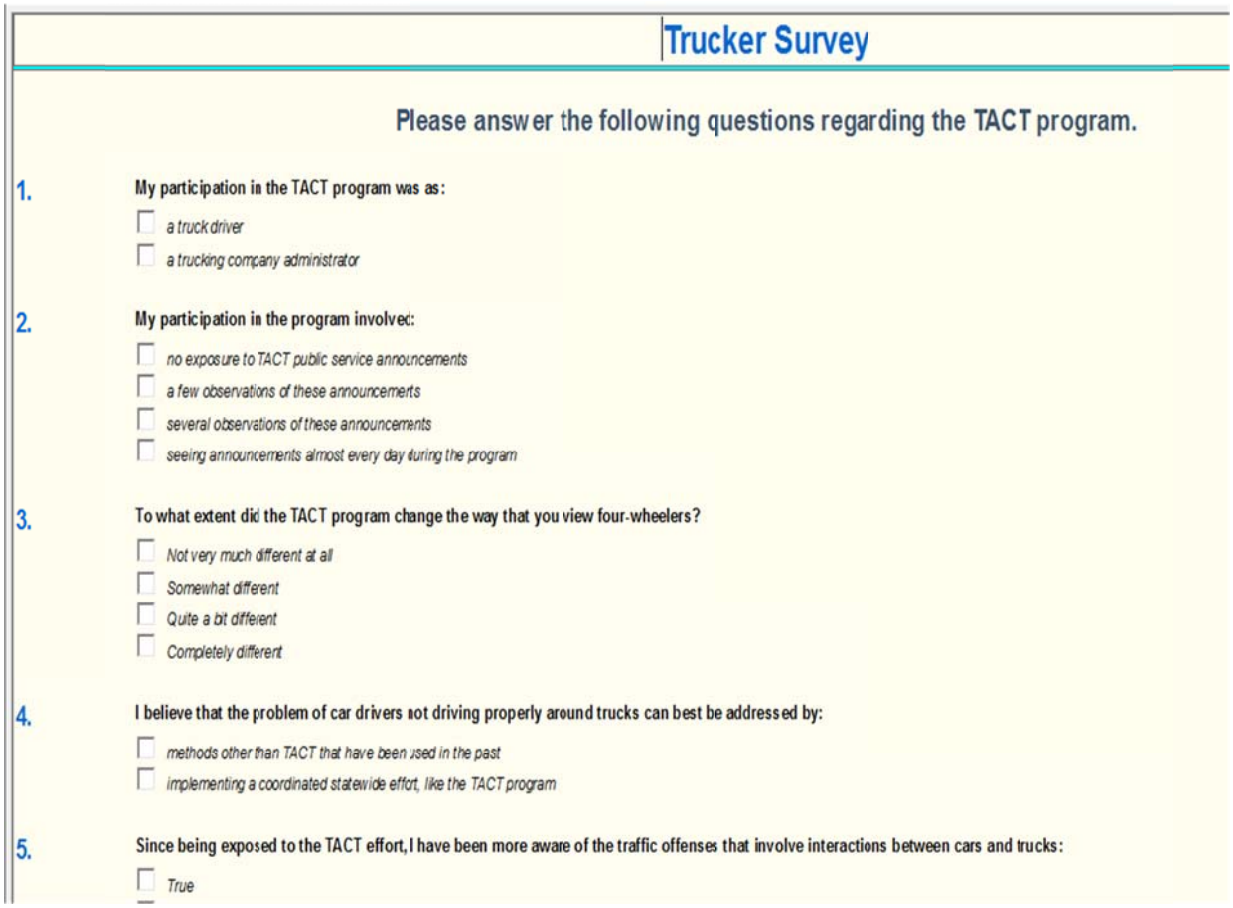


Displays 6.3.1.1 d and 6.3.1.1e indicate an overall positive opinion of the TACT program. Overall, the officers' attitudes toward the TACT program were general positive as well. The only possible exception would be to the question with regard to whether TACT was best run as a statewide program or left for individual officers to enforce. Although more officers responded they could best perform TACT-related activities on their own, over half indicated that awareness of car and truck interactions led to more citations after conducting the TACT program.

6.3.1.2 Recent Trucker Surveys

Truck drivers were also encouraged to complete an internet-based survey on the TACT program. The participation in the survey was completely voluntary and anonymous. The survey for the Truck drivers was also placed on the Safe Home Alabama website and the link was e-mailed to various trucking companies that operate in Alabama. Display 6.3.1.2 shows a screenshot of the Truck Driver survey.

Display 6.3.1.2 Truck Driver Survey



There was an overall positive attitude expressed toward the TACT conveyed via the trucker survey. There were only fifteen responses to the online trucker survey, and of these the majority was from administrators (i.e., owners and managers) not drivers. The results indicated industry support for TACT. Specifically, 94% of the respondents indicated the program was positive and 100% indicated they felt the enforcement was fair. Interestingly, the trucker survey indicated more support for large-scale programs such as TACT as opposed to more ad hoc, individual officer based enforcement.

Two thirds of the trucker survey respondents indicated they had been exposed to the PI&E campaign, while the remaining third indicated no awareness of the current program. More importantly, 60% of the respondents indicated the PI&E in some way changed the way they view cars on the road. Most all of the respondents indicated that the best way to address cars driving improperly around trucks was through a large-scale campaign such as TACT, 75% reported that they were more aware of the potential traffic offenses involving car-truck interaction as a result of the program. A quarter of the respondents stated they know of at least one trucker who received a citation as part of the TACT campaign. And finally, 87% of truckers surveyed believe that the TACT campaign accomplished its objective of changing driving behavior around trucks.

6.3.1.3 Recent Driver Survey

Surveys were issued to each of the study locations in February, April, June and July with the intention of covering the various study periods (*Before, PI&E, PI&E+E* and *After*). The final survey materials were obtained from the various driver licensing stations in mid-August 2011, about six weeks after the TACT project.

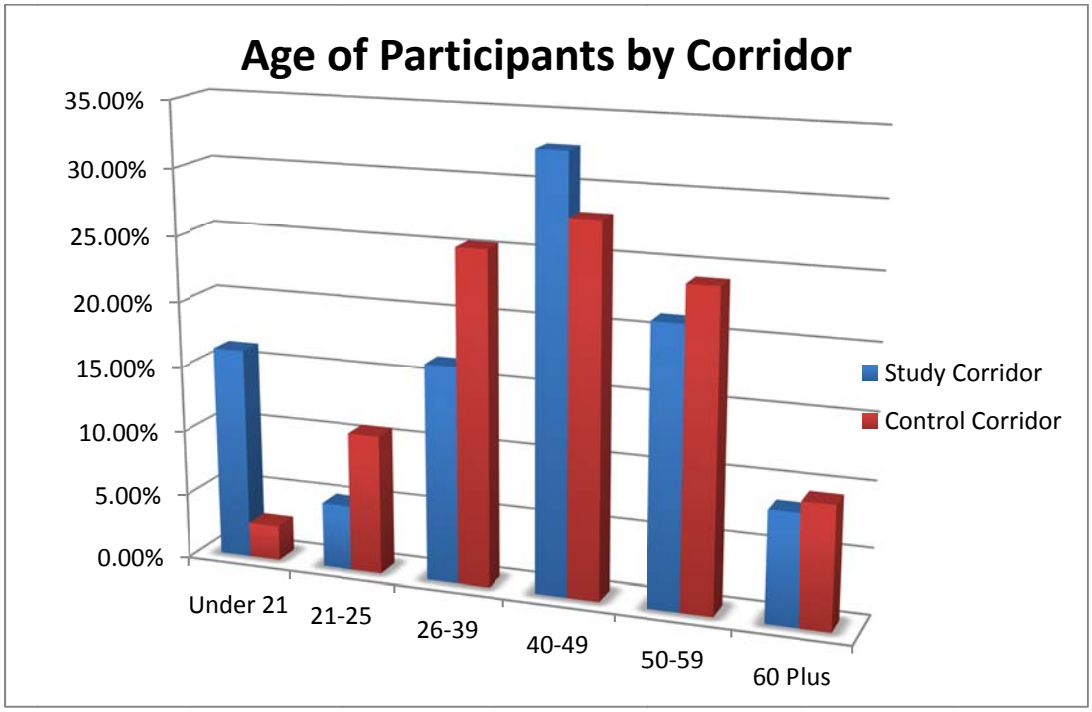
A total of 1,400 surveys were distributed and 232 survey responses were gathered from both the study and control corridors. Assuming that there was sufficient traffic in the Drivers' License Renewal Offices (DLROs) to support the completion of this number of forms, this indicates a 17% response rate. Display 6.3.1.3 shows the breakdown of survey responses for each study period within the study and control corridors.

Display 6.3.1.3 Surveys Distributed by Counties for each Study Period

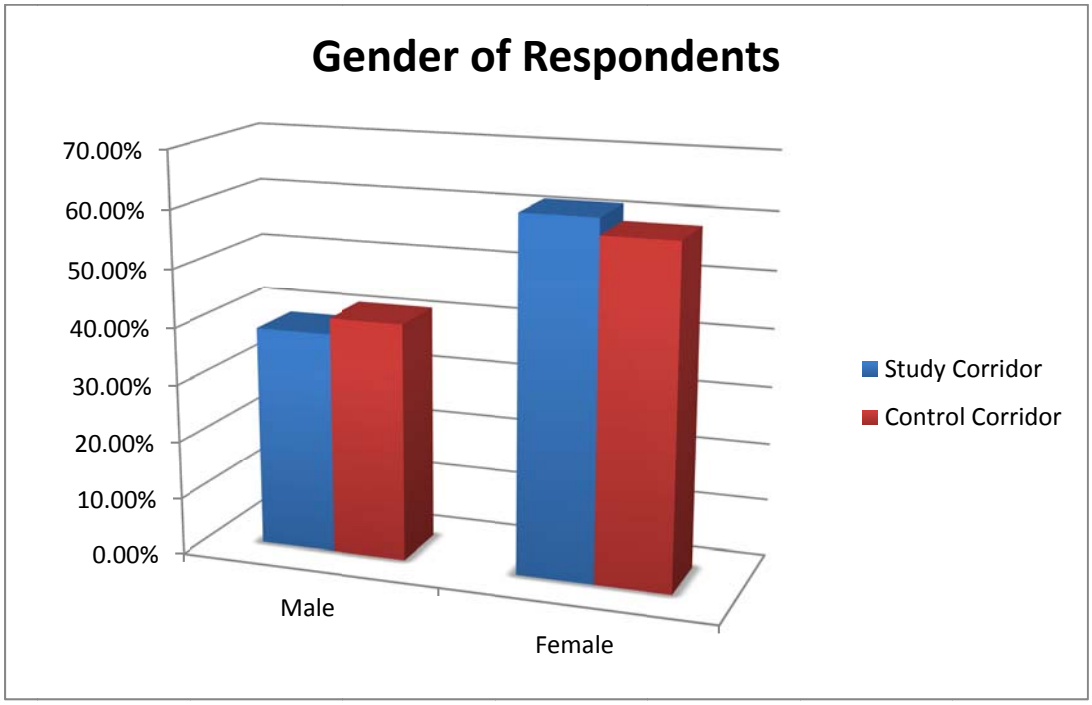
CORRIDOR	DLRO	BEFORE	PI&E	PI&E+E	AFTER	TOTAL
Study	Shelby	32	37	12	25	106
	Tuscaloosa	26	9	1	13	49
	Total Study	58	46	13	38	155
Control	Lee	12	25	9	13	59
	Macon	1	10	6	1	18
	Total Control	13	35	15	14	77
Total by Study Period		71	81	28	52	232

The demographics of the survey respondents were analyzed to discover if there were major differences among the DLROs, the test and control areas, and to get a feel for the respondents in general. Display 6.3.1.3a indicates more females responded to the survey than males. Interestingly, the relative percentages were roughly the same for both the study and control corridors. Display 6.3.1.3b shows the ages of the survey respondents. It is clear that a range of ages were surveyed at both locations. There were substantiallly more younger drivers (< 21 years old) surveyed in the study corridor.

