TENNESSEE

Strategic Highway SAFETY PLAN

2014

Driving Down Fatalities

TENNESSEE
2014
STRATEGIC HIGHWAY SAFETY PLAN

The Tennessee Strategic Highway Safety Plan has been developed under the oversight of the Tennessee Strategic Highway Safety Steering Committee to reduce the number of lives lost, human suffering, and the economic costs associated with motor vehicle crashes in Tennessee. By signing this document, the signatories agree to support the vision, mission, and goals of the 2014 Tennessee Strategic Highway Safety Plan.

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TENNESSEE
2014
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EXECUTIVE SUMMARY

In 2014, the State of Tennessee updated its Strategic Highway Safety Plan (SHSP, or "the Plan") to build on the foundation created by the original SHSP that was developed in 2004 and last updated in 2009. The Plan follows guidance provided by the Federal Highway Administration (FHWA) in March of 2013 for meeting requirements of the Moving Ahead for Progress in the 21st Century Act (MAP-21) to obligate funds under the Highway Safety Improvement Program (HSIP).

The Plan adopts a "Toward Zero Deaths" vision statement, which is the vision of a national and collaborative effort entitled *Toward Zero Deaths: National Strategy on Highway Safety*. The strategy intends to create a culture of safety by bringing stakeholders together to assess the current safety environment and to develop safety strategies from a data-driven process that is refined, implemented, and evaluated to continually plan for a safer future on our roadways. Historically, Tennessee has progressively improved safety on the state's roadways. The mission of this plan is to ensure that improvements in safety continue to result in a reduction of serious injury and fatal crashes. To achieve that result, the Plan focuses its strategies on achievable, time-bound, and measurable goals to reduce the occurrence of serious injuries and fatalities.

The 2014 SHSP is Tennessee's comprehensive transportation safety plan. It is based on safety data and was developed through consultation with a broad range of highway safety stakeholders – each with specific areas of expertise and experience. This group is identified as the Steering Committee and is responsible for the Plan's content and document preparation. This multi-disciplinary approach resulted in the identification of key emphasis areas, which will be the focus for improving safety on Tennessee's roadways under this plan. The Plan documents this approach, includes the roles and responsibilities of those implementing the Plan, and defines how success will be measured for each emphasis area and the Plan as a whole. The following six emphasis areas were identified by the Steering Committee to have the greatest potential for progress toward the Plan's vision, mission, and goals:

2014 SHSP Emphasis Areas

- Data Collection and Analysis
- Driver Behavior
- Infrastructure Improvements
- Vulnerable Road Users
- Operational Improvements
- Motor Carrier Safety

Individual goals, objectives, and countermeasures have been identified for each of the six emphasis areas. Because vehicular crashes involve multiple contributing factors (human, infrastructure, environment, and vehicle), the Plan addresses emphasis areas with strategies and countermeasures that utilize the Four E's of transportation safety: Engineering, Enforcement, Education, and Emergency Response. This fundamental approach is the basis of the Plan's mission statement. The Plan references these four safety disciplines throughout this document with the graphic notations shown in Figure 1.

Figure 1 - The Four "E"'s of Transportation Safety

The Four E's				
Engineering			Enforcement	
Education			Emergency Response	

The tracking of serious injuries is now required as a performance measure for the Plan in accordance with MAP-21 in addition to the tracking of fatalities. Previous plans only considered fatalities. The goal for the Plan is to reduce the number and rate of fatalities by 10% within the next five-years while reducing the trend of increasing serious injuries by remaining under the 2012 serious injury total of 7,574. These goals were developed through collaboration between safety partners and coordinated between other safety plans adopted by the state. The Plan's success will be measured by a statistical comparison of actual data to the Plan's goal statement. This goal is deemed to be appropriate and worthy of our effort to make the roads of Tennessee as safe as they can be. "Driving Down Fatalities" is the slogan for the 2014 Plan because it conveys our commitment to achieving this goal and is consistent with the "Toward Zero Deaths" vision.

STEERING COMMITTEE AND SAFETY PARTNERS

For the State of Tennessee, the Strategic Highway Safety Steering Committee has taken on the responsibility of developing and implementing this safety plan to meet MAP-21 requirements and to reduce fatalities and serious injuries in Tennessee. The team comprises the state agencies responsible for transportation and safety as well as other safety partners. Partners have been selected so that each of the four safety disciplines is represented in the development and implementation of the SHSP. The input and commitment of each safety partner are greatly appreciated.

Steering Committee

Tennessee Department of Transportation (TDOT)

Federal Highway Administration (FHWA)

Tennessee Department of Safety and Homeland Security (TDOSHS)

Tennessee Highway Patrol (THP)

Governor's Highway Safety Office (GHSO)

Federal Motor Carrier Safety Administration (FMCSA)

Metropolitan Planning Organizations (MPO) and Rural Planning Organizations (RPO)

Tennessee Regional Safety Council (TRSC)

Tennessee Transportation Assistance Program (TTAP)

American Automobile Association (AAA)

Additional Safety Partners

Mothers Against Drunk Driving (MADD)

Tennessee Sheriffs' Association (TSA)

Tennessee Association of Chiefs of Police (TACP)

Motorcycle Awareness Foundation of Tennessee (MAFT)

Tennessee Department of Health (TDOH)

National Highway Traffic Safety Administration (NHTSA)

Tennessee Trucking Association (TTA)

AARP

Insurors of Tennessee

Tennessee Education Association (TEA)

Tennessee District Attorney General's Office

Safe Routes to School National Partnership - Tennessee Network

VISION, MISSION AND GOALS

VISION:

Federal, state, and local agencies, civic groups, and private industries unified as safety partners and all working together toward zero fatalities and serious injuries on Tennessee roadways.

MISSION:

Using education, enforcement, engineering, and emergency response initiatives, work toward zero deaths and serious injuries by reducing the number and severity of crashes on Tennessee's roadways.

GOALS:

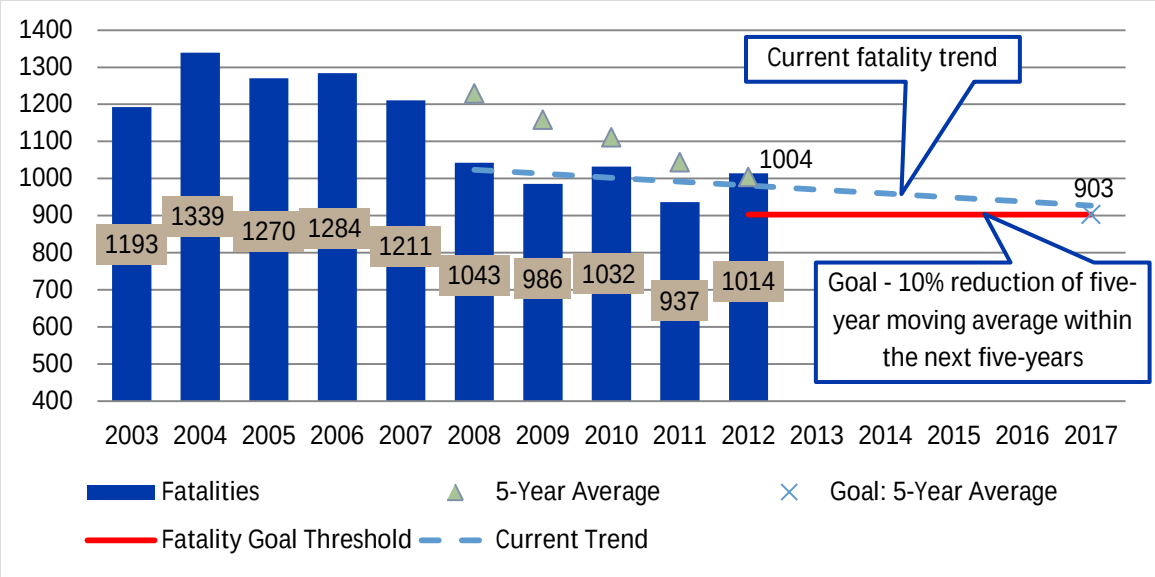
- Fatalities: Reduce the number of fatalities by 10% within the next five years.
- Fatality Rate: Reduce the rate of fatalities by 10% within the next five years.
- Serious Injuries: Reduce the current trend of increasing serious injuries by not exceeding the 2012 total value of 7,574 as an average over the next five years.
- Serious Injury Rate: Reduce the current trend of an increasing serious injury rate by not exceeding the 2012 total value of 10.65 serious injuries per hundred million vehicle miles traveled as an average over the next five years.

The time period for evaluation of the Plan's performance will be five years (maximum), which is the planned interval for updating the Plan. Recognizing that statistics will vary due to climate, economy, and isolated catastrophic events, the Plan's performance will be evaluated based on a five-year average of available data. The goal statements are based on the mission of continually working toward zero deaths, which will require Tennessee to maintain the trend of declining fatalities while reversing the trend of increasing serious injuries.

INTRODUCTION AND BACKGROUND

From 2008 to 2012, Tennessee experienced an annual average of more than 163,910 reported traffic crashes, which represents a slight reduction from the previous five-year average of 164,979. In 2008, 6,233 serious injuries and 1,043 fatalities occurred on Tennessee's roads. Based on preliminary data, there were 7,574 serious injuries and 1,014 fatalities in Tennessee in 2012. This data is illustrated in Figure 2 and Figure 3. As shown by Figure 2, historical and recent trends for fatalities are declining in Tennessee. Despite the overall declining trend, there have been recent years with an increase in traffic fatalities compared to the previous year. However, the trend for serious injuries is increasing. This is shown on Figure 3 on page 6.

Figure 2 - Fatalities on Tennessee Roadways



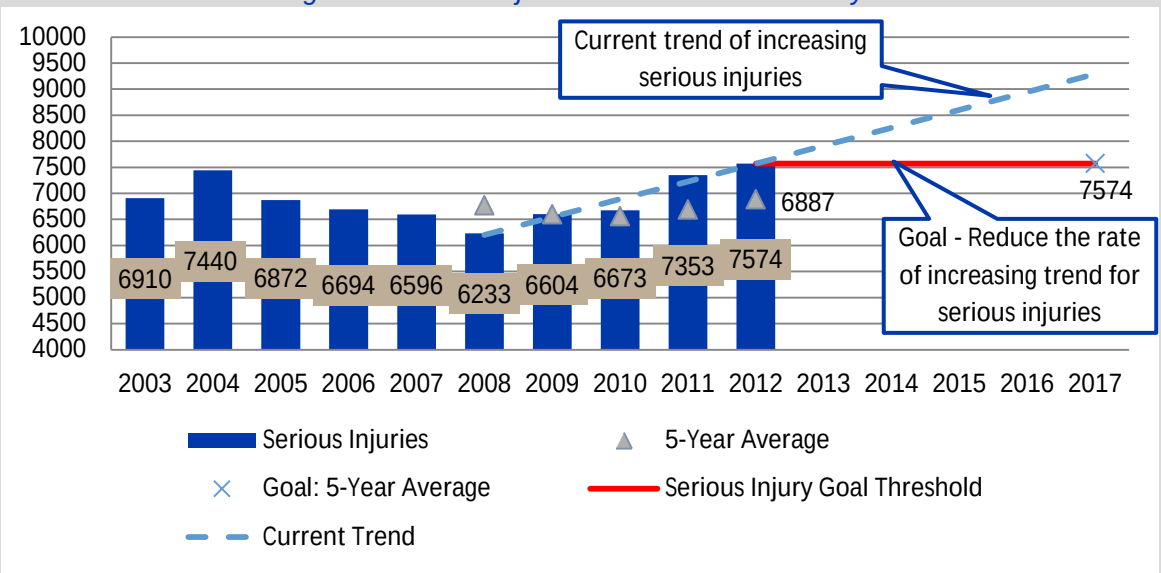
Source: TDOSHS[1]

Figures 2 and 3 depict the fatality and serious injury data over the past ten years. While the statistics vary from year to year, there are general trends associated with each data set. However, significant variations in the values in the data from year to year have been observed. To offset the impact of a single data point on the overall trend, calculation and evaluation of the five-year moving average of each data set was performed. This reduces the effects of large variations in the data from year to year and has been chosen as the basis for setting goals and evaluating the performance of the plan.

The five-year moving average ordinate for each year is the average of that year and the previous four years for a five-year average value. They are shown on the figures as triangles. For comparison, the current trend of each data set based on the past five years is shown as a dashed line on the figures. The solid red line and numeric value for each figure illustrates the targeted value for the goal.

For fatalities, that goal is to reduce the total number of fatalities by 10% over the next five years. That value, when computed from the 2012 five-year average value of 1,004 is 903. It should be noted that the goal statement does not target this value specifically for 2017, but rather targets achieving this value at some point within the next five years. For this reason, it is considered a goal threshold.

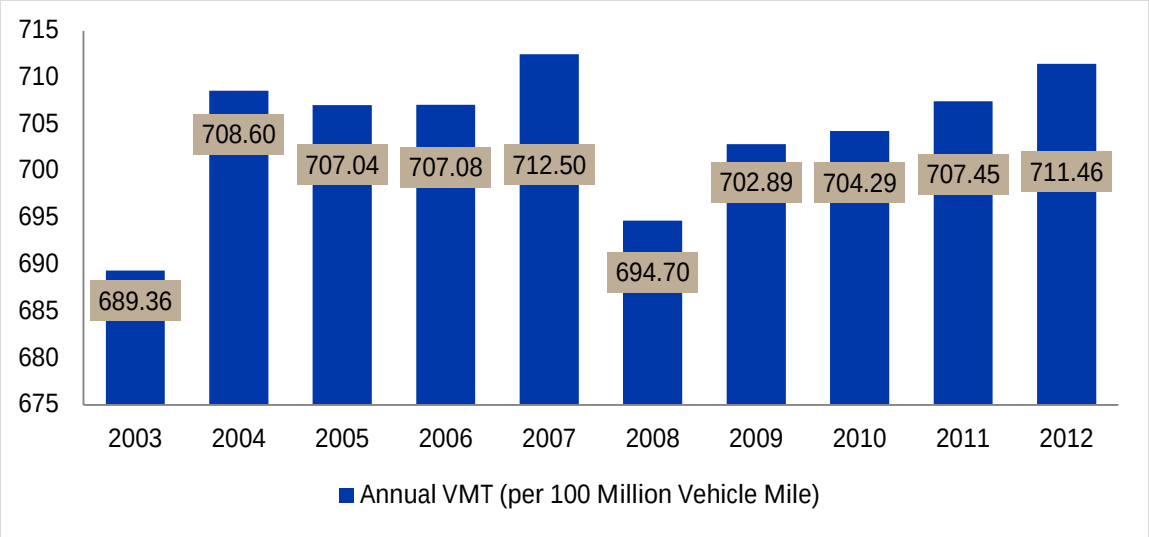
Figure 3 - Serious Injuries on Tennessee Roadways



Source: TDOSHS[2]

It is recognized that a reduction in fatalities can result in an increase in serious injuries with all other factors being equal. This factor contributes to the current upward trend of serious injuries and their associated five-year moving averages. The Plan's goal for serious injuries is simply to reduce the rate of the current trend of increasing serious injury statistics by limiting the average of serious injuries over the next five years to the current 2012 actual value of 7,574. This may seem like a targeted increase when compared to the 2012 five-year average value of 6,887. However, due to the recent increases in serious injuries from 2010 through 2012, the five-year moving average values will continue to trend upward until there has been enough reduction in the annual number of serious injuries over time to offset those values in the computation of the average. The maximum allowable values for serious injury statistics that can eliminate the positive trend for the five-year moving average within five years is a zero increase each year of the actual values.