Display 6.3.1.3a



Display 6.3.1.3b

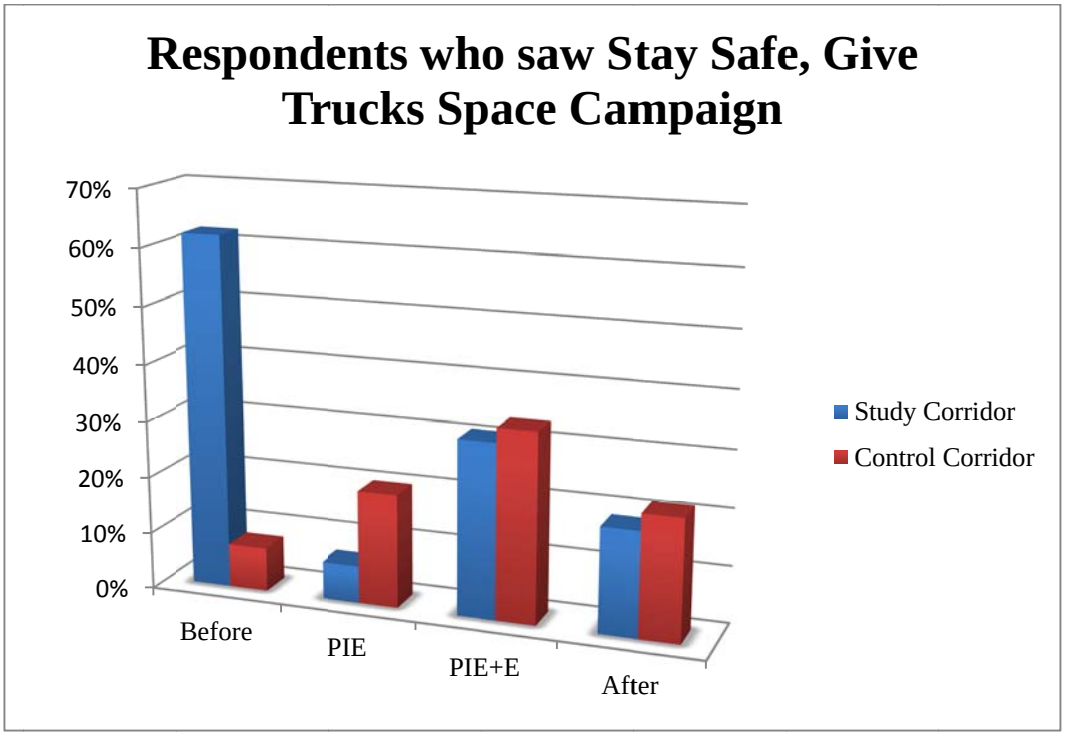


The majority (88%) of respondents indicated that they drove a passenger vehicle (car, mini-van, SUV, etc.). Less than 1% indicated they drove a motorcycle while 3% indicated they drove a large truck and another 3% indicated they drove a full-sized van. Roughly 25% indicated they drove between 5,000 and 15,000 miles per year, 25% indicated 15,001 to 20,000 and 25% responded than they drove more than 20,000 miles per year. Less than 15% indicated that they drove less than 5,000 miles per year and 6% stated they did not drive at all. This information was considered to be "richness" data as it was intended to allow a richer analysis of responses by driver type. Ultimately, no trends among these driving characteristics emerged or correlated with any group of responses to other questions.

6.3.1.3.1 Exposure to TACT Campaign

The first part of the driver survey was intended to measure whether or not respondents had been exposed to the PI&E materials. In order to measure this, the responses from the study corridor (where the PI&E campaign was targeted) were compared with responses from the control corridor (where no PI&E was directed). Unfortunately, the quality of some of the survey responses is suspect. For example, Display 6.3.1.3.1 shows the percent of respondents in each corridor indicating that they had seen the PI&E information during each of the fours study periods.

Display 6.3.1.3.1

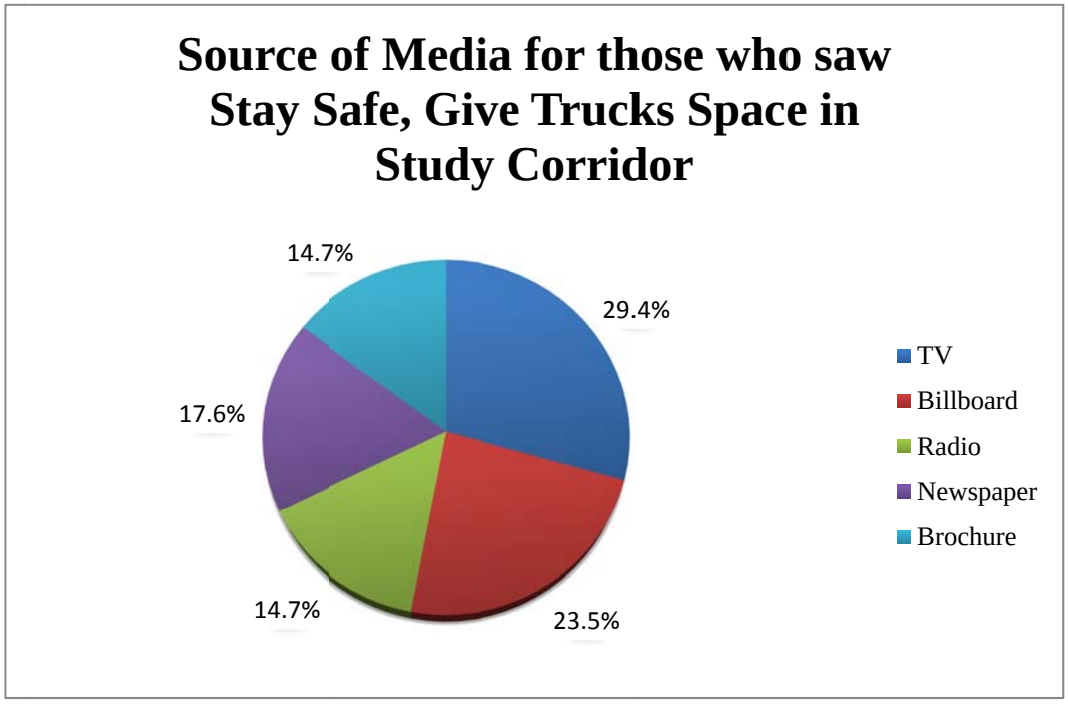


Display 6.3.1.3.1a indicates that some 60% of respondents in the study corridor had seen the PI&E materials during the study period. Of course, this is impossible as the PI&E materials had

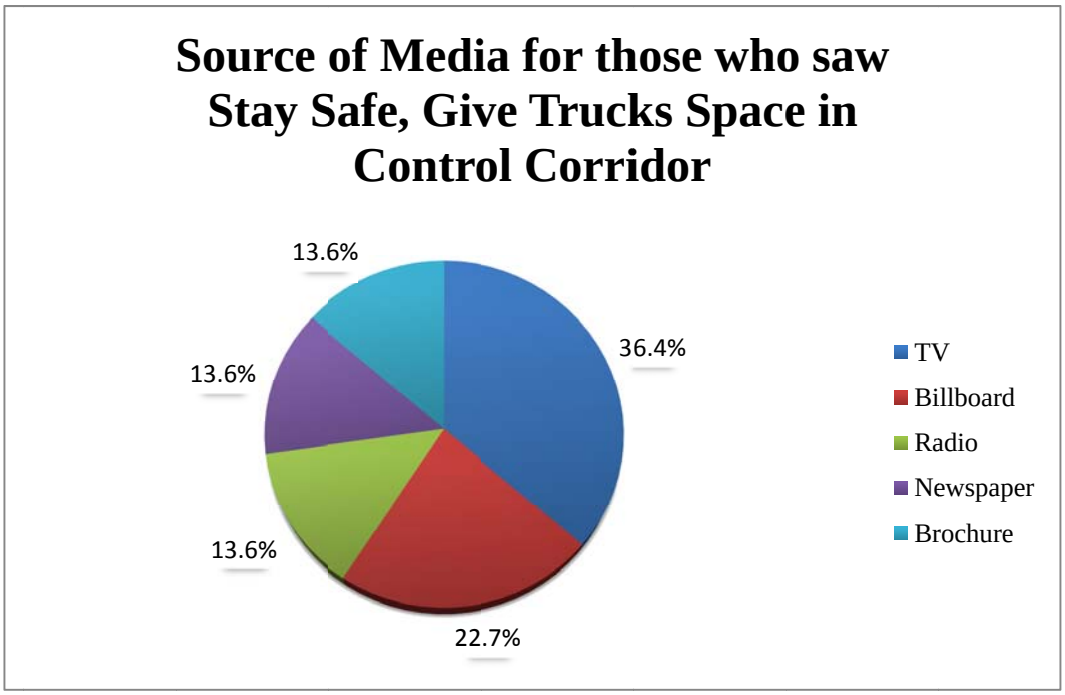
not yet been deployed. Such results might have been interpreted as indicating some linger awareness of previous PI&E campaigns but then it would be expected that the control corridor results would have been similar. Furthermore, the results for the PI&E period indicate that a larger percentage of respondents in the control corridor had seen the PI&E materials than in the study corridor where they were deployed. Again, these results defy expectation. Interestingly, the percentages are both similar and higher for the PI&E+*E* and *After* periods. While it is still unexpected that the percentage for the study periods would be less than that for the control corridor, it should be noted that by the time the PI&E+E period began, the earned media coverage (radio and television) had started. Thus it could be expected that the overall awareness could have increased and that, due to the nature of the earned media coverage, it extend well beyond the study corridor.

The survey was also used to determine how respondents were exposed (or believed they were) to the PI&E materials. Displays 6.3.1.3.1b and 6.3.1.3.1c present a breakdown of how respondents indicating that they saw the PI&E materials reported that how were exposed to it. Display 6.3.1.3.1b shows results from the study corridor whereas Display 6.3.1.3.1c presented results from the control corridor.

Display 6.3.1.3.1b



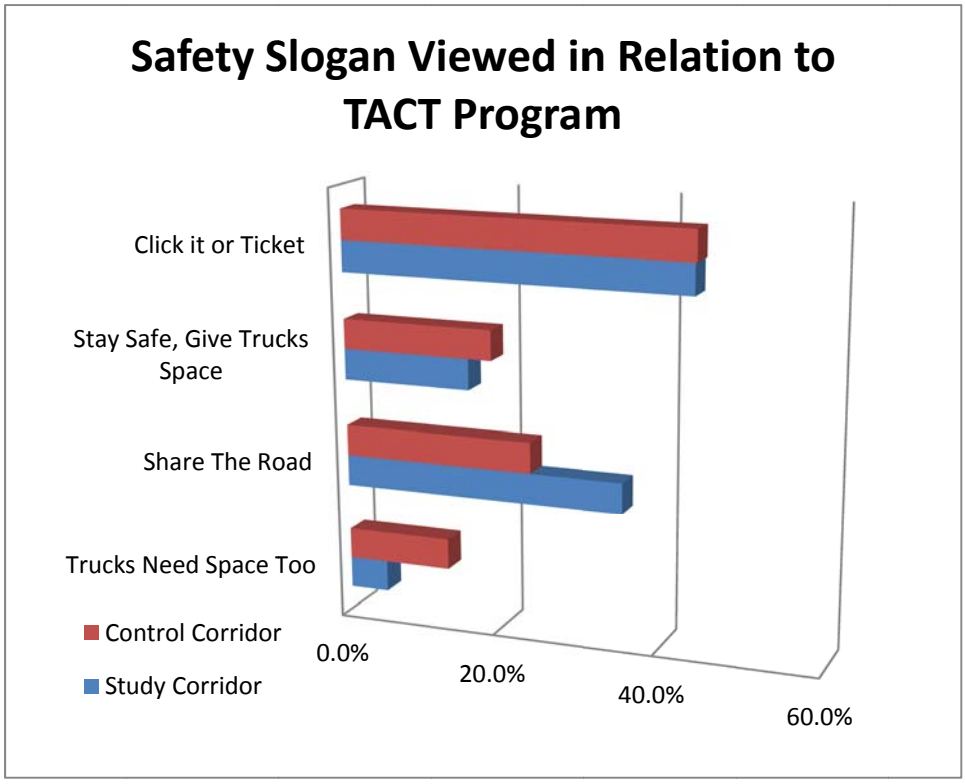
Display 6.3.1.3.1.c



The results indicate that the majority of exposure is attributable to the TV coverage. Interestingly, the billboards represented almost a quarter of the reported exposure in both corridors. While a unexpected result, perhaps it indicates some underlying mobility of Alabama drivers on the Interstate system.

Respondents were asked to identify the name of the truck safety program to which they had recently been exposed. The results are summarized in Display 6.3.1.3.1.d.

Display 6.3.1.3.1.d

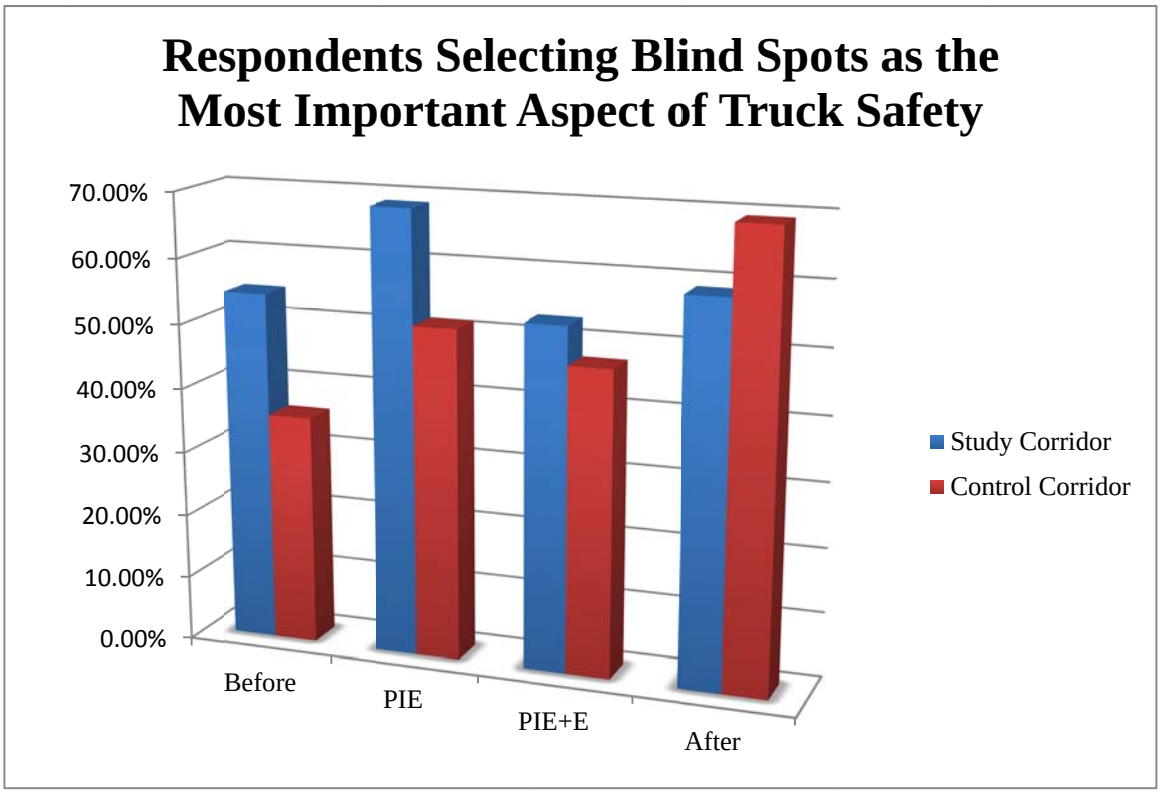


Display 6.3.1.3.1d does not indicate any meaningful recognition of the slogan used for the TACT campaign, "Stay Safe, Give Trucks Space." However, it does demonstrate that established programs such as "Click It or Ticket" and "Share the Road" have made a lasting impression. This is not to say that there was any problem with the slogan; just that it had not had enough exposure at this point to compete with these others which had been in place for some time.

6.3.1.3.2 Measuring Response to TACT Program

Ultimately, the intent of the PI&E was to positively affect driver behavior. As explained in previous sections, the initial crash analyses indicated that blind spot was involved in the majority of CMV-related crashes. Therefore, the PI&E campaign specifically addressed the issue of driving in the blind spot of a truck. Survey respondents were asked their opinion of what was the most important unsafe driving act to avoid with regard to driving around large trucks. The specific question was: "**Which of the following do you think is important when driving around large trucks? (Check one).**" The possible responses included; "Do not pull in front of a truck and slow down," "Do not tailgate trucks" and "Stay out of the truck driver's blind spots." Display 6.3.1.3.2 indicates that over half of the respondents in the study corridor consider driving in the blind spot as most important. Overall, Display 6.3.1.3.2 indicates an increasing trend of respondents choosing "the blind spot" as the most important unsafe act.

Display 6.3.1.3.2



A simple statistical analysis was conducted to show how the MS Excel Binomial Distribution function described in the Methodology Manual could be used to test before and after conditions. Display 6.3.1.3.2 shows a larger percentage of respondents in the before period indicating driving the blind spot as the most important safety factor around trucks. A statistical test was conducted to see if the increase was significant. The results of the test are summarized in Display 6.3.1.3.2a.

Display 6.3.1.3.2a Statistical Analysis of Before and After Reponses on Important Factors around Trucks

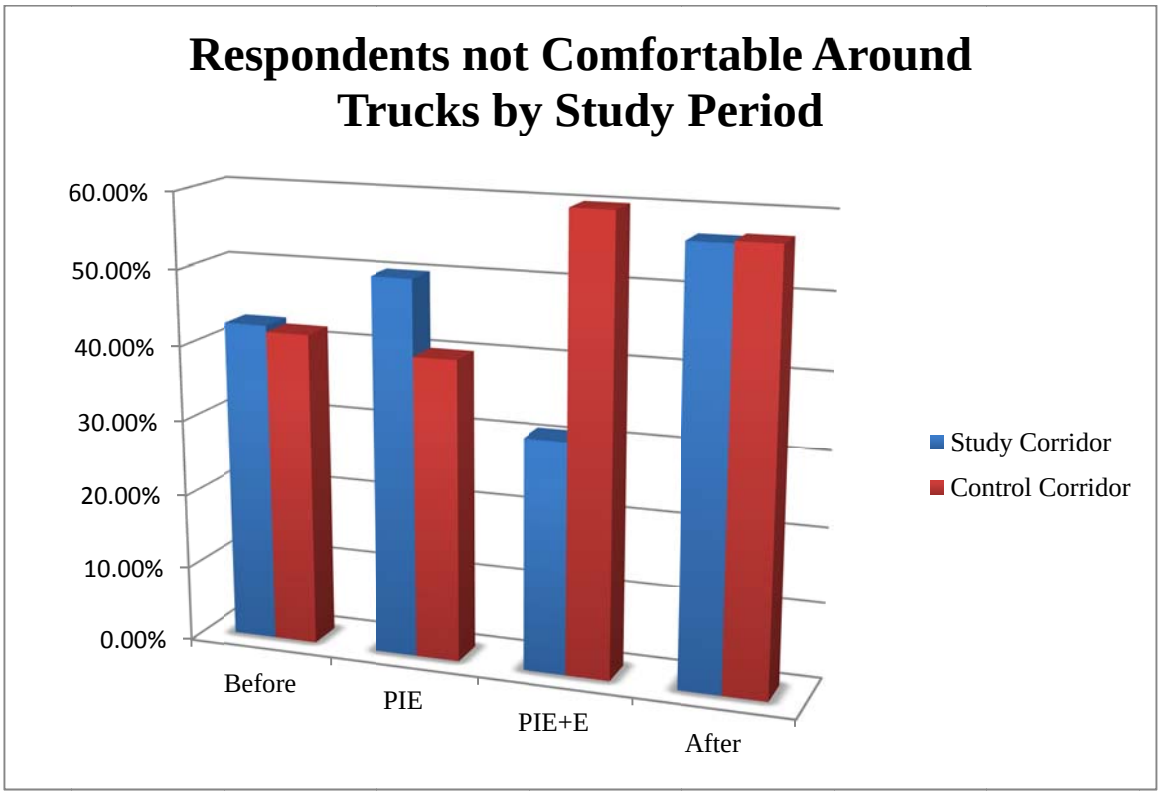
CHANGE IN DRIVERS IDENTIFYING IMPORTANT UNSAFE AROUND LARGE TRUCK - STUDY CORRIDOR	AFTER TACT		BEFORE TACT		PROB Before < After
	Number	%	Number	%	
Lane Change	14	30.43%	90	30.61%	0.5547
Tailgating	5	10.87%	44	14.97%	0.9880
Blind Spot	27	58.70%	160	54.42%	0.0769*
SUBSET TOTALS	46	100.00%	294	100.00%	1.0000
GLOBAL TOTALS					