Figure 4 - Vehicle Miles Traveled (VMT) on Tennessee Roadways



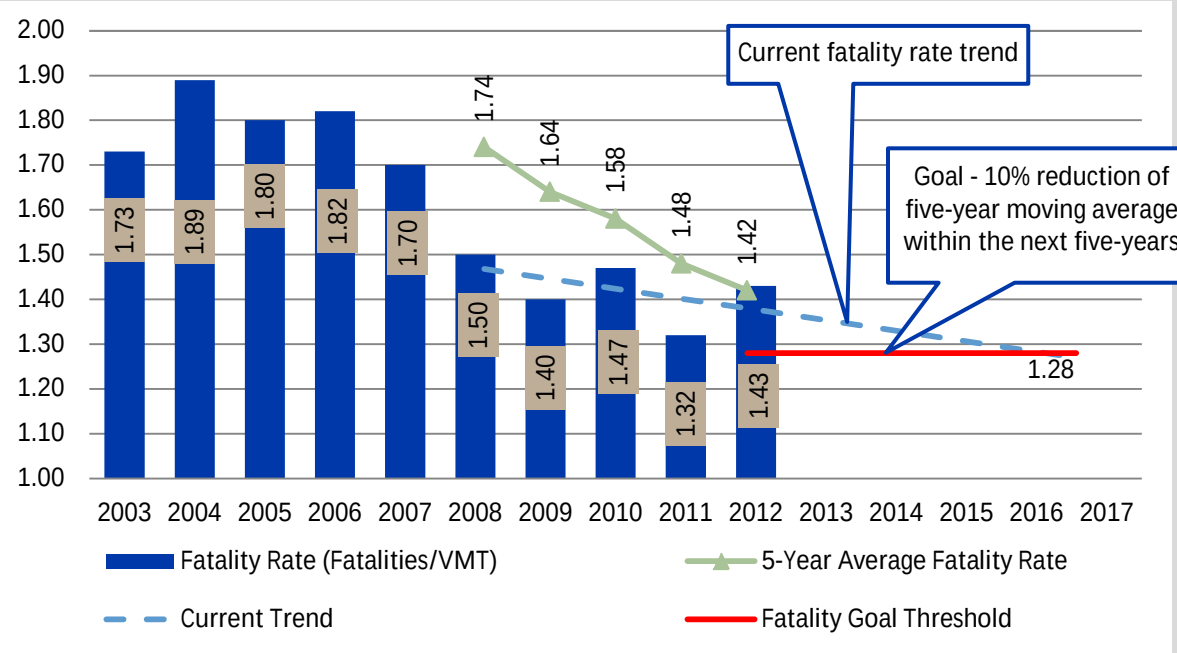
Source: TDOT/TDOSHS[3]

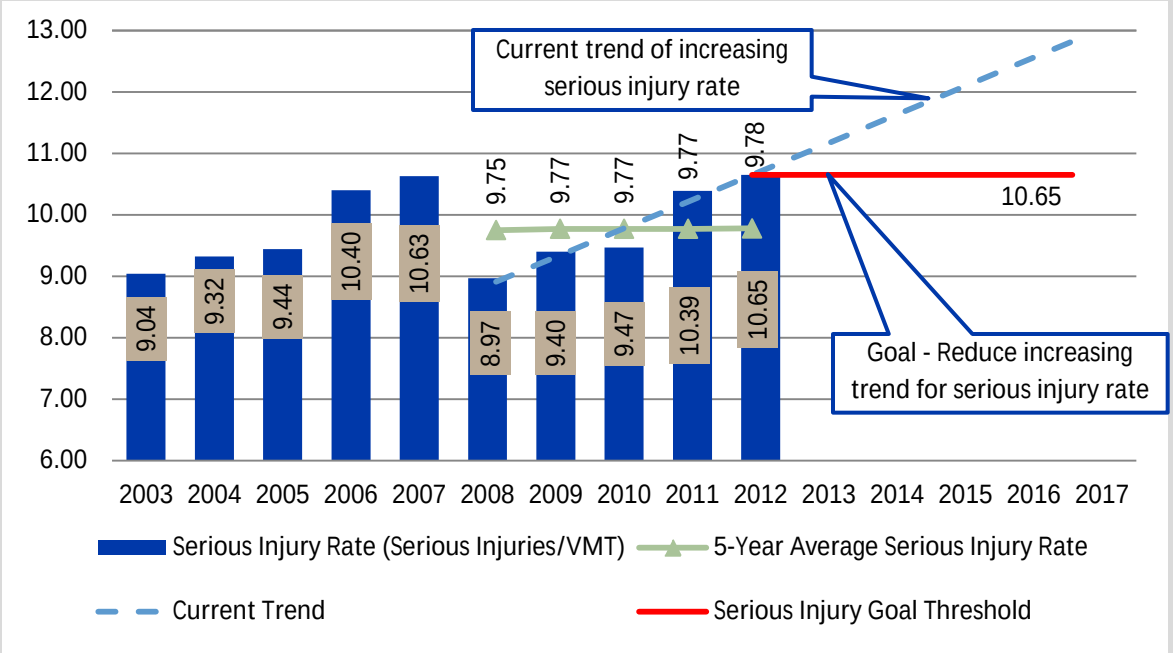
Tennessee experienced a 12% growth in population from 2000 to 2010. This is evident in the total volume of vehicle miles traveled (VMT) over the past ten years. The historic and recent trend in VMT is shown in Figure 4. The number of vehicles and the miles they are traveling are trending upward, even with the drop in VMT experienced in recent years (2008-2009) attributed largely to sluggish economic conditions.

To account for increases or decreases in the amount of travel on our roadways, fatalities and serious injuries are considered in relation to the VMT. Figure 5 shows the fatality rate (fatalities per 100 million vehicle miles traveled) for the past ten years, current five-year trend, and the most recent five-year moving average fatality rate values. The trends associated with the fatality rates exhibit similar characteristics shown by the data for fatalities. In 2012, Tennessee's fatality rate was 1.43 fatalities per 100 million miles driven, which is a 5% decrease from the 2008 fatality rate. The 2014 Plan sets a goal for the fatality rate equal to the goal for fatalities, which is a 10% reduction in the fatality rate within the next five years.

For comparison, the serious injury rates for the same time period are also depicted in Figure 5. As expected from the analysis of serious injury statistics, they are currently trending sharply upward after a brief period of decline during the economic recession. Generally, with more users driving more miles, there are more instances for serious crashes. When coupled with gains in safety and emergency response that are working to save lives, it is logical to predict an occurrence of more serious injuries. However, the increasing rate of serious injuries per vehicle miles traveled is an indication of safety issues that need to be addressed to prevent our roadways from becoming less safe over time. For this reason, serious injuries are now a performance measure equal to fatalities in the Plan.

Figure 5 - Fatality and Serious Injury Rates





Source: TDOT/TDOSHS[4]

As stated, serious injuries are now included with fatalities for reductions as a goal for the Plan. Many of these injuries represent extended rehabilitation care costs and loss of productivity. For an individual, these injuries vastly diminish quality of life. There are also substantial impacts within our communities relative to medical costs, lost wages, insurance costs, taxes, police, fire and emergency services, legal and court costs, as well as property damage. Economic losses due to traffic crashes are

estimated by FHWA to total $230 billion nationally.[5] In Tennessee for the year 2012, there were over 170,000 reported traffic crashes resulting in over 90,000 emergency room visits. The total economic cost to Tennessee due to traffic crashes in 2012 was estimated at $4.1 billion with $850 million in medical costs alone.[6] The benefits associated with improving safety along our roadways far exceed the costs associated with implementing this plan. Tennessee simply cannot afford inaction.

Past Performance

The previous SHSP was approved in 2009 and had an overall goal of reducing the total number of fatalities by 144 or more to have fewer than 900 fatalities by 2012. This specific goal was not met. However, there were significant performance gains in each emphasis area from the previous SHSP when comparing the five-year average of fatalities resulting from crashes relating to the Plan's emphasis areas. The five-year average was selected as the method of analysis to reduce the effects of random influences, such as inclement weather or catastrophic single events. Figure 6 tabulates the statistical gains in safety over the previous plan period.

There have also been many accomplishments in establishing the Plan's foundation of a collaborative effort with specific strategies directed at improving safety. Significant advances have been made in availability and consistency of traffic crash data through development of the Enhanced Tennessee Roadway Information Management System (ETRIMS) and the Tennessee Integrated Traffic Analysis Network (TITAN). The previous plan established an organizational structure of safety stakeholders and a system for defining safety needs and strategies for meeting those needs. Evaluation of the previous plan and current data can reveal areas of improvement and concern that provide focus for the updated plan. Some of the specific performance measures to note from comparing traffic crash records during the previous plan period are depicted in Figure 6.

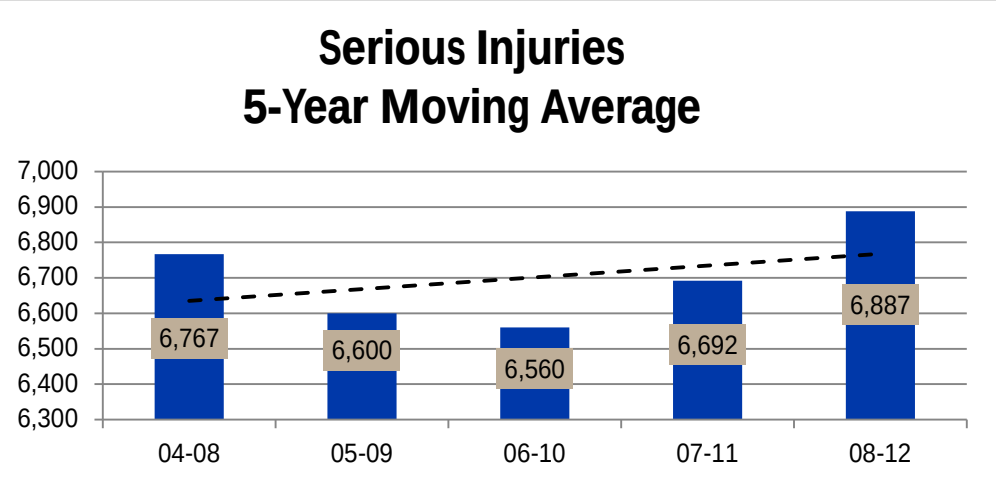
Figure 6 - Five-Year Fatality Average Comparison

Emphasis Area	5-Year Average of Plan Data		
	2009 SHSP Data (2004-2008)	2014 SHSP Data (2008-2012)	% Difference
Fatalities	1,229	1,004	-18%
Fatalities Involving Roadway Departure	803	634	-21%
Fatalities Involving Intersections	201	165	-18%
Fatalities in Work Zones	20	12	-39%
Fatalities Involving Large Trucks	142	96	-32%
Fatalities Involving Alcohol Impaired Drivers	403	291	-28%
Fatalities Involving Speeding	278	209	-25%
Fatalities Involving Unrestrained Occupants	571	416	-27%
Fatal Crashes	1,117	927	-17%

Source: 2009 SHSP and TDOSHS[7]

While it is clear that there have been significant gains in the reduction of fatality statistics during the previous plan period, there are still areas for concern. These are primarily associated with the consideration of serious injuries. The previous plan focused on fatalities, which are trending downward nationally as well as in Tennessee. However, serious injuries are trending upward. This is evident in the review of Figure 7, which depicts the moving five-year average from 2008 to 2012 for serious injuries: a new focus for the SHSP.

Figure 7 - Serious Injury Five-Year Moving Average



Source: TDOSHS[8]

Decreases in fatalities can be attributed in many cases to improvements in safety equipment of vehicles and improved response times for crashes. These and other factors tend to result in a statistical shift from fatalities to serious injuries. For this reason, some increases in serious injuries can be expected as a result of a reduction in the total number of fatalities. In recognition of this reality, the SHSP will now target the reduction of serious injuries in addition to fatalities.

Toward Zero Deaths

With over 33,000 fatalities occurring on the nation's highways each year, roadway safety remains one of the most challenging issues facing America. Although many highway safety organizations have stepped forward to address these needs, there has been no singular strategy that unites these common efforts until the "Toward Zero Deaths" initiative was created. Its name and mission are based on the premise that even one death is unacceptable, and therefore, we must aspire to move toward zero deaths on our roadways.

The "Toward Zero Deaths" strategy is a data-driven effort focusing on identifying and creating opportunities for changing our culture and building a foundation of safety on our roadways. It involves multiple disciplines in its approach to improving safety but realizes that significant reductions in roadway fatalities cannot take place without a change in our values and behavior as a culture. Tennessee is proud to become one of over 30 states to adopt this strategy for the basis of their SHSP.

UPDATE PROCESS

Created in November of 2004, the Tennessee Strategic Highway Safety Plan (SHSP) defines a system, organization, and process for managing the attributes of the road, the users, and the modes to achieve the highest level of highway safety by integrating the work of disciplines and agencies involved. These disciplines include the planning, design, construction, operation, and maintenance of the roadway infrastructure (engineering); injury prevention and control (law enforcement, emergency response, and health education); those involved in modifying road user behaviors (education and enforcement); and the design and maintenance of vehicles.

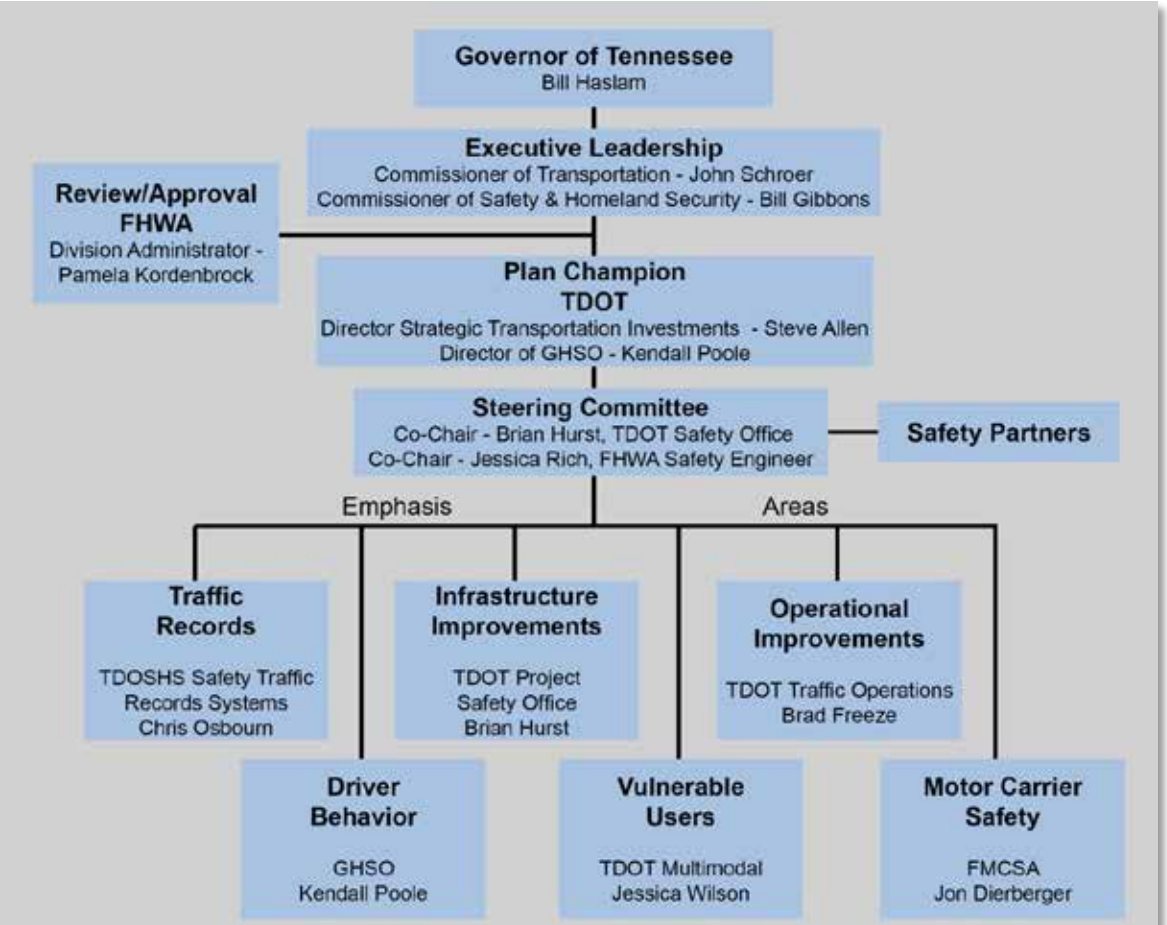
Legislation passed in 2012 (MAP-21) requires states to regularly update their plans to utilize Highway Safety Improvement Program (HSIP) funds. Current guidance is provided by *A Champion's Guidebook to Saving Lives, Second Edition*, which is published by the Federal Highway Administration (FHWA-SA-12-034). This update to the Tennessee SHSP was based on the principals established in 2004 and the guidelines of current legislation.