* Significant at the 0.10 alpha level

Display 6.3.1.3.2a shows that there was a significant increase in the percentage of respondents indicating the blind spot as the most important safety factor around large trucks. Such results imply that the PI&E campaign had a positive impact, since it specifically focused on the issue of blind spots. Unfortunately, no similar analysis could be done meaningfully for the control corridor as the number of responses was too small.

In addition to investigating any self-reported behavior changes, the survey attempted to gauge any attitudinal impacts of the TACT campaign. Respondents were asked whether or not they were comfortable driving around large trucks. Display 6.3.1.3.2b shows the percentage of respondents during each study period indicating they were not comfortable driving around large trucks.

Display 6.3.1.3.2b

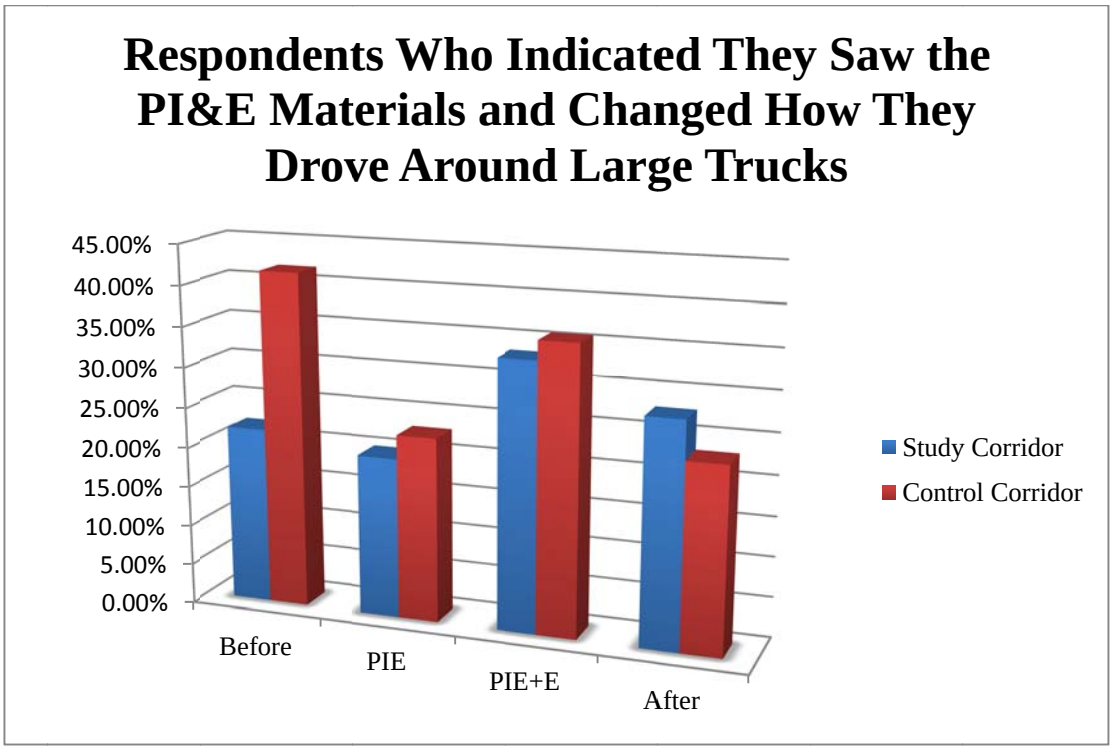


The most interesting observation from Display 6.3.1.3.2a is the fact that there was a substantial increase in the percentage of respondents not comfortable around trucks between the *Before* and *After* periods. The interpretation, however, is not clear. Perhaps the results indicate that the TACT campaign raised awareness of safety around large trucks, which had the effect decreasing comfort. If indeed this is the case, it may well be construed as a positive impact of the campaign.

The surveys elicited responses on self-reported behavior changes for each of the study periods in attempt to ascertain any effects of the PI&E and enforcement campaigns. Display 6.3.1.3.2c

shows the percentage of respondents who indicated seeing the PI&E materials indicating that they changed their driving behavior during each of the study periods.

Display 6.3.1.3.2c

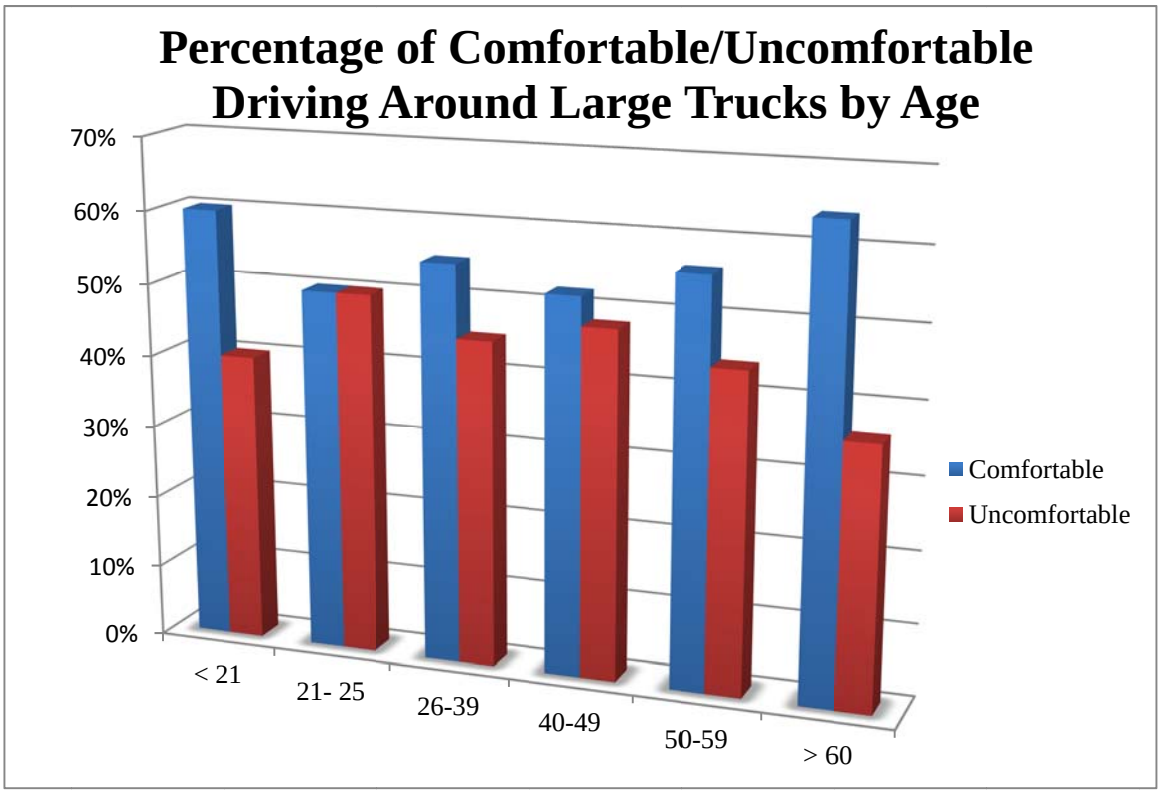


Again, if the data for the *Before* period is ignored, the results are interesting. Display 6.3.1.3.2c indicates a higher percentage of self-reported behavior changes after the PI&E campaign began. Furthermore, the data indicate more changes in self-reported behavior in the study corridor than control corridor after the study period that included PI&E and enforcement.

6.3.1.3.3 Summary of Driver Surveys

Interestingly, among the twelve total respondents that indicated they drove a large truck, ten indicated they were comfortable driving around large trucks. Additionally, respondents who drove more than 20,000 miles per year were much more likely to respond as being more comfortable around large trucks. Pick-up truck drivers showed a general trend of being more comfortable around truck but no other differences emerged. Finally, Display 6.3.1.3.3 shows that most respondents indicated they were comfortable driving around large trucks. Of particular interest is the relatively larger percentage of younger drivers who indicate they are comfortable around large trucks. This tends to substantiate the need to focus PI&E on younger drivers to increase awareness among this age group.

Display 6.3.1.3.3



Overall, the survey of the general driving population yielded some interesting results. Doubtless the results would have been more meaningful and it would have been possible to identify more trends and response patterns had there been better response rates, especially being more consistent among locations. Nonetheless, this exemplifies how a simple survey can be utilized to measure the exposure of drivers to a TACT campaign and the self-reported changes in driving behavior attributable to it.

6.3.2 Analyses of Original Surveys from the First Tact Project

Two post-TACT program surveys were conducted as part of the original TACT effort in Alabama – one for participating officers and one for truckers. These are covered in the next two sections. These surveys were conducted after the fact, and thus no before-after comparison could be performed. While this approach is not recommended, in some cases where there was inadequate provisions made for a "before" survey to be conducted, there may be no choice to only perform the survey after the fact. The examples presented here

6.3.2.1 Original Officer Survey

The officer survey was placed on line about a month after the TACT program had been completed. The participation in the survey was completely voluntary and totally anonymous.

All participating officers were encouraged to complete the survey. The following displays present the survey questions and summarize the responses.

1. My participation in the TACT program was as: Create Chart Download

	Response Percent	Response Count
a field enforcement officer	**88.4%**	**38**
an administrator	11.6%	5
answered question		43
skipped question		0

2. The extent of my participation was: Create Chart Download

	Response Percent	Response Count
less than five hours	16.3%	7
5-10 hours	9.3%	4
11-20 hours	14.0%	6
21-50 hours	23.3%	10
over 50 hours	**37.2%**	**16**
answered question		43
skipped question		0

3. To what extent do you see TACT activities to be different from your normal patrol activities? Create Chart Download

	Response Percent	Response Count
not very much different at all	27.9%	12
somewhat different	**55.8%**	**24**
quite a bit different	9.3%	4
completely different	7.0%	3
answered question		43
skipped question		0

4. I believe that it is best to perform TACT type of enforcement: Create Chart Download

	Response Percent	Response Count
on my own	48.8%	21
as part of a coordinated statewide TACT program	51.2%	22
answered question		43
skipped question		0

5. Since being involved in the TACT effort, I have been more aware of traffic offenses that in-volve interactions between cars and trucks: Create Chart Download

	Response Percent	Response Count
True	69.8%	30
False	30.2%	13
answered question		43
skipped question		0

6. Being more aware of traffic offenses that involve interactions between cars and trucks has led me to issue more citations for these types of offenses even after the TACT program was over: Create Chart Download

	Response Percent	Response Count
True	67.4%	29
False	32.6%	14
answered question		43
skipped question		0

7. Feedback that I have received from truckers as to the value of the TACT program has been:

Create Chart | Download

	Response Percent	Response Count
more positive than negative	**67.4%**	**29**
about the same positive and negative	30.2%	13
more negative than positive	2.3%	1
answered question		**43**
skipped question		**0**

8. Feedback that I have received from the general public as to the value of the TACT program has been:

Create Chart | Download

	Response Percent	Response Count
more positive than negative	44.2%	19
about the same positive and negative	**53.5%**	**23**
more negative than positive	2.3%	1
answered question		**43**
skipped question		**0**

9. Do you believe that the traffic law enforcement effort associated with the TACT program accomplished its objectives of changing driving behavior and saving lives?

Create Chart | Download

	Response Percent	Response Count
Yes	**92.9%**	**39**
No	7.1%	3
answered question		**42**
skipped question		**1**

The following is a discussion of the survey results, by question:

1. The vast majority (88.4%) of the respondents were enforcement officers; the remaining 11.6% were law enforcement administrators.
2. Only a little over 25% of the respondents had 10 hours or less participation in the TACT program, while over 60% had more than 20 hours, and 37.2% had over 50 hours. This indicates that the respondents generally had extensive experience with the TACT program.
3. Generally speaking the officers did not see the TACT program as being a major deviation from their normal activities. Only 26.3% of them responded with "quite a bit different" or "completely different," but almost the same proportion responded "not very much different at all." The majority (55.8%) responded with "somewhat different." The positive aspect of this response is that TACT was not perceived to cause a major disruption of officer activity. The downside is that some definitive changes in approach were expected. Apparently from the eCite comparisons there were major changes in the citations issued. Apparently officers did not perceive this to be a major change in their approach.
4. Officers were not unified as to whether a TACT program was needed or whether this could be done as effectively by individual independent activity on their part. They were split almost evenly on this question.
5. As opposed to Question 4, there was over a two to one majority who believed that due to the TACT program they are now more aware of traffic offenses that involve interactions between personal and commercial vehicles.
6. This response effectively reflects that of Question 5. Apparently those who felt that they were made more aware of certain offenses acted on that awareness by issuing more of these types of citations even after the TACT program was over.
7. This was an extremely one-sided response indicating the belief that the feedback that the officers got from truckers was positive to the TACT program. This can be compared to the responses from the truckers covered in the next section.
8. This question was an interesting contrast to the previous one. The question was effectively the same but instead of it being feedback from truckers it is feedback from the general public. Perhaps the feedback being referenced here is that when receiving a citation, which would not be expected to be very positive. Generally only about 6% of the citations were given to CMVs, so it is reasonable that CMVs would be more favorably disposed to the TACT program as opposed to the truckers.
9. The bottom line question of whether the TACT program saved lives received a very positive response of almost 93%.

In summary, it is clear that the officers' attitudes toward the TACT program are generally quite positive. The only possible exception was the question regarding whether the same thing could be accomplished without a statewide organized program. That was close to a 50-50 split, so it

cannot be considered to be either positive of negative toward the TACT program. The officers also indicated their support of the program in stating that they changed their approach as to what offenses they were more aware of and thus issued more citations in these areas.

6.3.2.2 Original Trucker Survey Analysis

The trucker survey was placed on line about a month after the TACT program had been completed. The participation in the survey was completely voluntary and totally anonymous. The AMA encouraged its members to participate. The following displays present the survey questions and summarize the responses.

1. My participation in the TACT program was as: Create Chart Download

	Response Percent	Response Count
a truck driver	4.7%	2
a trucking company administrator	**95.3%**	**41**
answered question		**43**
skipped question		**0**

2. My participation in the program involved: Create Chart Download

	Response Percent	Response Count
no exposure to TACT public service announcements	14.0%	6
a few observations of these announcements	**53.5%**	**23**
several observations of these announcements	27.9%	12
seeing announcements almost every day during the program	4.7%	2
answered question		**43**
skipped question		**0**

3. To what extent did the TACT program change the way that you view four-wheelers? Create Chart Download

	Response Percent	Response Count
Not very much different at all	**41.9%**	**18**
Somewhat different	23.3%	10
Quite a bit different	25.6%	11
Completely different	9.3%	4
	answered question	**43**
	skipped question	**0**

4. I believe that the problem of car drivers not driving properly around trucks can best be addressed by: Create Chart Download

	Response Percent	Response Count
methods other than TACT that have been used in the past	2.3%	1
implementing a coordinated statewide effort, like the TACT program	**97.7%**	**42**
	answered question	**43**
	skipped question	**0**

5. Since being exposed to the TACT effort, I have been more aware of traffic offenses that involve interactions between cars and trucks: Create Chart Download

	Response Percent	Response Count
True	**67.4%**	**29**
False	32.6%	14
answered question		43
skipped question		0

6. I believe that the TACT program: Create Chart Download

	Response Percent	Response Count
was biased toward the private vehicle drivers	4.7%	2
was trying to be fair in addressing offenses of both cars and trucks	**86.0%**	**37**
was biased toward truckers	9.3%	4
answered question		43
skipped question		0

7. My feeling as to the overall value of the TACT program is: Create Chart Download

	Response Percent	Response Count
more positive than negative	**81.4%**	**35**
about the same positive and negative	18.6%	8
more negative than positive	0.0%	0
answered question		43
skipped question		0

8. Feedback that I have received from the general public as to the value of the TACT program has been: Create Chart Download

	Response Percent	Response Count
more positive than negative	**53.5%**	**23**
about the same positive and negative	39.5%	17
more negative than positive	7.0%	3
answered question		43
skipped question		0

9. I know at least one trucker who received a ticket as a result of the TACT program. Create Chart Download

	Response Percent	Response Count
True	14.0%	6
False	**86.0%**	**37**
answered question		43
skipped question		0

10. Do you believe that the traffic law enforcement effort associated with the TACT program accomplished its objectives of changing driving behavior and saving lives? Create Chart Download

	Response Percent	Response Count
Yes	**67.4%**	**29**
No	32.6%	14
answered question		43
skipped question		0

The following presents a discussion of the results of the trucker survey, by question:

1. The vast majority (95.3%) of the trucker surveys were completed by trucking company administrators as opposed to truck drivers. This could possibly be due to computer

literacy or perhaps the reluctance of truck drivers to get involved. The Alabama Trucking Association was instrumental in getting the word out on the availability of the survey.

2. This response indicates that there was either a lack of involvement on the part of the respondents or a lack of public service announcements.
3. It is clear from this question that the TACT program had much more of an impact on the involved law enforcement officers than it did on the trucking administrators. The major proportion of the respondents (65%) indicated that their view of four-wheelers had not changed very much at all due to the TACT program.
4. This question can also be contrasted with the comparable officer's question. While the officers were split almost 50-50 as to whether a TACT program was preferable to individual action, the vast majority (97.7% … all except one respondent) favored the TACT approach over other methods used in the past. This shows almost unqualified support on their part for the TACT program.
5. The response as to whether the respondent is more aware of offenses that involve car-truck interaction is almost identical to that of the officers – a two to one statement that they were more aware.
6. It is clear that the majority (86%) felt that the TACT program was fair in addressing offenses of both cars and trucks. In addition, over 9% felt that they were biased toward the truckers, so only 5% had negative feelings with regard to the bias of the officers.
7. The overall feeling of the representatives from the trucking industry was positive – none indicated any negative feelings toward the program, and 81.4% indicated a more positive than negative feeling.
8. While still being positive, the feedback that they received from the general public was not nearly as favorable as their own. This could be due to some feedback coming from those who received citations.
9. The purpose of this question was to determine if the respondents' survey responses might have been biased by citations that they or their employees received. Since 86% of them did not know any truckers who received citations, it can be concluded that this was not a major factor in determining their responses.
10. The question as to whether TACT saves lives is essentially the same bottom line question that was asked of the law enforcement officers. Their response was 92.9% positive, while the response here is 67.4% positive. It can be concluded that law enforcement had a significantly higher positive feeling toward the TACT program than did the trucking administrators.