Organizational Structure

TDOT took the lead in the development of this plan update. The Strategic Transportation Investments Division of TDOT and the Governor's Highway Safety Office partnered to champion the necessary effort and to manage the Plan's development with input from many safety stakeholders. FHWA provided valuable assistance and guidance to produce a plan document in accordance with the guidelines. Figure 8 depicts the organizational structure for plan development and implementation. Support and guidance is provided by the Plan's Executive Leadership, which comprises the Commissioner of Transportation and the Commissioner of Safety and Homeland Security.

An important component to the organizational structure is the Steering Committee. Steering Committee members are listed on page 3 of the Plan. The Steering Committee provided review and comment to the previous plan and determined the content of the updated plan through collaboration. The Steering Committee comprises members that specialize in each of the four safety disciplines: education, engineering, enforcement, and emergency response. The committee corresponded throughout the update process and met to collaborate on key issues and plan content.

Figure 8 - Organizational Structure



See page 3 for abbreviation definitions.

The Steering Committee is led by its two co-chairmen, who also serve as the program coordinators to facilitate communication, collaboration, and managing day-to-day SHSP activities. From the Steering Committee, each emphasis area was assigned a team leader, or "champion," which is also depicted in the organization chart. These agencies have taken the lead in developing the goals, objectives, strategies, and countermeasures for their respective emphasis areas. They were selected based on their expertise and involvement in specific areas of transportation safety. Each emphasis area leader is also responsible for implementation, tracking, reporting, and evaluation of emphasis area action plans.

Steering Committee Collaboration

An initial coordination meeting was held to review the Plan update and discuss the refinement of emphasis areas. Previous emphasis areas were discussed, and new emphasis areas identified. A drafted list of emphasis areas was produced for further analysis. These emphasis areas are summarized in the following.

1. Data Collection and Analysis – Collecting, organizing, and analyzing data are critical elements that create the foundation of the SHSP. The Plan is data-driven for determining the key emphasis areas, establishing goals for each, determining a project's eligibility for safety funding, and for evaluating the performance of the Plan. Advancements are needed to fully utilize current data and to collect additional data necessary to facilitate the Plan.

2. Driver Behavior – Addressing driver behavior is critical to reducing fatal and serious injury crashes. Many contributing factors to crashes and increased severity are behavioral including impaired driving, distracted driving, aggressive driving, and failing to use appropriate restraint systems (seat belts, child restraints, and airbags).

3. Infrastructure Improvement – TDOT has implemented a variety of safety projects and initiatives to address safety risks in the state's roadway system. These include intersections, rail crossings, roadway departures, and roadway segments with a history of crashes. These and other safety programs will be further developed to identify improvements in the roadway infrastructure that will reduce severe crashes.

4. Vulnerable Road Users – Non-motorized road users (pedestrians and bicyclists), motorcyclists, and senior drivers represent a group of road users that have a higher potential of serious injury or fatality when involved in a crash.

5. Operational Improvement – How our maintenance, construction, law enforcement, and emergency response professionals perform their duties can have a significant effect on the number of fatalities and severity of injuries. This area addresses construction zones, incident management, and the management of congestion.

6. Motor Carrier Safety – Commercial Motor Vehicles (CMV) engaged in long-haul transportation represent a significant portion of fatal crashes along interstates in metropolitan areas. These are predominantly involving CMV traffic through the state.

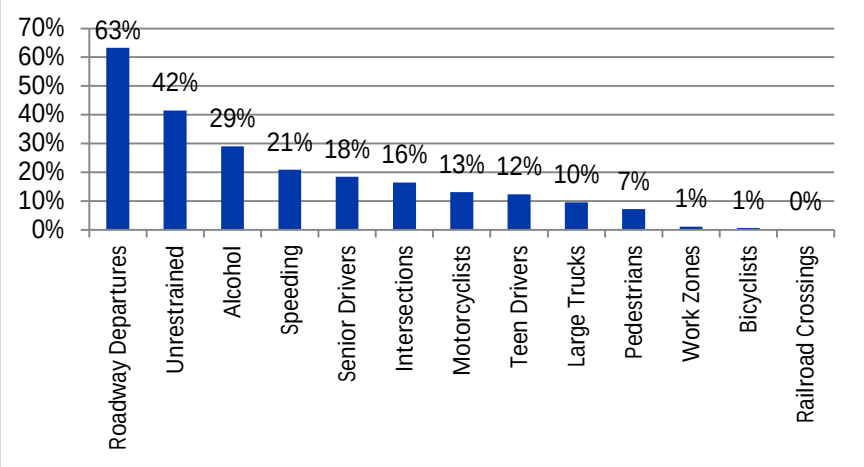
Data Analysis

Traffic and crash data was provided by the Department of Safety and Homeland Security (TDOSHS) pertinent to the emphasis areas identified by the Steering Committee. Data was analyzed for the five years preceding the most currently available crash records, 2008 through 2012. At the time of the Plan update, 2011 and 2012 data was considered preliminary, but suitable for analysis. Under TDOT's direction, this data was analyzed to determine if the selected emphasis areas represented the greatest opportunity for improving safety with the focus of our safety resources. The results of the analyses were distributed to the Steering Committee for review and comments as a draft of the plan.

Based on preliminary data, there were 1,014 fatalities in 2012 resulting from 928 crashes. These represent modest improvement from 2008 when there were 1,043 fatalities in 958 fatal crashes.[9] On page 5, the total number of fatalities on Tennessee roads over the past ten-years (2003-2012) is provided in Figure 2 and serious injuries in Figure 3 on page 6. It is clear that gains need to be made to successfully achieve the mission and goal of the Plan.

Review of contributing factors for recorded fatalities reveals certain areas that present the greatest opportunity for reducing the occurrence of fatal crashes. Figure 9 illustrates the percentage of total fatalities that are represented by each safety factor that was evaluated. In review of the data, it is evident that roadway departures, unrestrained occupants, alcohol related incidents, and speeding play a role in the majority of fatalities on Tennessee's roadways. Roadway departures represents the most predominate characteristic for fatalities and serious injuries. A roadway departure crash occurs when a driver loses control of their vehicle and departs the travel lane resulting in the vehicle colliding with either a fixed object or another vehicle. Other notable characteristics with a high occurrence of fatalities are senior drivers, intersections, motorcyclists, and teen drivers.

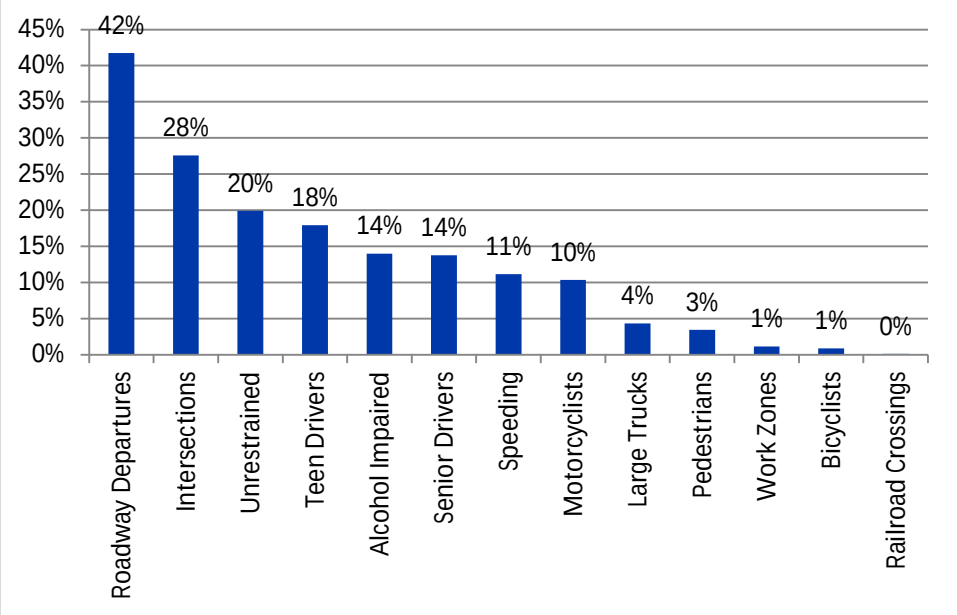
Figure 9 - Fatalities Percent of Total by Contributing Factor (2008-2012)



Source: TDOSHS[10]

Figure 10 depicts the distribution of serious injuries by contributing factor in a similar relationship. Crashes involving roadway departures, intersections, unrestrained occupants, teen drivers, and alcohol have significant representation in the total number of serious injuries over the past five years. It should be noted that the representation of teen drivers is significantly higher for serious injuries than for fatalities. It is the consensus of the Steering Committee that increases in serious injury crashes involving teen drivers could be attributed to distracted driving, which is a relatively recent, but rapidly growing, safety concern for our roadways.

Figure 10 - Serious Injuries Percent of Total by Contributing Factor (2008-2012)



Source: TDOSHS[11]

From Figures 9 and 10, it is evident that there are eight crash characteristics that should receive priority in the Plan. There are many other safety concerns represented in the remaining data that were not ignored. However, the emphasis areas chosen were evaluated to ensure that the top eight characteristics were addressed in the Plan. Figure 11 tabulates the emphasis area that addresses each of the top safety concerns. There is additional data analysis and discussion for each emphasis area listed in the table that follows in the emphasis area sections later in the Plan. The reason senior drivers appear in multiple emphasis areas is discussed in the following sections.

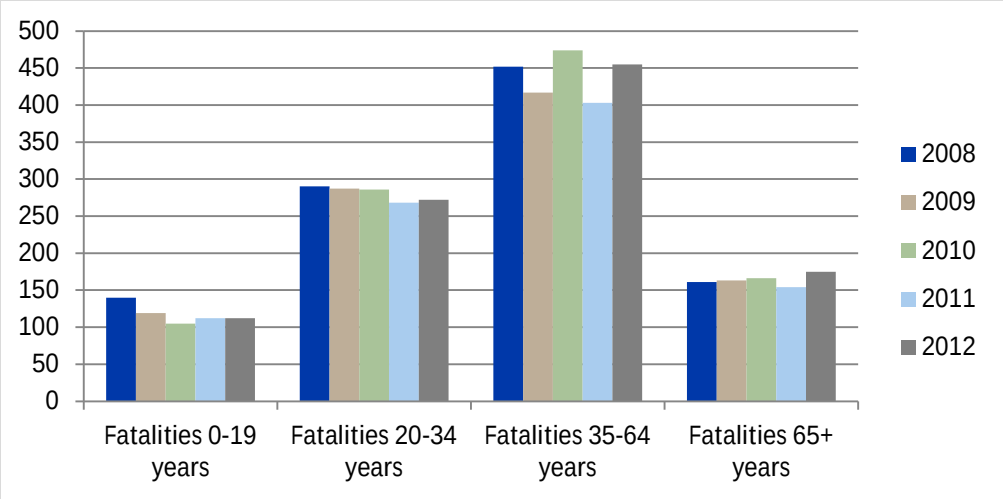
Figure 11 - Statistical Top Safety Concerns

Applicable Emphasis Area			
Infrastructure Improvement	**Driver Behavior**	**Vulnerable Road Users**	**Operational Improvements**
Roadway Departures	Unrestrained Drivers	Senior Drivers	Senior Drivers
Intersections	Alcohol Impaired (DUI)	Motorcyclists	
Senior Drivers	Teen Drivers		
	Speeding (Aggressive Driving)		

Source: 2014 SHSP

Fatal crashes were further analyzed to see if there are trends within age groups that should be addressed with the Plan. Figure 12 depicts the number of fatalities per age group over the past five years (2008-2012). The data suggests relative consistency in the distribution of traffic fatalities by age over this time period. There is a slight upward trend in the data for the sixty-five and over age category. This supports the heightened awareness of growing issues associated with an aging driving population in Tennessee and was the topic of concern for the Steering Committee.

Figure 12 - Fatalities by Age Group (2008-2012)



Source: TDOSHS[12]

Figure 13 - Fatalities and Serious Injuries for Drivers and Pedestrians Age 65+

Fatalities/Serious Injuries	2005	2006	2007	2008	2009	2010	2011
Driver Age 65+ Fatalities	137	140	132	122	104	120	117
Driver Age 65+ Serious Injuries	350	334	344	352	405	418	543
Driver 65+ [Fatalities + Serious Injuries]	*487*	*474*	*476*	*474*	*509*	*538*	*660*
Pedestrians Age 65+ Fatalities	9	7	11	13	11	9	7
Pedestrians Age 65+ Serious Injuries	18	11	18	11	15	16	17
Pedestrian 65+ [Fatalities + Serious Injuries]	*27*	*18*	*29*	*24*	*26*	*25*	*24*
Driver 65+ & Pedestrian 65+ [Fatalities + Serious Injuries]	*514*	*492*	*505*	*498*	*535*	*563*	*684*
Population Figures (per 1,000)	122	127	128	131	133	135	137
Rate (F+SI)/Population	4.2131	3.8740	3.9453	3.8015	4.0226	4.1704	4.9927
5-Year Moving Average					3.97	3.96	4.19

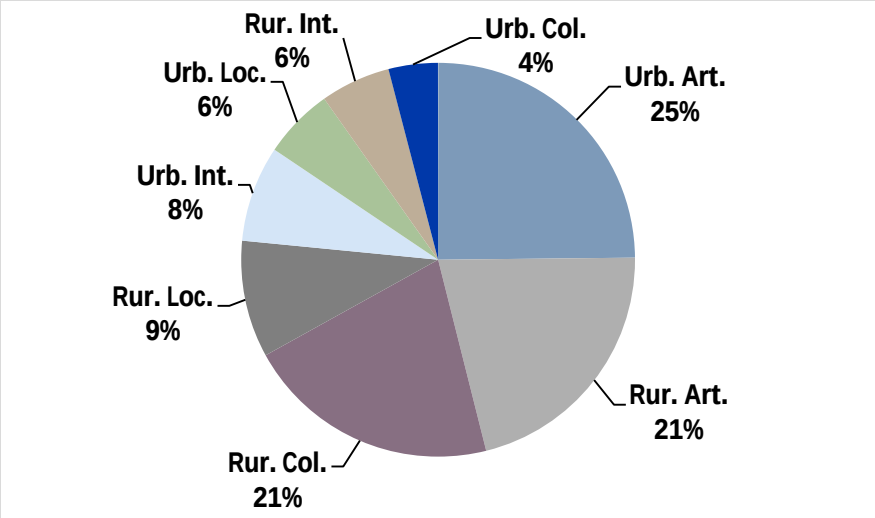
Source: TDOSHS[13]

Note: Values used to determine eligibility of special requirements for seniors under 23 U.S.C. 148(g)(2) and the predominant factors are shown in red

In regard to crashes involving the senior age group, ages 65 years and older, MAP-21 has special requirements to analyze data specific to fatalities and serious injuries for drivers and pedestrians of that age group. FHWA issued interim guidance on February 13, 2013 for states to perform this analysis as required by federal legislation 23 U.S.C. 148(g)(2). This legislation states if traffic fatalities and serious injuries per capita for drivers and pedestrians over the age of 65 in a state increases during the most recent two-year period for which data are available, that state shall be required to include strategies to address the increases in those rates in the state's subsequent SHSP. The analysis compares the most recent two-year interval of fatalities and serious injuries for the senior age group as a per capita of the total population. The per capita of the senior age group is provided by FHWA with the most recent year of 2011. Figure 13 summarizes the required analysis of this age group for the State of Tennessee. For the 2009 to 2011 five-year moving average data, there has been an increase in the per capita total for fatalities and serious injuries for this group from 3.97 in 2009 to 4.19 in 2011. Based on this analysis, the special requirements of this federal legislation will apply to Tennessee's update of the SHSP. From a secondary analysis, it can be seen that the predominant factors contributing to the statistical increase are fatalities (+13%) and serious injuries (+34%) for senior drivers. Strategies and countermeasures specifically targeting this group are included in the three emphasis areas: Infrastructure Improvement (page 45), Vulnerable Road User (page 55) and Operational Improvements (page 64).