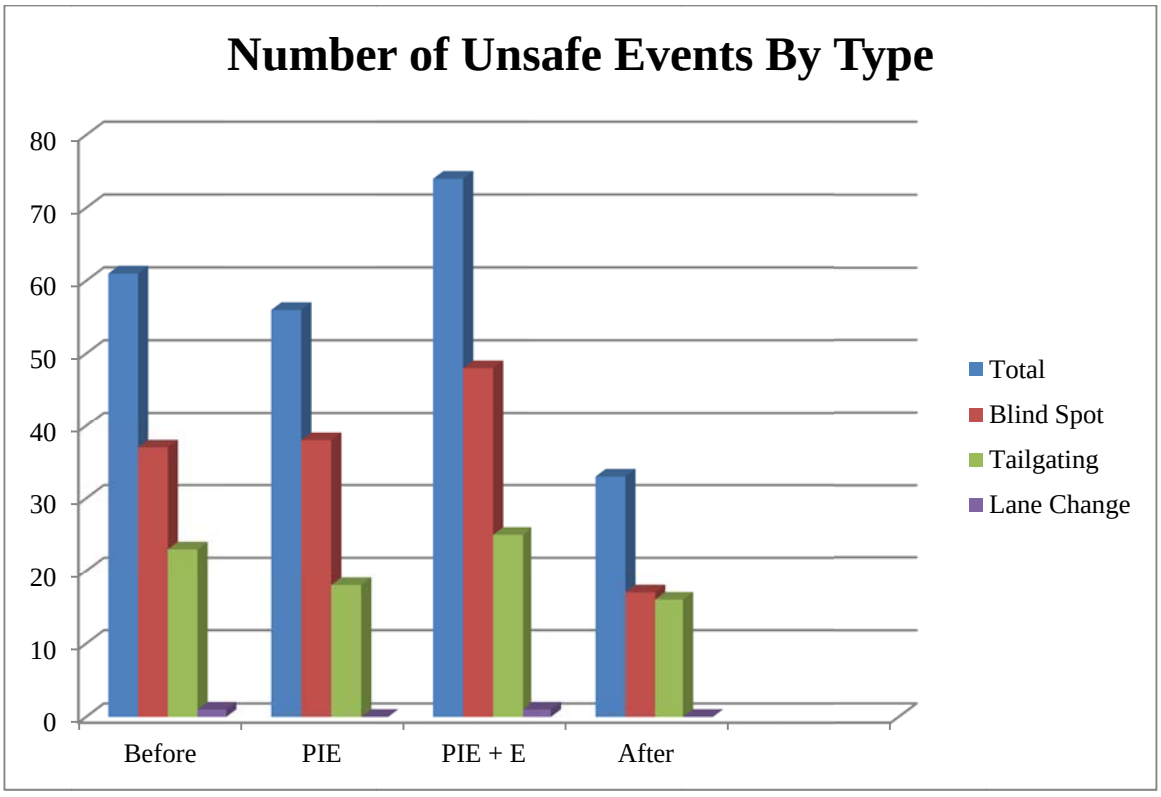
In summary, this survey given after the original comprehensive TACT project indicates an overall positive attitude toward the TACT program being expressed by the truckers, although the truckers' responses were not as positive in several aspects as that of law enforcement. The one notable exception was Question 4 in which the vast majority (97.7%) of truckers indicated that the TACT approach was preferable to other approaches used in the past. The law enforcement

response to this was about an even split. The truckers felt like law enforcement officers implementing TACT were generally fair, and, if anything, they perceived it to be a bit biased toward the truckers. They indicated a strong positive feeling for the TACT program, and their belief that the general public also supported it.

6.4 Observational Data Analysis

As discussed in Section 3.1.4.2.3, each of the four study periods were evaluated considering 150 events each. Recall that the four study periods were before anything, PI&E only, PI&E plus enforcement, and after; these will be referenced as: *Before*, *PI&E*, *PI&E+E* and *After*. The purpose of the evaluations was to determine whether any change in driving behavior occurred over the four study periods. The evaluations were based on fifty events observed from videos representing morning, midday and afternoon traffic conditions for each study period. Therefore, 600 total events were evaluated as safe or unsafe. Display 6.4 presents a summary of the unsafe events observed in each study period.

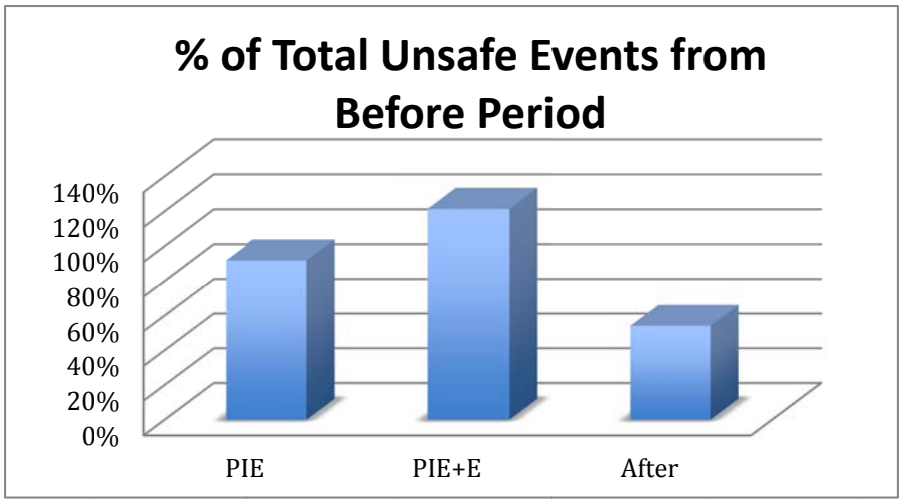
Display 6.4



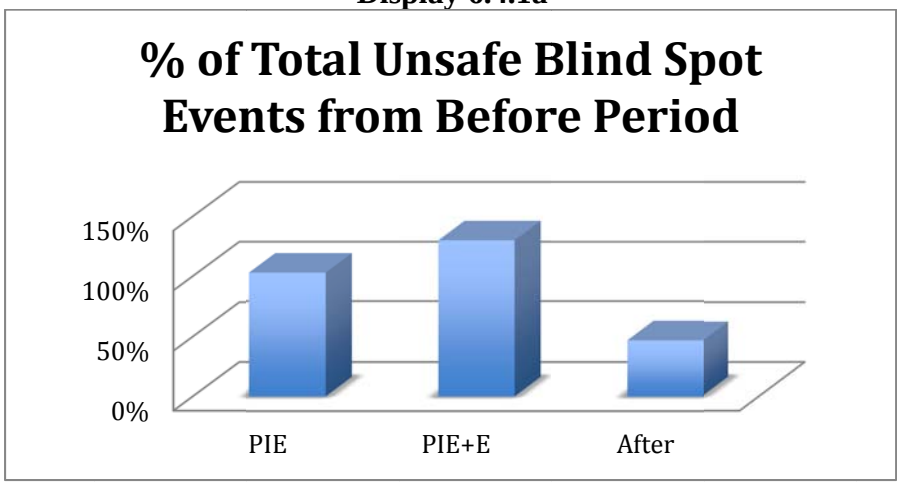
6.4.1 Comparison among Study Periods

Display 6.4 seems to indicate fewer unsafe events in the *PI&E* and *After* periods and an increase during the *PI&E+E* period. In order to investigate these trends further, Displays 6.4.1, 6.4.1a and 6.4.1b show the level of unsafe events in the *PI&E*, *PI&E+E* and *After* periods as a percentage of the number observed during the *Before* period.

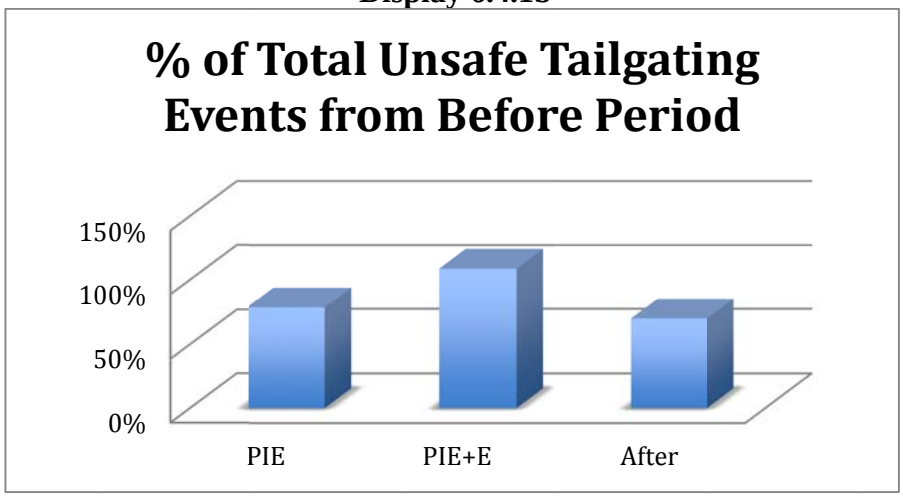
Display 6.4.1



Display 6.4.1a



Display 6.4.1b



Display 6.4.1 confirms the trend of fewer unsafe events during the *PI&E* and *After* periods and an increase during the *PI&E+E* period. Displays 6.4.1a and 6.4.1c show similar trends for the blind spot related events and tailgating events, respectively. Of particular interest, Display 6.4.1a shows that the blind spot-related events during the *After* period are less than 50% of the total observed during the *Before* period. Display 6.4.1b indicates that the number of observed tailgating events did not decrease as much as blind spot events between the *Before* and *After* periods. There was only one observed lane changing unsafe event during the *Before* period and none were observed during the *After* period.

A simple statistical analysis was conducted, which illustrates how the MS Excel Binomial Distribution function described in the Methodology Manual could be used to test before and after conditions. Displays 6.4.1a and 6.4.1b appear to indicate a larger decrease in blind spot events than tailgating events between the *Before* and *After* periods. A statistical test was conducted to see if the decrease was significant. The results of the test are summarized in Display 6.4.1c.

Display 6.4.1c Statistical Analysis of Before and After Observed Unsafe Event

CHANGE IN OBSERVED UNSAFE EVENTS BETWEEN BEFORE AND AFTER	AFTER TACT		BEFORE TACT		PROB Before < After
	Number	%	Number	%	
Lane Change	0	0.00%	1	1.64%	1.000
Tailgating	16	48.48%	23	37.70%	0.966
Blind Spot	17	51.52%	37	60.66%	0.097*
SUBSET TOTALS	33	100.00%	61	100.00%	1.000
GLOBAL TOTALS					

* Significant at the 0.10 alpha level

Display 6.4.1c indicates that the decrease in observed unsafe blind spot events is indeed statistically significant.

6.4.2 Accounting for Traffic Conditions

It is reasonable to expect that the number of occurrences of unsafe events would be a function of traffic levels. As indicated in Section 3.1.4.2.2, observational data was taken during morning, midday and evening peaks over the course of each of the study periods. Display 6.4.2 shows the number of total unsafe events observed during each study period, the peak hour (two-way) traffic volumes and percent trucks counted during the observation period. Using the methodology[1] set out in the 2010 *Highway Capacity Manual* (TRB, 2010), the peak hour traffic was converted to a passenger car equivalency (PCE). The number of unsafe events observed was then divided by the peak hour PCE to allow comparison among periods.

[1] Level terrain was assumed resulting in a truck equivalency factor (E_t) of 1.5 trucks per passenger car.

Display 6.4.2 Relationship Between Observed Total Unsafe Events and Traffic

STUDY PERIOD	TIME-OF-DAY	# OF UNSAFE EVENTS	HOURLY TRAFFIC VOLUME	% TRUCKS	UNSAFE EVENTS/PCE
Before	Morning	18	3386	18	0.0049
	Midday	26	3348	14	0.0073
	Evening	17	4172	16	0.0038
PI&E	Morning	17	3162	21	0.0049
	Midday	14	3135	24	0.0040
	Evening	24	5342	11	0.0043
PI&E+E	Morning	29	4970	10	0.0056
	Midday	20	3302	19	0.0055
	Evening	25	4298	15	0.0054
After	Morning	11	4856	12	0.0021
	Midday	9	2888	19	0.0027
	Evening	13	3264	14	0.0032

Display 6.4.2 confirms trends observed in Displays 6.4, 6.4.1 – 6.4.1b. Namely, there appears to be an overall reduction between the *Before* and *PI&E* periods, a slight increase during the *PI&E+E* period and then a larger decrease during the *After* period. It is worth noting that during the *PI&E+E* period, there was a work zone roughly two miles upstream of the observation area. Traffic was reduced from three lanes to one lane. It is likely the case that vehicles discharging from the work zone were driving in closer proximity than they were during the periods where no work zone was present. This may account for the higher number of observed unsafe events during the *PI&E+E* period when compared to the other study periods. A similar analysis was conducted on the blind spot events. The results are summarized in Display 6.4.2a.

Display 6.4.2a Relationship Between Observed Unsafe Blind Spot Events and Traffic

STUDY PERIOD	TIME-OF-DAY	# OF UNSAFE BLIND SPOT EVENTS	UNSAFE BLIND SPOT EVENTS/ PCE
Before	Morning	12	0.0035
	Midday	15	0.0045
	Evening	10	0.0024
PI&E	Morning	13	0.0041
	Midday	7	0.0022
	Evening	18	0.0034
PI&E+E	Morning	15	0.0030
	Midday	17	0.0051
	Evening	16	0.0037
After	Morning	6	0.0012
	Midday	4	0.0013
	Evening	7	0.0019

Display 6.4.2a indicates that the observed blind spot events follow similar trends to the total observed unsafe events. These results support the more conclusive statistically significant findings presented in Display 6.4.1c. Thus, it can be reasonably concluded that the occurrence of unsafe blind spot events decreased over the course of the current TACT campaign.

6.4.3 Summary of Observational Analyses

The previous sections presented the results of the analysis of observational data from traffic cameras located in the study corridor. The analysis was conducted to determine whether any change in driving behavior could be identified in the corridor that could be attributable to the TACT campaign. The results indicated that there had indeed been a reduction in unsafe blind spot-related events. As with any comparison of this kind, it is impossible to know that the observed reduction is the direct result of the TACT campaign. Nonetheless, the results are encouraging as the PI&E campaign was specifically designed to emphasize raising the awareness of the dangers of remaining in the blind spot of a truck.

7.0 Remarks on Drawing Conclusions

There were a number of conclusions drawn in the examples above. Some were quite favorable to the TACT projects as implemented in Alabama and elsewhere. Others showed no significant differences in metrics where some crash frequency or severity reduction were expected. It is important that all results be retained and that those performing evaluations as well as the administrators who they report to be objective and properly use the results not only for future project justification, but also to improve future programs.

7.1 Accomplishing the Evaluation Objectives

The following are evaluation objectives that were accomplished during the examples illustrated in this document:

- *To generally confirm the benefits of TACT programs and to establish the best estimate of its effectiveness in terms of reduced crash frequency and severity.*
    - The large comprehensive TACT project was found to reduce an estimated rounded average reduction in crashes during its implementation of three fatality crashes, six injury crashes and a total of 20 crashes (all severities).
    - Crash reductions on the smaller projects done in the interim tended to confirm the validity of these estimates.
- *To find at least one weakness in each of the TACT components.*
    - The timing of projects and especially PI&E during tornado season.
    - Not having resources available at the time when conditions were finally favorable to the evaluation.
    - The first TACT project and the interim projects did not have any PI&E except that which was obtained by media coverage.
    - Crash effectiveness on the smallest project was difficult to determine due to the low sample sizes.
- *To overcome these weaknesses by formulating recommendations for future TACT projects.*
    - Plan and launch the projects earlier in the funding cycle so that there is ample time for performing the project and the evaluation despite unexpected delays.
- *To seek out and establish, if possible, new and creative strategic approaches toward reducing the frequency and severity of CMV involved crashes.* There were two strategies that were suggested during these projects that might have merit for future consideration:
    - The use of social media as a method for getting through to younger drivers, and
    - The use of certain video footage that was obtained during the evaluation to be worked into future PI&E efforts.

7.2 Proper Use of Qualifiers

Qualifiers in this context are facts that might tend to mitigate or further explain the results of the evaluation studies. The following possible examples are presented for the studies that were used to illustrate the evaluation procedures above.

A major qualifier of the first project is the fact that very few states implement their TACT projects on a total-force-dedicated basis, and it is questionable as to whether Alabama will do this again in the future. Both state and federal funds were used in this effort, which was conducted for many purposes, not the least of which was to measure the effectiveness of such an approach. It was also the judgment of DPS management who were in authority at that time to utilize all funds for increases in officer participation as opposed to PI&E. While some level of PI&E came from news releases and earned media, most authorities agree that some minimal level of funding would probably multiply the overall effectiveness of the selective enforcement effort.

During the Interim period, the change of crash reporting had major impacts on the types of analysis that could be considered valid. In this case, there was an entirely new crash reporting form, together with an all new electronic crash reporting system. While the new form and the electronic reporting system both represent significant improvements in crash reporting in the state, these types of changes can have a major impact on the data being collected for analysis. In this case, there was a significant rise in the reported CMV crashes, due in large part to automatic checks in the eCrash software to determine if a vehicle is to be considered Commercial. Care should be taken to insure that even smaller scale changes in reporting are not invalidating the analysis.

As a result of the complications in reporting above the only approach that could be used to evaluate the effectiveness of the interim projects from a crash point of view was the one that was used, i.e., a comparison between the TACT and non-TACT months. Since the changes in reporting wer essentially completed prior to the interim period, there was a consistent way of measuring CMV-involved crashes. This was the best that could be done, but it is highly recommended that prior year months be used for comparison if at all possible, as was done for the first TACT evaluation.

Another issue in using 2009 for a “before” period would have occurred even if there was not a change in the reporting method since 2009 was not a non-TACT year. Questions could arise as to the validity of comparing two years in which TACT projects were in effect. Of course, the non-TACT months could have been used had all other things been equal.

This poses another question concerning the two approaches. Assuming that both have validity the question could be asked as to why the two crash-data-based evaluations produced results that

were so close to each other. Is it possible that a greatly reduced set of TACT projects can produce statewide results that are as great as the comprehensive nature of the original project? The answer is in the affirmative, especially if the possibility of carry-over from the initial project is considered. There is no assertion, however, that this is the case. Nonetheless, the possibility should be noted as a possible qualifier in explaining the results. But it does seem reasonable that an initial thrust that pulls out all of the stops followed up by very carefully targeted smaller efforts could be a very effective way to implement a TACT approach over time.

As a final example qualifier, it should never be assumed that the addition of one patrol officer will always produce a linear decrease in crashes. There is a minimal level of both selective enforcement and PI&E that is necessary to produce any measurable impact at all. Above that, the addition of resources will tend to increase effectiveness, as was observed in the correlation between hours of effort and reduced crashes reported above. For example, it could be that a doubling of the effort, say from 200 to 400 hours per month will significantly increase the benefits obtained. However, economists recognize that most programs can only utilize a given increased level of resources effectively, after which added resources will begin to diminish the marginal effects. In the worst case the increase in resources can have a zero marginal effect, or it can even be counterproductive to the entire program. A proven example of this in in software development, where adding programmers to a project above a given level not only produces a zero marginal effect, but actually decreases the total overall performance of the entire team. The concept of diminishing returns also applies to law enforcement resources and is a concept that should be one that is understood by every decision-maker. This is especially true when there is a clear downside to allocating too many resources to a given purpose – that being the drawing away of resources that might better be utilized elsewhere.

8.0 Annotated Literature Review

The following documents are numbered according to their reverencing in this report.

1. *Penny, N. et al, "Ticketing Aggressive Cars and Trucks (TACT) in Washington State: High Visibility Enforcement Applied to Share the Road Safely," Report Number DOT HS 810 603, May 2006.*
   http://www.nhtsa.gov/people/injury/aggressive/tact/pages/techsummary.htm
   Very comprehensive study involving several evaluation metrics, including observed violations and observed violation rates per observation hour.
2. "TACT Quarterly eUpdates," published quarterly
   http://www.fmcsa.dot.gov/documents/safety-security/TACT-Newsletter-Sept09-508.pdf
   Contains list of countermeasures tried in other states and some effectiveness metrics.
3. FMCSA, TACT "Ticketing Aggressive Cars and Trucks,"
   http://www.fmcsa.dot.gov/safety-security/tact/index.htm
   This web site provides information and resources regarding:
   - TACT background, purpose, and mission
   - Action Planning tips for starting a TACT program
   - Participating TACT States
   - Industry affiliates and Federal and State safety partners
   - Guidelines for conducting a TACT high-visibility traffic enforcement program
   - Funding and grant opportunities for TACT
   - Relevant research about passenger and commercial motor vehicle safety
   - Useful Tips for motorists and professional truck drivers
4. FMCSA, "Share the Road Safely Program,"
   http://www.sharetheroadsafely.org/tact/tact.asp
   This web site is devoted to educating drivers on sharing the road.
5. NHTSA, "Ticketing Aggressive Cars and Trucks in Washington State,"
   http://www.nhtsa.dot.gov/people/injury/aggressive/tact/pages/Intro-TACT-Model.htm
   One of the first web sites and thus somewhat dated (2005).
6. Institute for Transportation Research and Education at NC State University, "TACT web reference page," http://itre.ncsu.edu/VAMS/cmv/tact.html
   Contains a reference list to several articles on TACT alternative approaches:
   - Automated capture of vehicle speeds and following distances
   - Focusing on avoiding real risk rather than a ticket (examples given)
   - Technological approaches – variable signs.
7. Hughes, R. G., "Recommendations to Enhance the Effectiveness of the FMCSA Program, TACT,"
   http://itre.ncsu.edu/VAMS/cmv/documents/ITRE_Imp_TACT_Prog.pdf
   One of the articles from the ITRE recommendations.