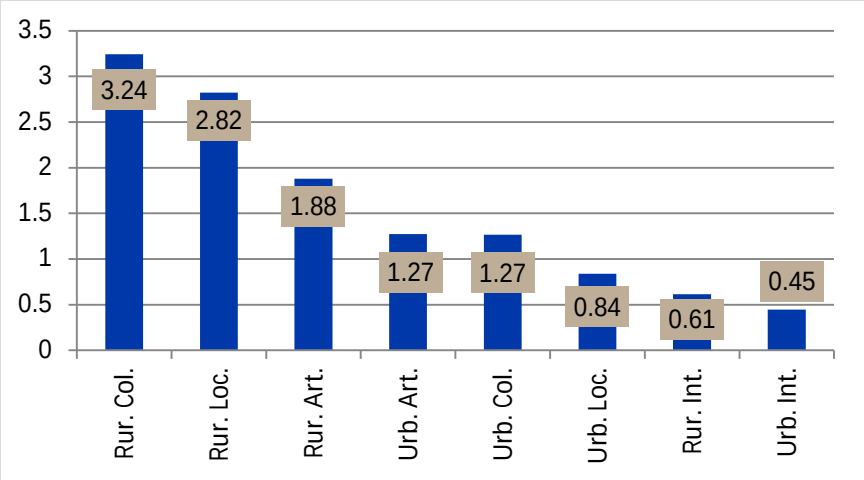
Figure 14 illustrates the distribution of fatal crashes by roadway classification for 2008 through 2011. Arterials, both urban and rural, account for the greatest number of fatalities. Rural collectors and local roads account for the next highest occurrence of fatalities followed by urban interstates. However, as seen on Figure 15, converting the number of fatalities to a fatality rate (fatalities per 100 million vehicle miles traveled) yields a different order with rural collectors and local roads accounting for nearly the same number of fatal crashes per 100 million vehicle miles traveled as the remaining classifications combined. This information was discussed by the Steering Committee and utilized in the development of strategies and countermeasures by emphasis area leaders in order to focus resources in areas most likely to produce positive results.

Figure 14 - Fatal Crashes by Classification (2008-2011)



Source: NHTSA FARS Encyclopedia (10/31/13)[14]
Note: See glossary for abbreviated terms.

Figure 15 - Fatal Crashes Annualized by VMT (2008-2011)



Source: Source: NHTSA FARS Encyclopedia (10/31/13) and TDOT HPMS System[15]
Note: See glossary for abbreviated terms.

Other Criteria

Based on requirements of current legislation, the Steering Committee also considered the following additional factors during development of the emphasis area strategies and countermeasures.

1. Findings from previous road safety audits
2. Locations of fatalities and serious injuries and locations that present risk for potential crashes
3. Crashes with fatalities and serious injuries to bicyclist and pedestrians
4. Cost effectiveness of improvements
5. Improvements to railroad crossings
6. Safety on local roads

Plan Details

Based on review of the safety data and criteria above, the Steering Committee confirmed inclusion of the emphasis areas previously identified at the initial coordination meeting. Individual goals, objectives, and countermeasures have been identified for each of the six emphasis areas. Emphasis area goals focus on five-year horizons to provide short-term, measureable milestones that are consistent with the long-range target defined by the Plan's goal statement.

Because vehicular crashes involve multiple contributing factors (human, infrastructure, environment, and vehicular), the Plan addresses emphasis areas with countermeasures that

utilize the four "E's" of transportation safety: engineering, enforcement, education, and emergency response. This basic strategy is a basis of the Plan's mission statement.

The Plan involves all aspects of traffic safety to reduce the occurrence of crashes, lessen the severity of crashes, and mitigate the effects of crashes. Collectively, the emphasis areas represent the Plan's current focus for achieving the greatest benefits to traffic safety through future efforts and investment. An important tool for identification and prioritization of safety needs is an improved system for collecting and assimilating traffic crash data. For this reason, there is an emphasis area that is focused on the collection, maintenance, and access to traffic records.

The Plan was further refined by distributing it to other organizations and agencies with specific interest in highway safety in Tennessee. This group includes the Plan's safety partners as illustrated in the organization chart included on page 12 and listed on page 3. Safety partners received a copy of the plan with a request for comments and their assistance in implementing the plan. Comments received will be incorporated into Plan updates.

DATA COLLECTION AND ANALYSIS EMPHASIS AREA PLAN

Background and Overview

A complete traffic records program is necessary for problem identification, planning, operational management or control, and evaluation of a state's highway safety activities. Each state, in cooperation with its political subdivisions, should establish and implement a traffic records program to collect and provide information for the entire state. This type of program is basic to the implementation of all highway safety countermeasures and is the key ingredient to their effective and efficient management. Access to timely and accurate data aids engineering staff to properly identify and address safety concerns, focuses law enforcement on the greatest needs, and connects all safety partners in the singular goal of reducing the occurrence of crashes involving fatalities and serious injuries on Tennessee's roadways.

Traffic Records

The Highway Safety Improvement Program (HSIP) is a data-driven program to reduce fatal and serious injury crashes. The appropriate use of integrated traffic records to plan and assess safety programs and leverage critical resources is needed to implement the HSIP Program. The systems utilized to collect, store, and analyze traffic safety information require continuous assessment. This promotes the open exchange of techniques and ideas to improve the availability of information used by highway safety partners.

A critical challenge facing Tennessee's state and local transportation safety professionals is optimizing the use of information technology. Knowing the specifics relating to traffic crashes is the foundation of a comprehensive traffic safety analysis system. Proactive decisions can be made and effective safety policies and projects implemented by improving the availability of crash, traffic, citation, medical, judiciary, criminal, and driver records. To facilitate this, a central point of contact for statistical data information was established in the Tennessee Department of Safety and Homeland Security.

The TITAN was developed to improve the accuracy and storage of crash records. TITAN is a multi-stage program consisting of a core system housing multiple functional components of highway safety and law enforcement data. TITAN will expand based on the availability of funding, resources and technical support. The first phases of TITAN are improving the availability of crash and citation data in Tennessee and are identified as TITAN E-Crash, TITAN Paper-Crash, and TITAN E-Citation. The MAP-IT tool is used to provide mapping capabilities for law enforcement officers to quickly and easily identify where a collision occurred after the crash site has been cleared and the officer has moved to a safe location. Additional TITAN applications will be developed to

address criminal activity, arrests, and other traffic safety related reporting. TITAN currently has more than 9,000 users statewide. Data within TITAN is recorded and accessed by law enforcement across the state as well as by TDOSHS, TDOT, FHWA, GHSO, FMCSA, Tennessee judges, court clerks, and others.

Bridge Inspection Records

Much like the traffic records program, Tennessee's bridge program relies on bridge condition data collected as required by the National Bridge Inspection Program (NBIP). This program was created following the catastrophic collapse of a bridge over the Ohio River taking forty six lives on December 15, 1967. The bridge inspection program was instituted in Tennessee in the early 1970's to provide safety to the motoring public through the inspection and collection of condition data on all bridges on public roadways. Even though the National Bridge Inspection Program has been in place for more than forty years, the aging of the bridge population, funding constraints, and the demands of increasing traffic volumes and heavier freight loads require TDOT and its managers to be diligent in understanding and responding to the condition of Tennessee's bridges. The data collected through the NBIP is used each year to make determinations on restricting heavy traffic and, where appropriate, closure of unsafe bridges.

The highway bridge program is a data driven program to ensure the safety of the public and to reduce potential for fatalities on bridges that have become unsafe since the last inspection. The statewide bridge inspection program is the key component of the highway bridge program because it provides the engineering staff with proper data to systematically determine appropriate actions to ensure the safety of structures. This information includes cursory inspections; follow-up inspections to closure and posting conditions; follow-up inspections for recent repairs; and reporting of deficiencies in bridge safety features, such as bridge rails and approach guardrails. The program includes the inspection of state maintained bridges as well as those owned and maintained by county and local governments and municipalities with public roads. TDOT maintains seventeen bridge inspection teams that perform a "hands-on" inspection of all elements of over 19,740 structures on a maximum cycle of twenty four months. The conditions of each structure are reported with sketches, a description of conditions, and photographs that engineering staff incorporate into a load rating analysis and overall condition evaluation of the structures. Within Tennessee's inventory of bridges, there are approximately 500 bridges that require underwater inspections and condition reporting of pier foundations by certified divers on a maximum sixty-month cycle.

Bridge safety continues to be a national safety issue, and the collection and analysis of that data is critical to protecting the public. Unsafe bridges must be identified for closure to eliminate public exposure to bridges that may fail and cause fatalities or serious injuries. TDOT closes approximately fifty-seven bridges per year as a result of the inspection program. Structural analysis of existing bridges, based on the their current condition from the inspection data collected, may require a structure to be posted for reduced weight limits in order to continue operating safely. With TDOT's inspection cycle, improper or missing posting signs or closure barricades are often discovered. TDOT works with the bridge owner to ensure bridges are correctly posted or closed, again reducing the public's exposure to possible bridge failures. Scour inspections are also performed to determine the need for bridge closures during periods of high water. Scour may occur during major rain events and is the most common cause of bridge failures nationwide. These failures can be sudden and catastrophic. In 2013, TDOT performed 179 scour inspections.

While it is difficult to quantify the number of lives that are saved at each bridge location by our safety inspections, it is universally accepted that this program is a key component of TDOT's safety plan to ensure that all bridges in Tennessee are safe with a goal of zero fatalities or serious injuries on our bridges each year.

Supplemental Data

For some safety programs, a location's eligibility cannot be determined with just the number and severity of crashes experienced at a location. Some programs require comparison of its actual crash rate with a critical rate that is based on a statewide average of roadways with the same classification and traits. To calculate a location's actual crash rate, crash data is used in conjunction with data such as traffic volume, roadway classification, and geometric conditions. In Tennessee, this data is stored in the Enhanced Tennessee Roadway Information Management System (ETRIMS). Beyond providing crash data and the additional information required for crash rate calculations, ETRIMS maintains data that provides engineering staff with other useful information such as shoulder widths, the condition of bridges, pavement age and characteristics, and horizontal geometry. These types of information aid in the initial determination of probable causes of current safety issues and help to identify potential safety concerns that warrant further investigation or preventative action.

Work Zone Data

The Final Rule on Work Zone Safety and Mobility (Rule) was published in October of 2007. Under the updated Rule, agencies are required to use work zone data at both the project and process levels to manage and improve work zone safety and mobility. At the project level, the Rule requires agencies to use field observations, available work zone crash data, and operational information so that timely action is taken at the project level to correct safety or mobility issues in

the field. At the process level, the Rule requires agencies to analyze work zone crash and operational data from multiple projects to improve agency processes and procedures and to continually pursue the improvement of overall work zone safety and mobility.

With many of Tennessee's highways and bridges that are aging, work zone activity will continue to be significant in occurrence throughout the state and perhaps increase in number to rehabilitate or replace aging highways and bridges. A vast majority of road and bridge work takes place adjacent to traffic. Tennessee continually seeks to improve work zone safety by refining the state's standards, guidelines, and procedures regarding work zones. Increased field observations and enhanced crash data within work zones will be needed not only to meet requirements that are established in the Rule but to continue the state's efforts to improve work zone safety.[16]

Goal and Objective

Emphasis Area Goal: To make the collection, management, and accessibility of safety data timely, consistent, accurate, and to integrate with other data sources as necessary for analysis, planning, evaluation and monitoring.

Emphasis Area Objective(s): To complete integration of all written crash records and receive 100% of crash reports electronically and automatically into TITAN by December 31, 2014 to conform to the State of Tennessee Senate Bill passed and signed into law in 2012 to amend Tennessee Code Annotated §55-10-108 and §55-10-111 relative to motor vehicle accident reports.[17]

Strategies and Countermeasures

Strategy 1 - Improve traffic data collection systems, hardware, and technology to provide data more timely and efficiently.
1.1 Replace current end-of-life laptop computers; purchase, install, and maintain new computers to ensure peak performance for the Tennessee Highway Patrol (THP).
1.2 Expand TITAN to improve timeliness and accuracy of data collection, analysis processes, and traffic safety data systems including the linkage of crash, roadway, driver, medical-injury surveillance system and ambulance and trauma system, enforcement, conviction, criminal, and homeland security data.
1.3 Update the TDOT Linear Reference System (LRS) for locating recorded crashes, improving crash data recorded locations, and identifying potential safety projects.
1.4 Integrate ETRIMS Database for efficient and consistent analysis of current data by TDOT for safety analysis conducted by TDOT and TDOSHS.

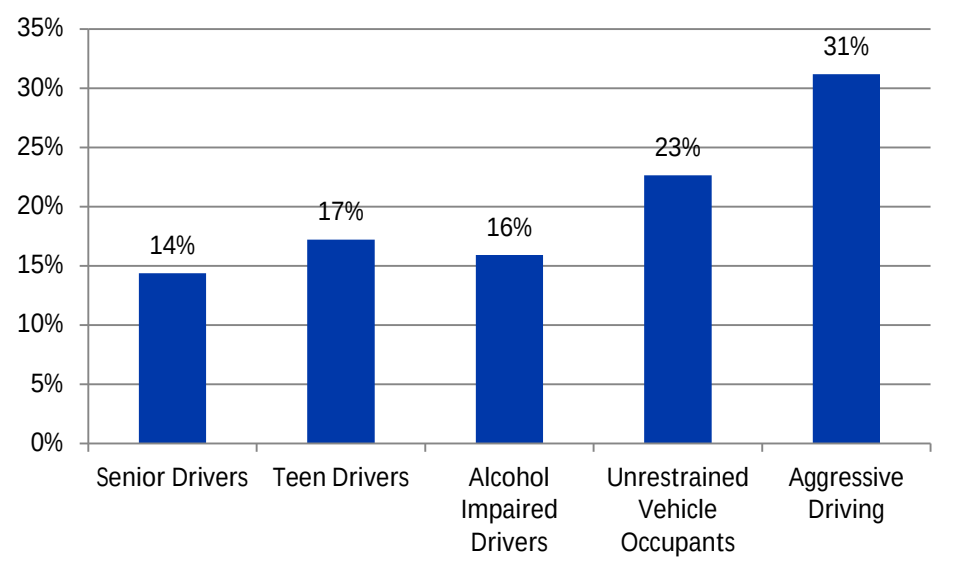
Strategy 2 - Improve data collection in the field and data distribution to expedite and improve delivery of relevant data for safety analysis, infrastructure improvement, and law enforcement.
2.1 Create a training program to improve the operational readiness of the Tennessee Highway Patrol (THP) and all local law enforcement agencies investigating crashes that occur on Tennessee roadways. Include training on data collection, submission, analysis, definitions, importance, and appropriate uses for traffic safety data.
2.2 Distribute data-driven statistics (utilizing predictive analytics) indicating the days and times most alcohol related crashes are occurring to each district captain on a weekly basis.
2.3 Conduct an annual supervision and leadership class for all new supervisors and selected troopers on developing and using enforcement plans utilizing traffic records data.
2.4 Develop an online crash instructional manual with data definitions defined by Model Minimum Uniform Crash Criteria (MMUCC), ANSI D-20 and D-16, FARS and SafetyNet criteria.
2.5 Expand local partner agencies' participation in the collection and use of crash information with focus on rural county law enforcement and highway officials through promotion and education of ETRIMS, TITAN, and MAP-IT by TDOSHS and TDOT.
2.6 Continue to maintain and keep current supplemental data used in crash rate calculations and in determination of probable and potential safety concerns.
2.7 Expand data collection of work zone related crashes in TDOT PPRM (Program, Project and Resource Management), integrate work zone crashes in ETRIMS and TITAN, and emphasize "Protect the Queue" program.
2.8 Maintain bridge inspection program and collection of bridge condition data as necessary to identify, analyze, evaluate and improve bridges with potentially unsafe conditions.

DRIVER BEHAVIOR EMPHASIS AREA PLAN

Background and Overview

Addressing driver behavior is a critical factor in reducing fatal and serious injury crashes. From analysis of the 2008 to 2012 crash data, the predominant behavior characteristics are alcohol-impaired driving, aggressive driving, occupant protection, and teen drivers. These driver behavioral characteristics were cited as one or more of the contributing factors to 34,308 out of a total of 39,449 fatalities and serious injuries that resulted from crashes in Tennessee from 2008 to 2012. Figure 16 depicts the fatalities and serious injuries that each of these driver behavioral characteristics was cited during this period as a percentage of the total. Also depicted is the percent of senior driver related crashes during the same time period.

Figure 16 - Fatalities and Serious Injuries Involving Driver Behavior (2008-2012)



Source: TDOSHS[18]

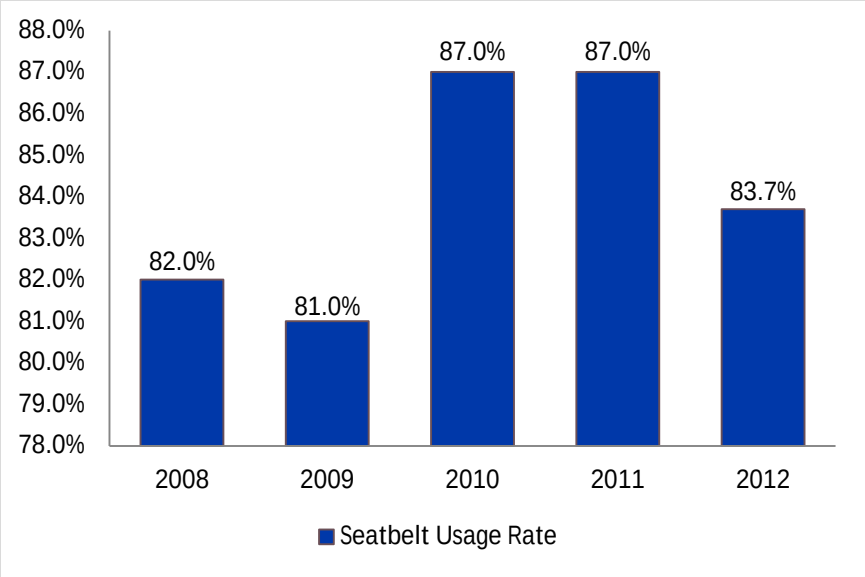
As shown in Figure 16, no single characteristic is a predominant cause of fatalities and serious injuries with driver behavior related crashes. Poor decision making by the driver, impaired driving, and an overall lack of knowledge for the needs and rights of other road users all significantly contribute to driver behavior related crashes. To address these, enforcement and education are emphasized in the corresponding strategies. Senior drivers are shown here for comparison. A discussion of senior drivers is provided in the Vulnerable Road User Emphasis Area.

Crash data analyzed for this emphasis area contained overlapping instances of varying characteristics. This is expected when many crashes involve more than one contributing factor. For this reason, crash totals for driver behaviors as a sum of the totals for each characteristic exceed the total number of fatalities and serious injuries. This is illustrated in Figures 23 and 24 that accompany the goal statement for the emphasis area.

Occupant Protection

In June 2012, a statewide observational survey was conducted in Tennessee concerning "All Vehicle" restraint usage rate. The survey's findings revealed an occupant restraint user rate of 83.7%, slightly lower than the 2011 national average of 84%.[19] However, historic usage rates from 2008 to 2012, shown in Figure 17, indicate an overall positive growth in the percentage of roadway users wearing seatbelts.

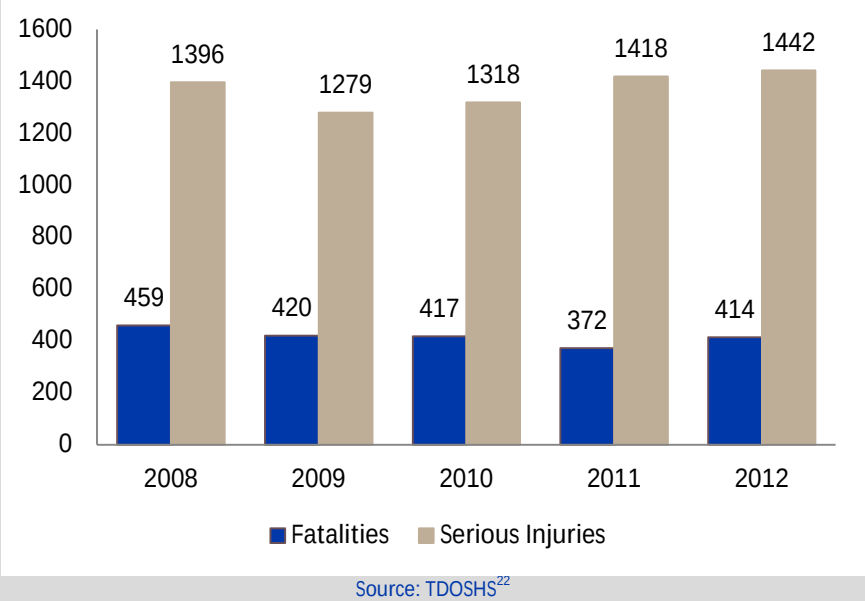
Figure 17 - Seatbelt Usage Rate (2008-2012)



Source: TDOSHS[20]

Despite the increase in seatbelt usage from 2008 to 2012, fatalities and serious injuries related to unrestrained vehicle occupants still remain a safety concern. Figure 18 shows data reported by TDOSHS indicating the total number of fatalities and serious injuries related to unrestrained vehicle occupants from 2008 to 2012. As shown in the figure, a decreasing trend in the number of fatalities related unrestrained occupants was observed. Conversely, the number of serious injuries due to unrestrained vehicle occupants has experienced positive growth. In 2012, unrestrained vehicle occupants were a contributing factor to 414 (41%) of the total fatalities and to 1,442 (19%) of the total serious injuries that resulted from crashes in Tennessee. Nationally, the percentage of crash-related fatalities linked to unrestrained vehicle occupants was 48% in 2011.[21]

Figure 18 - Unrestrained Vehicle Occupants Related Fatalities and Serious Injuries (2008-2012)



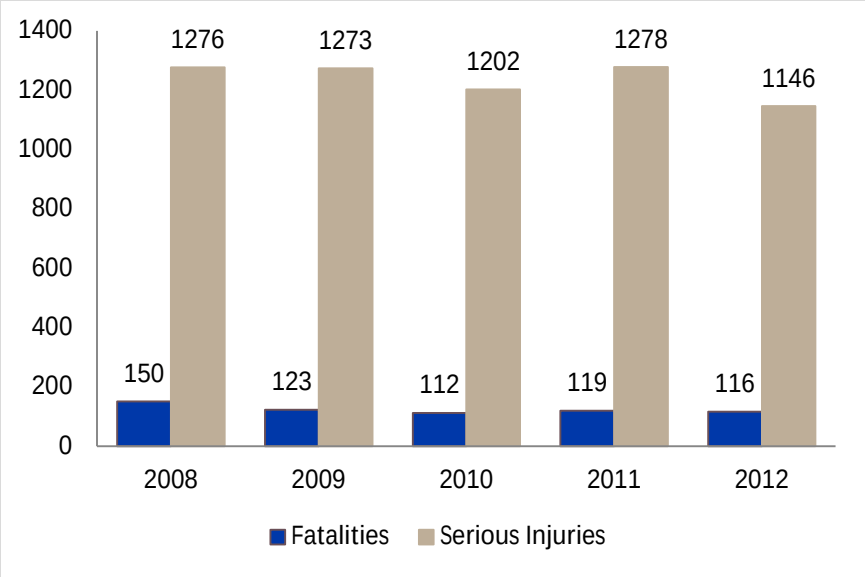
Source: TDOSHS[22]

Teen Drivers

Teen drivers are new and inexperienced motorists. This group is represented in data collected by the TDOSHS for the age group 13 to 19 years of age. This particular subset of drivers continues to be over-represented in fatal and injury crashes. Speeding, driving on the wrong side of the roadway, failure to yield the right-of-way, reckless driving, and impaired driving have been observed to be the five most predominant factors in severe crashes involving teen drivers.

Nationally, 10% of all crashes that resulted in a fatality in 2011 involved teen drivers.[23] Crash-related fatalities and serious injuries involving teen drivers from 2008 to 2012 in Tennessee are shown in Figure 19. As shown in the figure, teen drivers were involved in 116 (11%) of the total fatalities and 1,146 (15%) of the total serious injuries that resulted from crashes statewide in 2012. While the 2012 totals are significant, the data from 2008 to 2012 suggests a decreasing growth trend for both serious injuries and fatalities for this group.

Figure 19 - Teen Driver Related Fatalities and Serious Injuries (2008-2012)

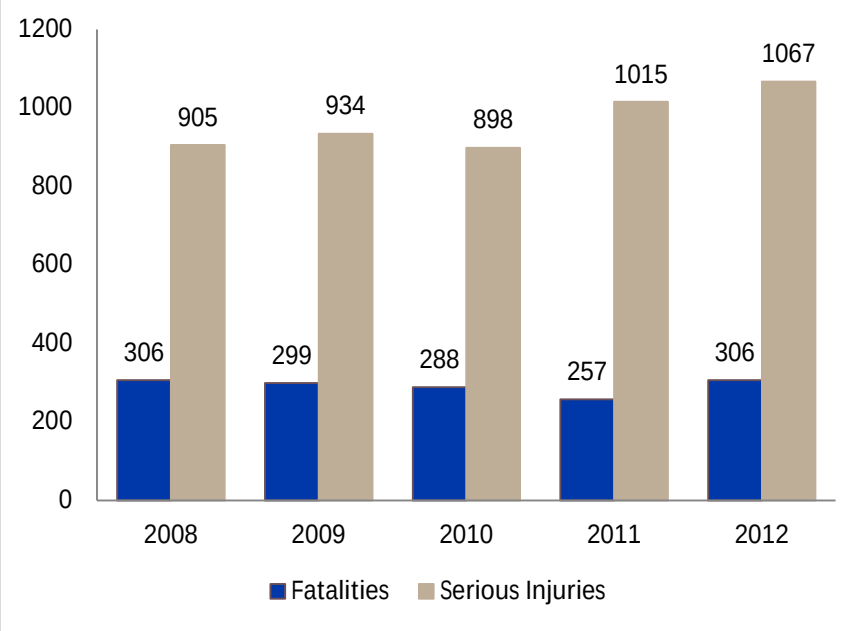


Source: TDOSHS[24]

Alcohol-Impaired Driving

Alcohol-related crashes resulting in either a serious injury or fatality have had a significant impact on the lives of our citizens and the economy of our state. The number of alcohol-related fatalities and serious injuries occurring on Tennessee roadways from 2008 to 2012 are shown in Figure 20. As seen in the figure, a slight downward trend in the number of alcohol-related fatalities is represented by the data. However, the number of fatalities remained constant when comparing only the 2008 and 2012 data. Alcohol-impaired driving related serious injuries exhibited an increase during the same time period. In 2012, 306 (30%) of the total fatalities and 1,067 (14%) of the total serious injuries that resulted from crashes statewide involved alcohol-impaired driving. Nationally, the percentage of crash-related fatalities involving alcohol-impaired driving was 31% in 2011.[25]

Figure 20 - Alcohol Related Fatalities and Serious Injuries (2008-2012)



Source: TDOSHS[26]

Distracted Driving

In 2010, 3,092 people in our nation were killed in crashes involving a distracted driver.[27] One of the most alarming and widespread forms of distracted driving is cell phone usage. According to a Carnegie Mellon study, driving while using a cell phone reduces the amount of brain activity associated with driving by 37%.[28] A report from the National Safety Council estimates that about one out of every four traffic crashes is caused by people talking on cell phones or sending text messages.[29] Text messaging is a major concern because it combines three types of distraction – visual, manual, and cognitive. In other words, texting involves taking your eyes off the road, your hands off the wheel, and your mind off the task of driving. These behaviors are often cited as inattentive driving. Regardless of the terminology, these create unsafe conditions on our roadways.

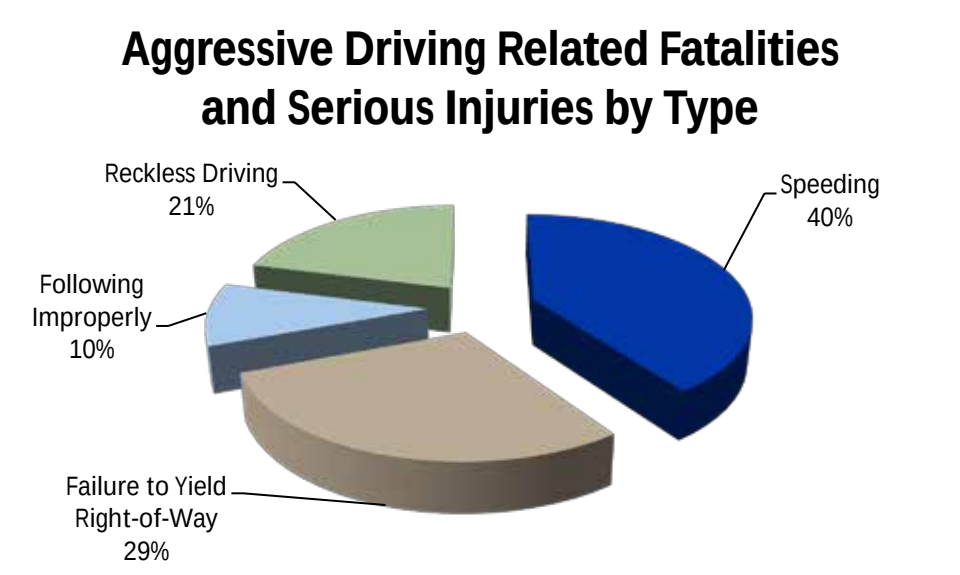
To tackle this ever-increasing problem, Tennessee will focus on ways to change the behavior of drivers through legislation, enforcement, public awareness and education—the same tactics that have curbed drinking and driving and increased seat belt use. In Tennessee, current legislation does not meet the federal standard for receiving funds dedicated to addressing this safety

concern. Therefore, education and law enforcement will incorporate measures to address distracted driving into other programs as funding allows while the legislature considers amending the current legislation.

Aggressive Driving

Excessive speeding, changing lanes frequently without signaling, following too closely, driving on shoulders to pass, driving across marked barriers, shouting or gesturing at other drivers, and stress created by traffic congestion are manifestations of aggressive driving. Combined, the various types of aggressive driving were cited as contributing factors to 2,346 (47%) of the total fatalities and to 9,957 (29%) of the total serious injuries that resulted from crashes in Tennessee from 2008 to 2012. Of these identified signs of aggressive driving, excessive speeding is predominantly associated with crashes causing fatalities and serious injuries on Tennessee highways. As shown in Figure 21, speeding was cited as a contributing factor in 40% of the total aggressive driving related fatalities and serious injuries statewide from 2008 to 2012.