8. US Government Account Office, "Truck Safety: Share the Road …," http://www.gao.gov/products/GAO-06-916 and http://www.gao.gov/new.items/d06916.pdf
Dated evaluation (2006). Recommendations: find the most cost-effective methods.
9. Kentucky State Police, "KSP Kicks Off TACT Enforcement Program," http://www.kentuckystatepolice.org/hsp/news_release/2008/10_07_08.htm
Similar to other kick-off web pages.
10. Green, Eric R., "Evaluation Plan for the TACT Program in Kentucky," http://www.ktc.uky.edu/Reports/KTC_10_02_KSP1_10_1F.pdf
Very good summaries of the evaluations performed.
11. Green, E. R., "Evaluation Plan for the TACT Program in Kentucky," TRB, TRIS, (Abstract only: http://tris.trb.org/view.aspx?id=917360), Kentucky
Kentucky Transportation Center Research Report KTC-10-02/KSP1-10-1F, February 2010.
12. Nevada Department of Public Safety, "Badge on Board," http://www.badgeonboard.nv.gov/
Some good background information.
13. Alabama Media Portal 2.0, FMCSA Safety Grant Funds Trooper Efforts, http://media.alabama.gov/pr/pr.aspx?id=2127
News release from Alabama September 9, 2009.
14. Federal Register, Vol. 71, No. 57, Friday, March 24, 2006, Notices, http://www.cvsa.org/documents/news/fmcsa_grant_notice.pdf
Enabling legislation for the TACT programs.
15. F. Dennis Thomas, et al, Evaluation of a high visibility enforcement project focused on passenger vehicles interacting with commercial vehicles. Journal of Safety Research 39 (2008) 459-468.
http://www.inspectieloket.nl/Images/20%20Evaluation%20of%20a%20high%20visibility%20enforcement%20project%20focused%20on%20passenger%20vehicles_tcm296-282204.pdf
Summary of very rigorous evaluations of TACT in Washington State. "Media activities included television, radio, and newspaper advertisements as well as posters, banners, flyers, road signs, and large trucks wrapped in TACT banners that traveled up and down the intervention corridors." Other key observations and findings:
    - "The Click it or Ticket model is a well known selective traffic enforcement model and is associated with an impressive increase in safety belt use across the nation."
    - "A selective traffic enforcement model typically relies heavily on enforcement of a state's traffic safety laws and is supported by intensive paid publicity that focuses on enforcement."
16. TACT State Details web site (FMCSA),

http://www.fmcsa.dot.gov/safety-security/tact/stateOverView.htm
Pages for participating states: GA, KY, NC, PN, WA, AL, TX, NV, OR, IA, MT, NJ.
17. Checklist of Requirements for a TACT Program (FMCSA)
http://www.fmcsa.dot.gov/safety-security/tact/check-list.htm
18. NHTSA, "TACT in Washington Sate – Evaluations,"
http://www.nhtsa.gov/people/injury/aggressive/tact/pages/Eval-Spec-Exp.htm
Specific Evaluation Methods and Results – summary.
http://www.nhtsa.gov/people/injury/aggressive/tact/pages/contents.htm
Table of contents for the entire report.
19. NHTSA, "ACT in Washington State – complete report."
http://www.nhtsa.gov/DOT/NHTSA/Traffic%20Injury%20Control/Articles/Associated%20Files/810603.pdf
Complete study, contains data collection forms and statistical explanations as well as results. Saved.
20. FMCSA TACT web sites.
http://www.nozone.org/tact/tact.asp (the NoZone program)
http://www.fmcsa.dot.gov/safety-security/tact/index.htm (general TACT)
21. Summary of TACT program in Alabama.
http://caps.ua.edu/outreach_tact.aspx
References to problem identification and route selection techniques.
22. NTIS Web Page:
http://www.ntis.gov/search/product.aspx?ABBR=PB2010102650
Reference to the Pennsylvania evaluation report of their TACT program (fee charged).
23. Ralph Craft, "The Large Truck Crash Causation Study,"
http://www.fmcsa.dot.gov/facts-research/research-technology/analysis/fmcsa-rra-07-017.htm
24. Steil, Dana et al; TACT Ticketing Aggressive Cars and Trucks Evaluation Report; Center for Advanced Public Safety, March 1, 2010.
http://www.safehomealabama.gov/articles/TACT_2009_Evaluation_Report-17-Final.pdf
25. Cunningham, C. M., et al, "Is TACT Effective in Changing Driver Behavior: Evidence from North Carolina TACT III Effort," Submitted for consideration for publication and presentation at the 90th Annual Meeting of the 41 Transportation Research Board, January 23-27, 2010. This study is discussed in Section 3.1.4.1.
26. Parrish, A. S., et al, "CARE: An Automobile Crash Data Analysis Tool," IEEE Computer, 0018-9162/03, June, 2003.
27. Brown, D. B., et al, CARE Web Page, Safe Home Alabama,
http://www.safehomealabama.gov/category.aspx?cat=54
28. USDOT Federal Motor Carrier Safety Administration www.fmcsa.dot.gov/safety-security/tact/tactactionplanning.htm. From this report: "As part of the TACT program design, a State should gather relevant crash and fatality data to identify high-risk areas. … The evaluation plan should detail how the TACT research plan will be determined-data collection methods, segments and measurement criteria."

29. NHTSA, Guidelines for Developing a Municipal Speed Enforcement Program, http://www.nhtsa.gov/people/injury/enforce/program.htm. The following summarizes this report:
    - "Select a traffic safety issue to serve as the program's focus.
    - Select zones within the community on the basis of speed-related crashes and citizen complaints of speeding.
    - Devote considerable, high visibility enforcement effort to the special zones for at least six months.
    - Collect relevant data to be able to evaluate program effects.
    - All special traffic safety enforcement efforts should be accompanied by vigorous publicity programs to achieve the maximum general deterrence effects. In fact, it might be the publicity as much as the enforcement that causes any objective improvements in measures of traffic safety. A committee of concerned local citizens can be organized to direct this effort, and to provide other assistance with the program.
    - The most effective programs are characterized by close cooperation between police and committee personnel. The process should be one in which police help with the publicity program and committee members assist police in their special enforcement efforts.
    - Newspapers are the greatest source of public awareness of special enforcement programs, but the program activities must be newsworthy to receive news coverage. Any effort to enhance the "newsworthiness" of a program or activity will contribute to free publicity, and ultimately, to public awareness."
30. US DOT Federal Motor Carrier Safety Administration, Report to Congress on the Large Truck Crash Causation Study, March 2006. The following were reported regarding crash events and associated factors:
    - "Most common factors for both truck and passenger drivers in crash events were driving too fast for conditions, making an illegal maneuver, legal drug use, unfamiliarity with the roadway, and fatigue.
    - Fatigue was recorded for the passenger vehicle driver twice as often as for the truck driver
    - There was very little illegal drug use or alcohol use assigned to truck driver, but more of both recorded for passenger vehicle drivers.
    - Additional analysis of specific crash risk factors that can be subjected to countermeasures by the government and the public."
31. The Unsafe Driving Acts of Motorists in the Vicinity of Large Trucks, Stuster, Jack; Anacapa Sciences, Inc. February 1999; http://www.fmcsa.dot.gov/documents/udarepo.pdf. The unsafe acts listed in this study were summarized as follows:
    - Driving inattentively (e.g., reading, talking on the phone, fatigue),
    - Changing lanes in front of a truck, then braking (for traffic, toll gate, exit, etc.),

- Changing lanes abruptly in front of a truck,
- Driving in the "no zones,"
- Unsafe passing, primarily passing with insufficient headway,
- Unsafe turning, primarily turning with insufficient headway,
- Unsafe Crossing (i.e., pulling out in front of an approaching truck),
- Merging improperly into traffic or failing to permit a truck to merge,
- Pulling into traffic in front of a truck without accelerating sufficiently,
- Maneuvering to the right of a turning truck,
- Crossing a lane line near the side of a truck (while passing or changing lanes),
- Driving between large trucks,
- Failure to discern that the trailer of a turning truck is blocking the roadway, and
- Nearly striking the rear of a slowly moving, stopped, or parked truck.

32. Aggressive Driving; http://www.nhtsa.gov/Aggressive; contains a number of definitions related to aggressive driving and links to other resources, e.g., *Stop Aggressive Driving Tookit.*
33. A Guide for Planning and Managiing the Evaluation of a TACT Program, USDOT, FMCSA; http://www.fmcsa.dot.gov/documents/safety-security/guide-evaluation-tact.pdf (no date); the following summarizes the contents of this document:
    - Introduction
        - Definition of the TACT model: "By combining high-visibility enforcement with extensive paid and earned media ***about the enforcement***, a significant increase in a driver's perceived risk of a ticket for a specific violation can be generated. This, in turn, creates the desired general deterrence of unsafe behaviors and improves safety."
        - The Washington State TACT project was described very briefly.
        - The need for ongoing evaluation.
    - Appropriate Evaluation
        - For improvement as opposed to proving a point.
        - Creating a closed-loop system.
        - Integration throughout the project.
        - Value of problem identification.
        - Need for detailed planning and quantitative objectives.
    - Finding an Evaluator
    - TACT Evaluation Components and Techniques
        - Measures of effectiveness and data to obtain these measures.
        - Experimental design for effectiveness measures.
        - Necessity for administration evaluation – documenting what was done.
        - Surveys.
        - Behavioral observational measurements.
        - Crash reduction measurements.

- Key Points (paraphrased from the report:)
    - Evaluation should be an integral part of a TACT project since it can contribute to an improved project from the proposal to the final report.
    - TACT evaluation requires the involvement of a trained and experienced evaluator or evaluation team.
    - Each evaluation must be tailored to the objectives, scope, approach, and resources of the particular project.
    - The Washington State TACT project evaluation is a good ***example***, but it is not a fixed ***model*** that must be repeated by all other TACT projects.
    - The evaluator must be viewed and performs as an integral member of the TACT project team.
    - TACT projects and their evaluations should be fully consistent with the STEP approach.
    - The general deterrence model provides good guidance for selecting appropriate TACT evaluation measures of effectiveness and data collection techniques.
- Evaluation Measurement Techniques (Appendix A) – this is an excellent listing of the process and performance metrics that should be considered.
- Washington State TACT Survey (Appendix B)

34. Frequently Asked Questions: TACT; http://www.fmcsa.dot.gov/safety-security/tact/faqs.aspx – contains extensive basic information on TACT, as well as links to other FMCSA TACT topics.
35. TACT e-Toolkit; http://www.fmcsa.dot.gov/safety-security/tact/e-toolkit.htm – this is an operational TACT advisory page as opposed to one that centers on evaluation; it provides a number of tools to get a TACT program started.
36. Alternative Approach to TACT Evaluation (and "Treatment"): Some Additional NCSU/ITRE Thoughts and Suggestions; http://itre.ncsu.edu/vams/cmv/documents/Alt_TACT_Eval.pdf -- documentation summary of findings from (6 and 7).
37. Evaluation of the Ticketing Aggressive Cars and Trucks (TACT) Program in Pennsylvania (071408); August 14, 2009; ftp://ftp.dot.state.pa.us/public/pdf/BPR_PDF_FILES/Documents/Research/Complete%20Projects/Smart%20Transportation%20Solutions/TACT%20Project%20Report%20Final.pdf
    This is an excellent and comprehensive review of the Pennsylvania TACT that took place in the southern part of that state in late 2008. It was based on surveys and did not involve crash or citation records.