Figure 21 - Aggressive Driving Related Fatalities and Serious Injuries by Type (2008-2012)

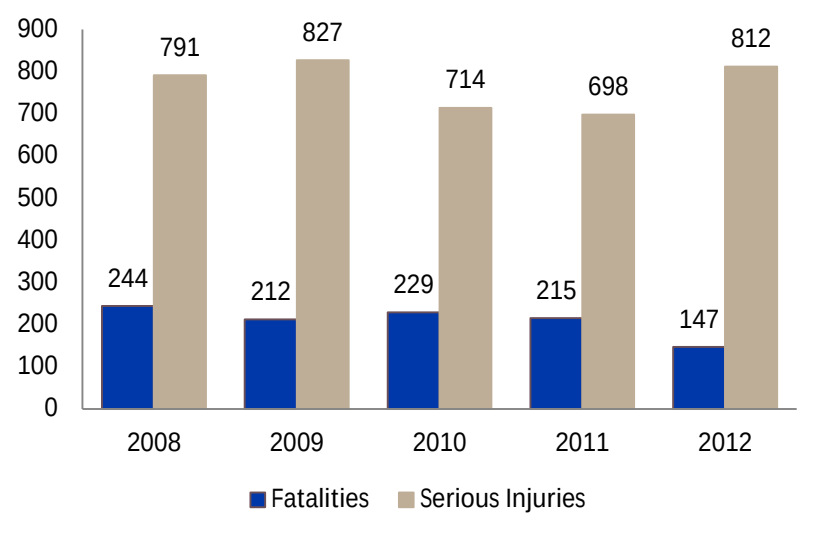


Source: TDOSHS[30]

To focus on speeding, Figure 22 shows the number of fatalities and serious injuries that had speeding cited in the crash record from 2008 to 2012. As seen in the figure, the number of fatalities experienced each year associated with speeding is on a steady decline. Over the same time period, only a modest declining trend can be discerned for the number of serious injuries

associated with speeding. While the overall trend may be declining, the 2012 number of serious injuries was significantly greater than those experienced in 2008. In 2012, 147 (15%) of the total traffic fatalities and 812 (11%) of the total serious injuries that resulted from crashes statewide involved excessive speeding as a contributing factor. Nationally, the percentage of crash related fatalities attributed to excessive speeding was 31% in 2011.[31]

Figure 22 - Speeding Related Fatalities and Serious Injuries (2008-2012)



Source: TDOSHS[32]

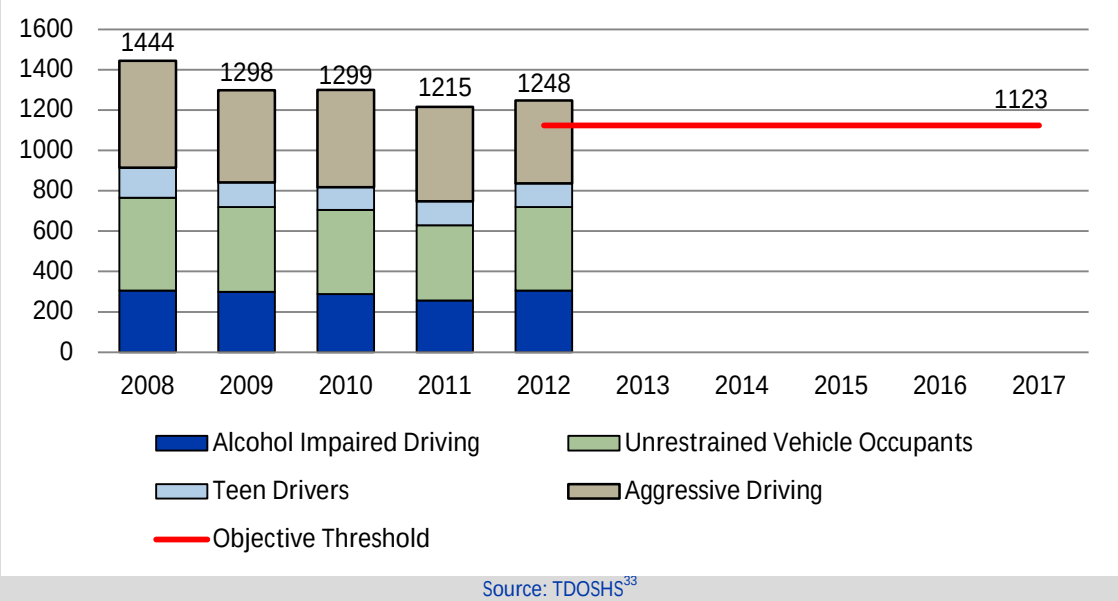
Goal and Objective

Emphasis Area Goal: To provide a safer environment for all modes of transportation in Tennessee through educating Tennessee's driver population and improving law enforcement efforts.

Emphasis Area Objective(s): Fatalities: Reduce the number of fatalities, citing these four predominating forms of driver behavior as a contributing factor, by 10% within the next five years.

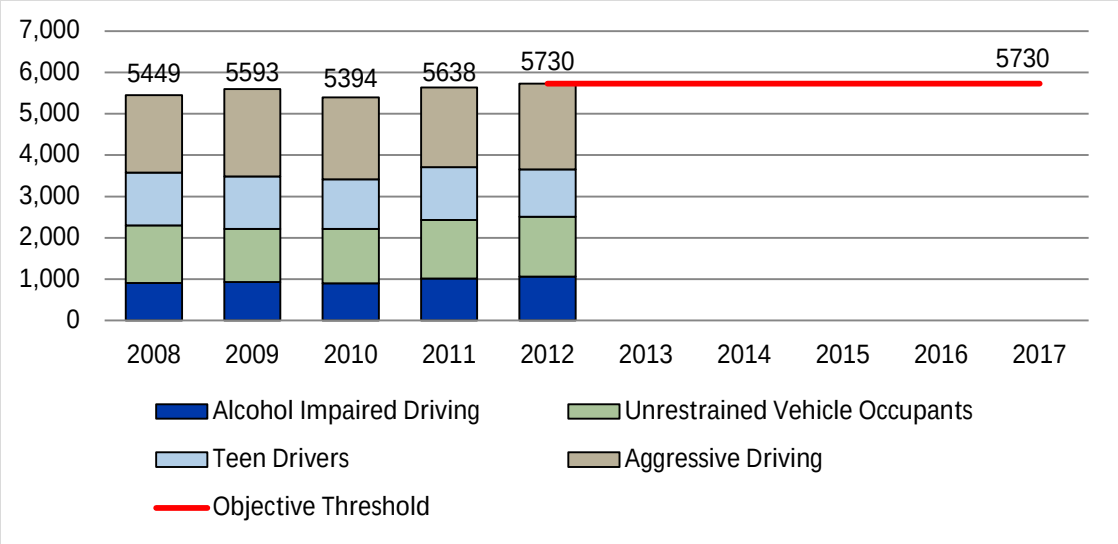
Serious Injuries: Reduce the current trend of increasing serious injuries involving these four predominating forms of driver behavior by not exceeding the 2012 total value of 5,730.

Figure 23 - Driver Behavior Emphasis Area Fatality Objective



Source: TDOSHS[33]

Figure 24 - Driver Behavior Emphasis Area Serious Injury Objective



Source: TDOSHS[34]

Strategies and Countermeasures

The following strategies and countermeasures target improving the behavior of drivers across the state to create a safer driving population. In recognition of data analysis presented in this plan, certain areas will receive special attention. These include senior drivers as a group of drivers and rural areas for communities that present the greatest needs for improvements, based on

statistics. While these strategies and countermeasures will be applied statewide, additional data analysis and agency coordination will be performed to identify ways to target these two focus areas under this Plan.

Strategy 1 - Reduce the number of impaired drivers on Tennessee's roadways.
1.1 Coordinate conference and training programs for law enforcement officers, prosecutors, and judges to facilitate in the detection, arrest, adjudication, and conviction of alcohol and drug impaired drivers.
1.2 Coordinate DUI enforcement projects that provide high visible patrols and selective enforcement methods utilizing current field sobriety techniques and target areas with high impaired driving arrests and crashes through data-driven analysis.
1.3 Partner with stakeholders and other interested groups to support and make recommendations for impaired driving state laws and establishment of specialized prosecution of driving under the influence.
1.4 Establish a statewide tracking system for Blood Alcohol Concentration (BAC) levels of offenders.
1.5 Reduce minors' access to alcohol and other drugs through vendor education and enforcement of underage sale laws.
1.6 Provide high-risk driver education programs targeting drivers aged 15-21 with a focus on impaired driving. Continue to address college campus impaired driving and other high risk transportation related behavior issues.
1.7 Collaborate with organizations to address youth alcohol and drug problems i.e., select Committee on Children and Youth and Tennessee Council of Juvenile and Family Court Judges.

Strategy 2 - Reduce aggressive driving practices among motorized road users.
2.1 Develop and implement enforcement programs aimed at aggressive driving in high frequency areas.
2.2 Evaluate the adoption of a statutory traffic law through the legislative process to clearly define aggressive driving for enhanced enforcement efforts.
2.3 Evaluate the adoption of a uniform citation for enforcement that will serve as a tracking mechanism for courts and traffic records analysis.
2.4 Use engineering measures to effectively manage speeds through design and safety improvements.

Strategy 3 - Increase usage of proper vehicle occupant restraint.
3.1 Coordinate and promote child passenger safety (CPS) initiatives.
3.2 Promote education and training for children and parents on proper child safety belt use.
3.3 Increase monitoring of seat belt usage and provide advice on usage to both the traveling public and CMV drivers.
3.4 Provide high-risk driver education programs and defensive driving programs targeting drivers aged 15-21 focusing on seat belt usage.
3.5 Continue to support youth seatbelt programs.
3.6 Coordinate conference and training programs for law enforcement officers, prosecutors, and judges to become aware of and implement the provisions of the Child Passenger Restraint Law (T.C.A 55-9-602(c)(2)) and coordinate training programs to facilitate the sanctions imposed by the legislation.
3.7 Pursue changes in legislation that will further encourage proper use of restraints.

Strategy 4 - Increase education and enforcement targeted at reducing distracted driving.
4.1 Continue to educate drivers on the danger of texting and driving as allowed by current funding and enforce the current texting law.
4.2 Seek legislation that meets federal standard for dedicated funding to address texting and driving.

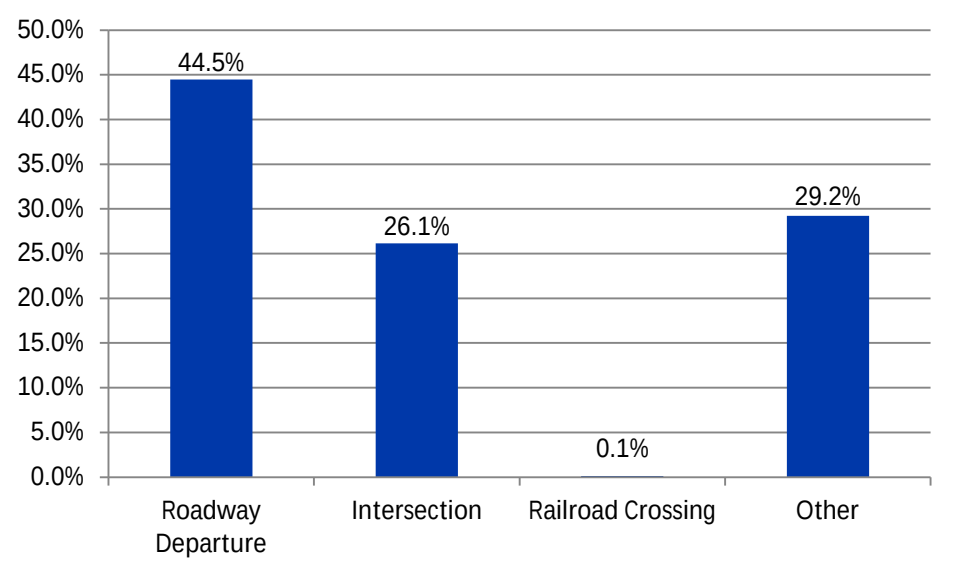
Strategy 5 - Reduce crashes involving teen drivers.
5.1 Provide driver education and defensive driving programs for teen drivers (see definition) with a focus on aggressive driving and other high-risk transportation related behavior issues. Include focus on distracted driving as allowed by funding.
5.2 Reduce minor's access to alcohol and other drugs, including vendor education and enforcement of underage sale laws.

INFRASTRUCTURE IMPROVEMENTS EMPHASIS AREA PLAN

BACKGROUND AND OVERVIEW

The Infrastructure Improvement Emphasis Area focuses on improving safety at specific locations or features along the roadways that are associated with higher occurrences of fatal and serious injury crashes. The emphasis area focuses primarily on roadway departures, intersections, and railroad crossings. Roadway departures and intersections were selected based on statistical data. Combined, they were cited in 3,994 (80%) of the 5,012 fatalities and 23,869 (69%) of the 34,437 serious injuries reported from 2008 to 2012 in Tennessee. Railroad crossings, while statistically insignificant compared to other locations or features, are required to be addressed per MAP 21 requirements. The percentage of fatalities and serious injuries statewide from 2008 to 2012 that each location or feature was cited is shown in Figure 25.

Figure 25 - Fatalities and Serious Injuries by Infrastructure Type (2008-2012)



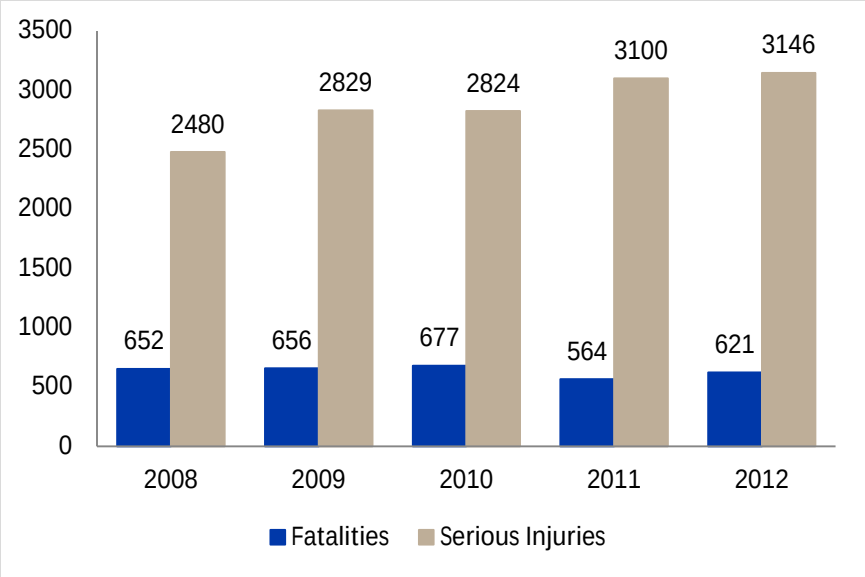
Source: TDOSHS[35]

Other locations collectively represent a large percentage (29.2%) of roadway locations or features experiencing fatal and serious injury crashes. These include infrastructure elements such as freeway ramp terminals with excessive queue lengths and roadway configurations subject to wrong-way movements. High crash rates at any of these locations indicate a safety risk in the roadway infrastructure that can be addressed with safety improvements. The safety improvements considered should take into account safety issues related to senior drivers. Additionally, education and law enforcement are also seen as effective tools to reduce the frequency and severity of crashes at roadway locations that present a safety concern.

Roadway Departures

A roadway departure crash occurs when a driver loses control of their vehicle and departs the travel lane resulting in the vehicle colliding with either a fixed object or another vehicle. In 2012, roadway departure was cited as a contributing factor to 621 (61%) of the total fatalities and to 3,146 (42%) of the total serious injuries that resulted from crashes statewide. Nationally, roadway departure was cited for approximately 51% of fatal crashes on highways in 2011.[36] Figure 26 shows the yearly total number of roadway departure related fatalities from 2008 to 2012 on Tennessee highways. From the figure, roadway departure related crashes experienced a modest downward trend for fatalities and an increasing trend for serious injuries over the same time period.

Figure 26 - Roadway Departure Related Fatalities and Serious Injuries (2008-2012)



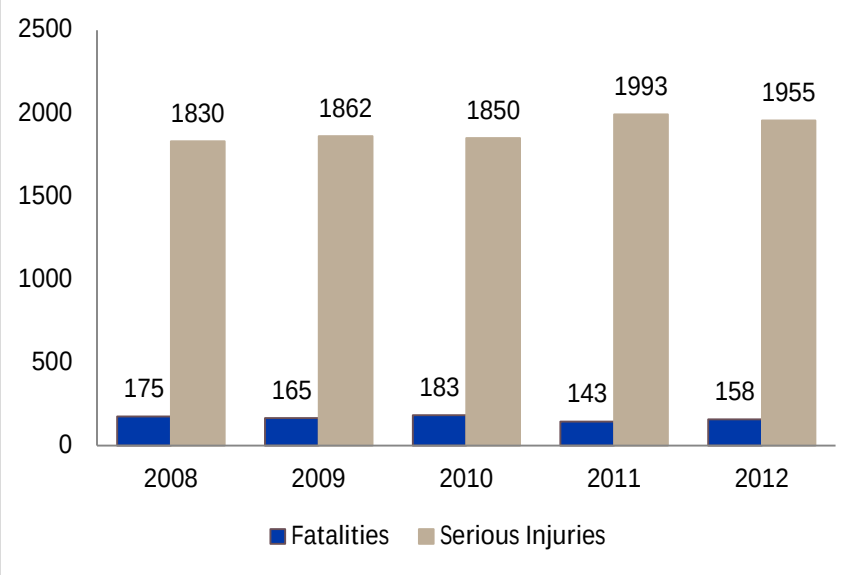
Source: TDOSHS[37]

Intersections

Intersection-related crashes include stop-controlled, signal-controlled, and alternative intersections such as roundabouts, traffic circles, diverging diamond interchanges, and J-turns. Nationally, intersection-related crashes accounted for about 21% of fatalities and about 50% of serious injuries on highways in 2011.[38] This type of crash accounted for 158 (16%) of the total fatalities and for 1,955 (26%) of the total serious injuries on Tennessee highways in 2012. Figure 27 depicts the number of intersection-related fatalities and serious injuries that occurred on Tennessee's highways from 2008 to 2012. From the

figure, intersection-related crashes experienced a modest downward trend for fatalities and a modest increasing trend for serious injuries over the same time period.

Figure 27 - Intersection-Related Fatalities and Serious Injuries (2008-2012)

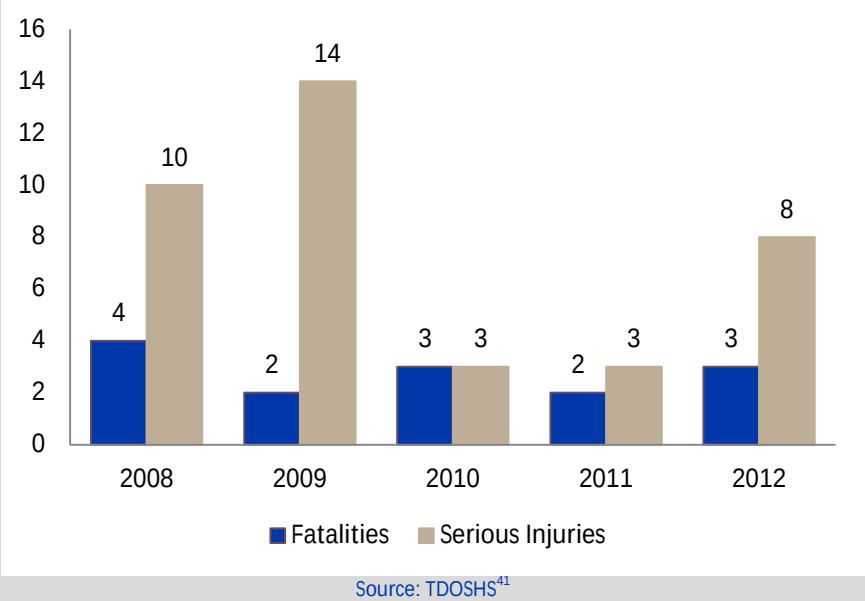


Source: TDOSHS[39]

Railroad Crossings

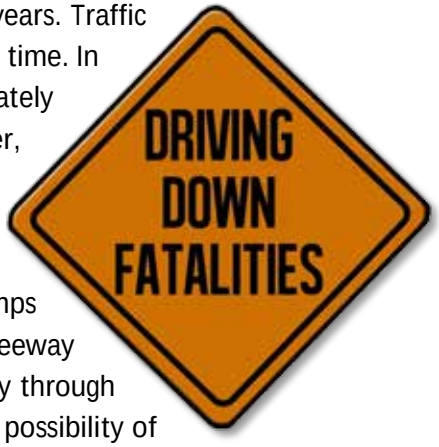
Crashes occurring at railroad-highway grade crossings have a high potential to result in a serious injury or fatality due to the involvement of trains. However, fatalities and serious injuries occurring at railroad-highway grade crossings account for a small percentage (no more than 0.1%) of crash-related fatalities and serious injuries in Tennessee. Nationally, 0.8% of total crash-related fatalities occurred at highway-railroad grade crossings in 2011.[40] Figure 28 enumerates the number of fatalities and serious injuries occurring at highway-railroad crossings statewide from 2008 to 2012. No trend in the yearly fatality and serious injury totals related to crashes at highway-railroad grade crossings was evident based on the random numbers shown over the time period.

Figure 28 - Railroad Crossing-Related Fatalities and Serious Injuries (2008-2012)



Source: TDOSHS[41]

Other Infrastructure Considerations



Freeway Ramp Terminals – A vast majority of Tennessee's interstate highway and freeway system has been in existence for more than forty years. Traffic has increased tremendously on those facilities over this period of time. In 2012, interstate highways and freeways accounted for approximately 1.3% of the total road mileage in Tennessee.[42] However, approximately 32% of the total vehicle miles travelled in Tennessee during 2012 occurred on interstate highways and freeways.[43] This large traffic demand on these types of road facilities has created congestion at many interchange exit ramps particularly at diamond interchanges, and this has resulted in freeway exit ramp queue lengths that encroach into the adjacent freeway through lane during peak hours of traffic. Such a condition increases the possibility of rear-end and sideswipe crashes for freeway exiting and through traffic and increases congestion.

Senior Drivers – Road sites with deficient curvature, intersection, and interchange geometry and visibility present challenges particularly for senior drivers to safely maneuver through such sites due to the driver's declining physical conditions and slower decision-making skills. The numbers and percentage of senior drivers (defined as drivers aged 65 years and older) has increased nationally and in Tennessee since 2008, and these figures will continue to increase in the years to come as the numbers and the percentage of the senior age population continues to increase. The U.S. Census Bureau estimated 13.7% of the national population in 2012 is aged 65 years old and

older,[44] and they project the percentage of this age group to increase to more than 20% by 2030.[45] As noted in the Update Process section under Data Analysis on page 17, there has been an increase in the per capita total for fatalities and serious injuries to senior drivers and pedestrians on Tennessee roads over the most recent two years of complete data (from 2009 to 2011) with most of this increase attributed to senior drivers. The special rule for older drivers under Section 148 of MAP-21 will mandate strategies and countermeasures focused on improving safety for this age group.

Partial Cloverleaf Interchange (PARCLO) – TDOT completed a program in 2012 directed at reducing the occurrence of wrong-way movements at interchange ramp intersections with a PARCLO configuration. Those types of interchanges often feature interstate exit ramps and entrance loop ramps (or vice-versa) that intersects roads at or near the same point. These types of interchange configurations have historically created confusion for some drivers resulting in wrong-way movements on one of the ramps. The PARCLO program addressed such ramp locations with a history of crash problems due to wrong-way ramp movements with the installation of additional warning and regulatory signs, pavement markings, and other safety measures. The performance of the PARCLO program will continue to be monitored and additional measures taken as appropriate.

Rural Roadways – It is recognized from the analysis illustrated on page 18 that rural roadways account for a greater percentage of fatal crashes, especially when considered by vehicle miles traveled. It was the consensus of the Steering Committee that roadway characteristics are likely to be the most contributing factor to higher crash rates in rural areas. For this reason, rural roadways will be of particular concern for strategies and countermeasures associated with infrastructure improvements. TDOT has initiated the Local Roads Safety Initiative (LRSI) and Road Safety Audit (RSA) programs to identify segments of local and rural roads with a history of high occurrences of fatal and serious injury crashes and address them with safety improvements. The update of the ETRIMS database to include all local roads will enhance the identification of such routes with safety deficiencies.

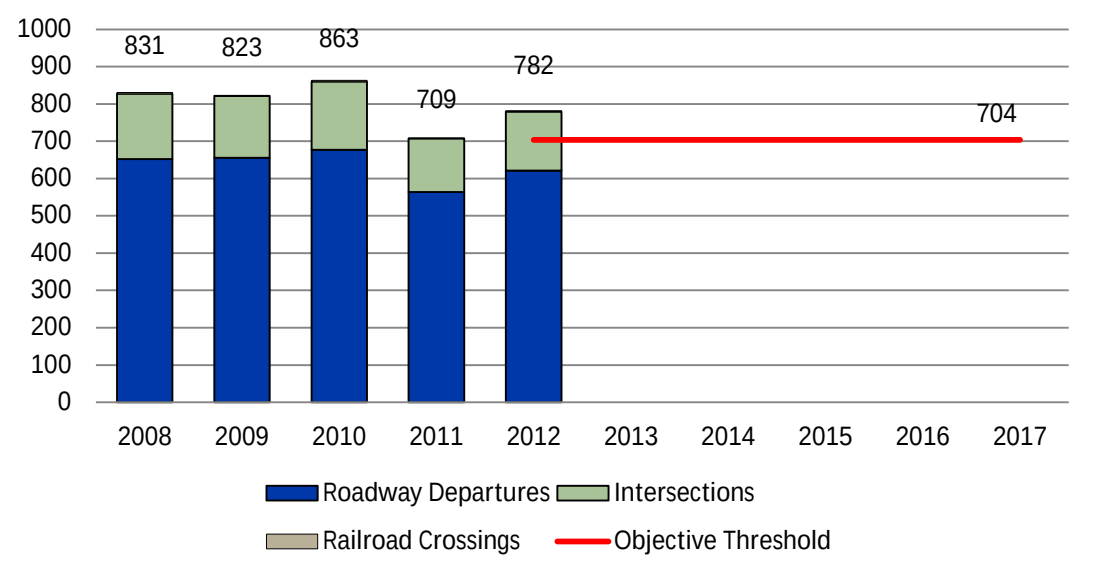
Goal and Objective

Emphasis Area Goal: The goal for this emphasis area is to reduce the number of fatalities and serious injuries resulting from crashes related to intersections, railroad crossings, and lane departures.

Emphasis Area Objective(s): Fatalities: Reduce the number of infrastructure related fatalities by 10% within the next five years.

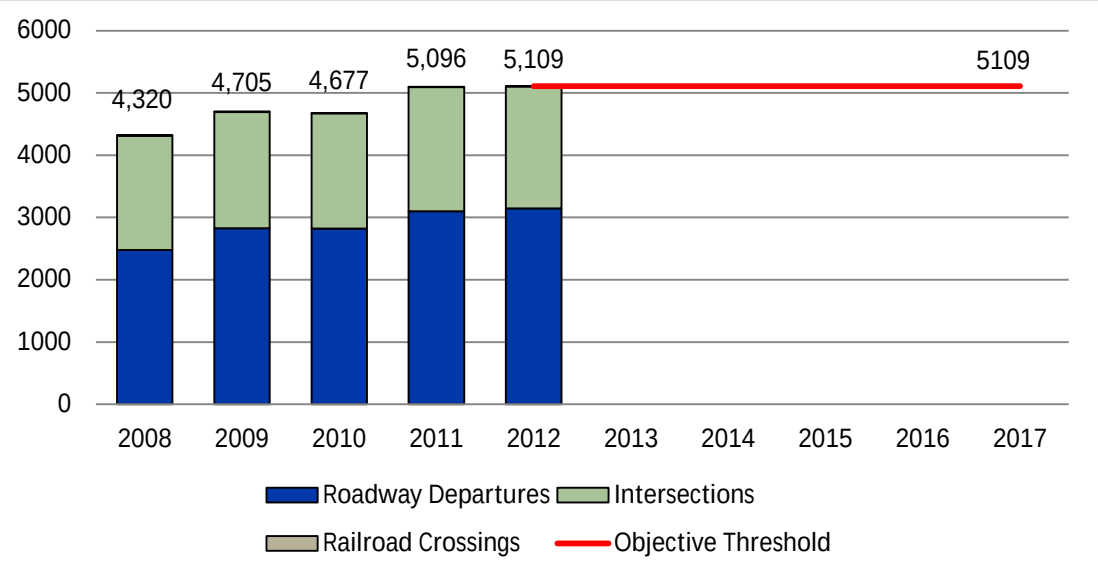
Serious Injuries: Reduce the current trend of increasing serious injuries by not exceeding the 2012 value of 5,109.

Figure 29 - Infrastructure Emphasis Area Fatality Objective



Source: TDOSHS[46]

Figure 30 - Infrastructure Emphasis Area Serious Injury Objective



Source: TDOSHS[47]

Strategies and Countermeasures

The basic strategy for this emphasis area is to continue reducing the number and severity of intersection, railroad, and roadway-departure type crashes by implementing unique and creative safety solutions. These include Road Safety Audits (RSAs), various action plans, safety initiatives, enhanced enforcement of traffic laws and educational programs.

The strategies and countermeasures below are not specific to any particular roadway classification, unless noted. However, due to the existing condition of rural roadways in the state in comparison to those in urban areas, there are more needs for improvement in rural areas. For this reason, most general strategies are currently applied more in rural areas than urban. This will remain the case under this Plan, with additional focus on improvements to rural roadways in recognition of the analysis shown on page 18, which shows a larger occurrence of fatal crashes occurring on rural roadways.

Strategy 1 - Reduce the likelihood and severity of crashes involving vehicles departing the travel lane at high crash locations by improving roadway geometry, roadway pavement surfaces, roadsides, roadside barriers, and traffic control devices.	
1.1 Road Safety Audits (RSAs) – Identify and review roadway segments with disproportionate occurrences of roadway departure related crashes. Fund and prioritize improvements to these segments through federal-aid and state-aid roadway departure safety programs based on the number and severity of fatal and injury crashes on interstate, state and local routes.	
1.2 Roadway Departure Action Plan – Develop and implement TDOT-funded roadway departure improvement plans to enhance safety along deficient roadway segments of interstate, state and local routes. Provide safety features in plans such as centerline, edge line and shoulder rumble strips and stripes; signing (including advisory speed plates) and pavement marking; reflectorized snowplowable pavement markers; alignment and object delineation; cable barrier installation; asphalt pavement safety edge installation; and other appropriate measures.	
1.3 High-friction Surface Safety Initiative – Identify road segments of interstate and state routes such as horizontal curves, steep grades and intersection approaches where drivers brake excessively and prematurely "polishes" the pavement or bridge surface which reduces the surface friction and leads to skidding. Develop plans for such road segments to replace the pavement surface with skid resistant high-friction pavement surface and to install skid resistant high-friction surface overlay to bridge decks.	
1.4 Shoulder Widening Program – Identify and prioritize, by the number of fatal and serious injury crashes, rural state route segments with shoulder widths of less than two feet and speed limits of 45 MPH or more. Develop plans to include shoulder widening to two or more feet and to pave the shoulders.	

1.5 Local Roads Safety Initiative (LRSI) – Identify and review roadway segments of local non-state routes in counties or sections of counties not represented by a MPO with disproportionate occurrences of fatal and serious injury crashes per mile. Fund and prioritize safety improvements to these segments through federal-aid safety programs based on the number and severity of fatal and injury crashes per mile on these routes.	

Strategy 2 - Reduce the likelihood and severity of intersection-related crashes with improvements to intersection geometry, traffic control, and visibility.	
2.1 Road Safety Audits (RSAs) – Identify and review intersections at local and state routes with disproportionate occurrences of fatal and injury crashes. Fund and prioritize such intersections based on the number and severity of these crashes; and develop plans to reduce conflicts in traffic flow by improving geometry, traffic control, roadway lighting, pedestrian accommodations and other appropriate measures.	
2.2 Intersection Action Plan – Identify and review stop-controlled and yield-controlled intersections on state routes with a history of four or more crashes occurring within a three-year time period, and develop plans to improve intersection signing and pavement marking and to install object delineation at such sites.	
2.3 Spot Safety Program – Initiate safety studies by regional TDOT Traffic Engineers of state route intersections located within cities or towns with populations of less than 50,000. Develop limited-cost safety projects for eligible sites to install a traffic signal, fix a sight distance problem, add turn lanes with or without a traffic signal, install a flashing beacon or install school flashing signals.	
2.4 Partial Cloverleaf Safety Initiative – Identify and review such interstate, freeway and expressway interchanges where the entrance and exit ramps are in close proximity which could result in wrong-way movements onto the mainline facility. Develop plans to include skip line and arrow pavement markings, Do Not Enter and Wrong-Way signs with red reflective posts, and roadway directional signs to address these deficiencies.	
2.5 Wrong-Way Vehicle Detection Initiative – Identify interchange exit ramp locations with a history of wrong-way vehicle entries and apply Intelligent Transportation System (ITS) solutions to detect wrong-way vehicles and to use this information to flash wrong-way signs, to change dynamic message signs (DMS) to warn oncoming traffic of the presence of a wrong-way vehicle, and to notify law enforcement of such a vehicle.	
2.6 Incorporate countermeasures from intersection safety programs into the TDOT Traffic Design Manual and TDOT Roadway Design Standard Drawings, as appropriate.	
2.7 Develop a program to inventory and bring up to the MUTCD standards the shape, color, dimensions, legends, borders, and minimum retroreflectivity or illumination of roadway regulatory, warning, and guide signs on Tennessee roadways.	

Strategy 3 - Reduce the likelihood of conflict between trains and vehicles at railroad crossings with improvements to geometry, traffic control and visibility.
3.1 Section 130 Program – Review and select railroad crossing safety projects based on crash prediction models which consider past crash experiences, number of trains, train speeds and number of cars at crossing sites. Develop project proposals which may include flashing lights, gates, warning time adjustments, geometric improvements, signing, pavement markings, and other safety measures at crossing sites.
3.2 23 CFR 646 Investigations – Review and make recommendations for any highway-railroad crossing within the limits or near the terminus of any federal-aid new or reconstruction highway project. Recommendations to such projects may include railroad-related signing and pavement markings, flashing lights, gates, warning time adjustments, geometric improvements, and other railroad crossing safety measures.

Strategy 4 - Educate roadway users and local agencies to the factors contributing to intersection, roadway departure and railroad crossing crashes. Raise awareness of roadway users to the importance of observing traffic control and adhering to traffic laws.
4.1 Develop an educational campaign to increase safety awareness at intersections, roadway segments and railroad crossings.
4.2 Develop and implement programs to focus law enforcement at intersections and along roadway segments with high occurrences of serious injury or fatal crashes.
4.3 Utilize Tennessee Transportation Assistance Program (TTAP) to train local agencies and practitioners on identification of safety concerns and improvement options at roadway intersections, railroad crossings, and roadway segments.

Strategy 5 - Reduce the lengths of interchange exit ramp queues with improvements to interchange off-ramp capacity, geometry, and visibility.
5.1 Road Safety Audits (RSAs) – Identify and review interchange exit ramp sites on interstate highways and freeways where ramp queue lengths are long enough to block an interstate highway or freeway through lane during peak traffic times.
5.2 Ramp Queue Program – Identify safety and capacity improvements to interchange exit ramps on interstate highways and freeways where ramp queue lengths are excessive during peak traffic times. Fund and develop plans to implement safety and capacity improvements to such interchange off-ramps.

Strategy 6 - Improve the safety of senior drivers by reducing roadway geometric deficiencies and enhancing roadway visibility on state and interstate highways.
6.1 Identify intersections on state highways with geometric and visual deficiencies, and provide geometric and visual measure improvements recommended in the *Highway Design Handbook for Older Drivers and Pedestrians*. Fund and prioritize improvements based on the number and severity of fatal and injury crashes at these intersections.
6.2 Identify interchange ramp locations on interstate highways and freeways with disproportionate occurrences of merging and weaving crashes, and provide geometric and visual measure improvements recommended in the *Highway Design Handbook for Older Drivers and Pedestrians*. Fund and prioritize improvements based on the number and severity of fatal and injury crashes at these sites.
6.3 Identify horizontal and vertical curvatures on segments of state and interstate routes with disproportionate occurrences of crashes, and provide geometric and visual measure improvements recommended in the *Highway Design Handbook for Older Drivers and Pedestrians*. Fund and prioritize improvements based on the number and severity of fatal and injury crashes at these sites.
6.4 Identify inconspicuous passive railroad crossings and provide visual measure improvements recommended in the *Highway Design Handbook for Older Drivers and Pedestrians*.
6.5 Review TDOT Standard Drawings and incorporate recommendations contained in the *Highway Design Handbook for Older Drivers and Pedestrians* as appropriate.
6.6 Develop a program to inventory and bring up to the MUTCD standards the shape, color, dimensions, legends, borders, and minimum retroreflectivity or illumination of roadway regulatory, warning, and guide signs on Tennessee roadways.

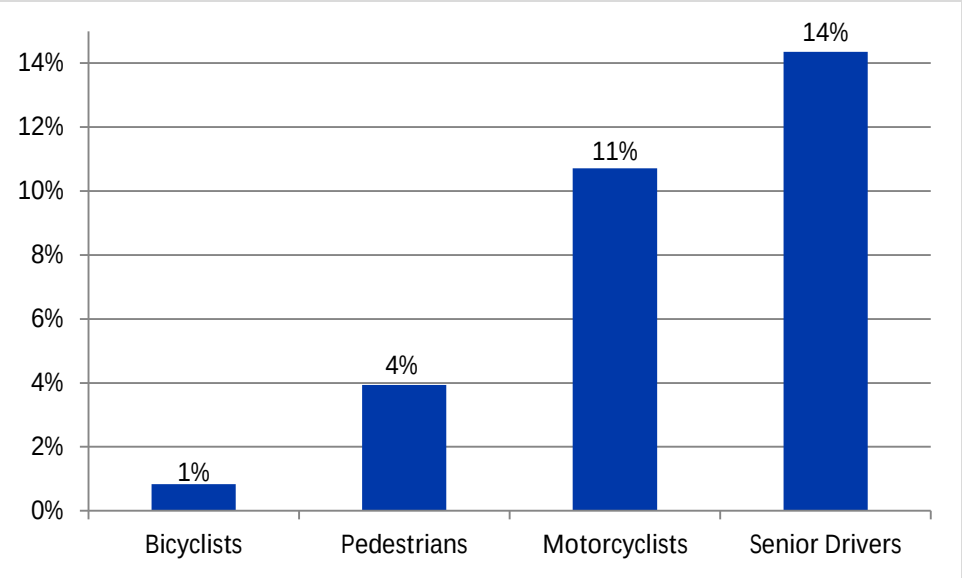
VULNERABLE ROAD USERS EMPHASIS AREA PLAN

BACKGROUND AND OVERVIEW

All road users are at risk of suffering either a serious injury or fatality when involved in a crash. However, the risk of such an outcome for certain groups of road users is greater due to factors such as age, type of vehicle occupied, or mode of transportation. The users with the greatest probability of suffering a serious injury or fatality due to a crash are referred to as vulnerable road users.

People using non-motorized modes of transportation (bicyclists and pedestrians), motorcyclists, and senior drivers (drivers who are 65 years or older) are classified among those groups considered to be vulnerable road users. Together, crashes related to these four road user groups accounted to 409 (40%) of the total fatalities and to 1,993 (26%) of the total serious injuries that occurred in Tennessee in 2012. The percentage of related fatalities and serious injuries that involved each of these road user groups from 2008 to 2012 is illustrated in Figure 31.

Figure 31 - Vulnerable Road User Fatalities and Serious Injuries by Group (2008-2012)



Source: TDOSHS[48]

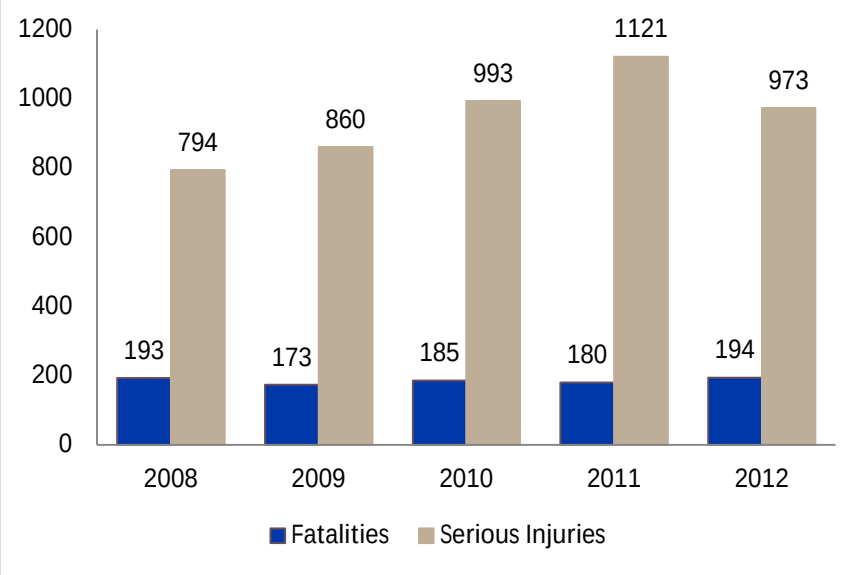
Senior Drivers

The senior driver population is represented significantly when crash rates are calculated based on miles traveled, fatality rate per crash, or number of crashes per 100 thousand licensed drivers. Nationally, senior drivers aged 65 to 74 represented an involvement rate of 14.4 fatal crashes per 100 thousand licensed drivers of that age group in 2011. That rate increased, however, for senior drivers older than age 74 to an involvement rate of 18.0 fatal crashes per 100 thousand licensed

drivers of that age group during that year.[49] According to the National Cooperative Highway Research Program, drivers age 65 and over represent an increasing proportion of the driving population. By 2030, one in five Americans will be age 65 or older.[50] As people age, a decline in sensory, cognitive, or physical functioning can have an impact on their driving skills, as well as increase their vulnerability to injury once involved in a crash.

Crashes involving senior drivers accounted for 194 (19%) of the total fatalities and 973 (13%) of the total serious injuries resulting from crashes occurring in Tennessee in 2012. As shown in Figure 32, virtually no increase was observed from 2008 to 2012 for the number of fatalities involving senior drivers. However, an increase was observed for the number of serious injuries involving senior drivers over the same time period.

Figure 32 - Fatalities and Serious Injuries involving Senior Drivers (2008-2012)



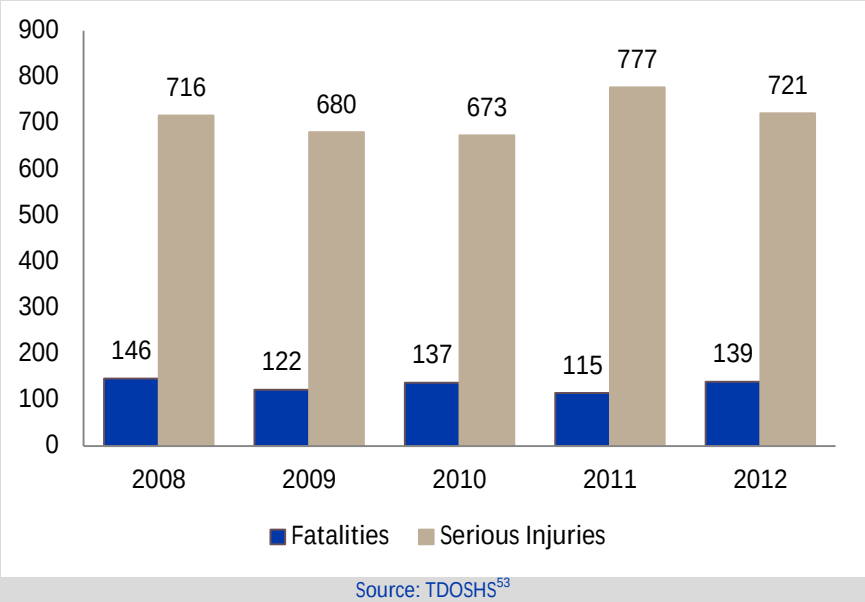
Source: TDOSHS[51]

Additionally, the senior population statistics shown on page 17 of the SHSP show an increasing trend for fatalities and serious injuries per capita for drivers and pedestrians ages 65 or older. The increase shown over the most recent two years of complete data (from 2009 to 2011) will mandate strategies and countermeasures specific to senior drivers under Section 148 of MAP-21 to address the increase. Recently, a program has been initiated that is focused on reducing fatalities and serious injuries for this population group. This program, the Yellow DOT Program, is detailed in the Operational Improvements Emphasis Area Plan on page 59. The program assists first responders at the scene of an emergency on Tennessee's roadways with vital medical information of participants in need of emergency medical treatment. Seniors need to be educated on the use and benefits of the program.

Motorcycles

Nationally, statistics using 2011 data show that 14% of all fatalities and 12% of all serious injuries result from crashes involving motorcycles.[52] Tennessee crash data from 2012 yielded similar findings with crashes involving motorcycles accounting for 139 (14%) of the total fatalities and 721 (10%) of the total serious injuries. The yearly totals for fatalities and serious injuries from 2008 to 2012 are shown in Figure 33. As shown in the figure, a slight decreasing trend was observed for the number of fatalities involving motorcycles while the number of serious injuries involving motorcycles exhibited almost flat growth, increasing by a minimal amount over the same time period.

Figure 33 - Fatalities and Serious Injuries involving Motorcycles (2008-2012)



Source: TDOSHS[53]

While these are modest improvements in fatality statistics, addressing safety concerns unique to motorcyclists would greatly aid in reducing the probability of fatality and serious injury. Of these concerns, motorcycle awareness by other vehicles is considered to be the most predominant. It is estimated that approximately 48% of crashes on Tennessee roadways involving motorcycles resulted from right-of-way violations by another vehicle.[54] Motorists must exhibit proper awareness, providing sufficient room for motorcycles to operate safely as required by roadway conditions and to make certain that no motorcycle traffic is in conflict with a motorist's lane change.

Non-Motorized Road Users

Approximately one-third of Americans does not drive because of age, disability, license restrictions, or choice, and thereby rely on other methods of transportation. Bicycling and walking not only provide physical health benefits, but they are also important transportation options.[55] Public transit, which is primarily reached by foot and bicycle, has experienced increased use during the past few years.[56] Non-automobile trips serve to reduce the roadway burden for motorized vehicular trips and help to alleviate congestion and improve air quality. In addition, data increasingly demonstrates that roadways with facilities for walking and bicycling, such as sidewalks and bicycle lanes, have lower crash rates for all modes, including motorized modes.

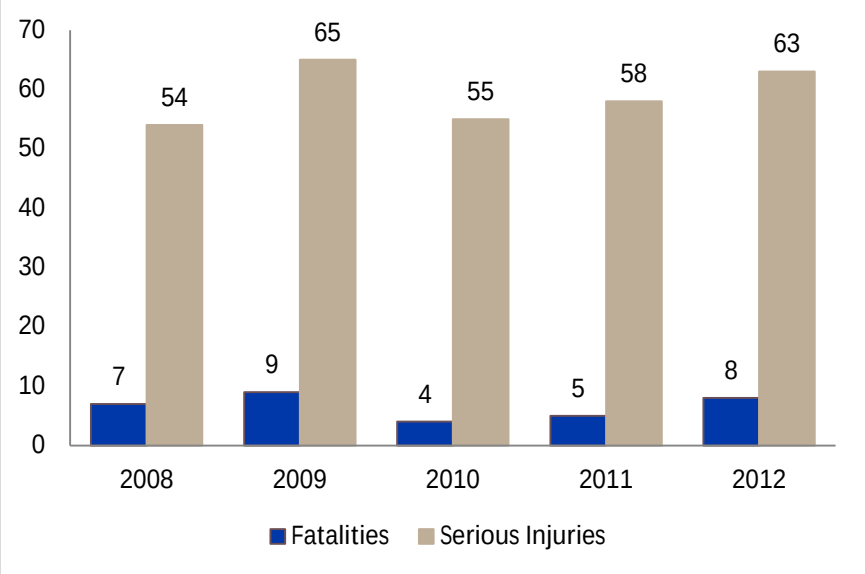
Non-motorized users are the most vulnerable users of our transportation system and are more at risk of injury or fatality if involved in a crash with a motor vehicle. Total traffic deaths have declined significantly in Tennessee over the last ten years, but progress in reducing non-motorized fatalities has been inconsistent as shown in Figures 34 and 35. Tennessee must ensure safety issues for these users are identified and addressed. Drivers of motorized vehicles must exhibit appropriate driver behavior by sharing the road safely with bicyclists and pedestrians.

Bicyclists

In 2012, crashes involving bicyclists accounted for 8 (1%) of the total fatalities and 63 (1%) of the total serious injuries resulting from crashes occurring in Tennessee. For comparison, the 2011 national bicycle related fatality and serious injury percentages were 2% of all fatalities and 4% of all serious injuries resulting from a crash involving bicyclists.[57] From 2008 to 2012, the number of fatalities involving bicyclists has remained relatively constant while the number of serious injuries involving bicyclists has increased. The yearly total number of fatalities and serious injuries over this time period is provided in Figure 34.

Tennessee state law considers bicyclists to be vehicles when operated on the roadway and requires bicyclists to obey the same traffic rules as motorists. Bicyclists who do not obey traffic rules put themselves and other roadway users in danger. Bicyclists should ride in the appropriate lane of travel and should obey all traffic laws. Motorists by law (Jeff Roth and Brian Brown Bicycle Protection Act of 2007), must allow a minimum of three feet when passing a bicyclist, and by this law allow a bicyclist to take the entire lane if the lane is too narrow for motorists to safely pass the bicyclist within the lane. Motorists by law must exhibit due care when driving and should be mindful of other modes, and should never force a bicyclist to a shoulder in order to pass or use other aggressive means to force a bicyclist from their position on the roadway.

Figure 34 - Fatalities and Serious Injuries involving Bicyclists (2008-2012)



Source: TDOSHS[58]

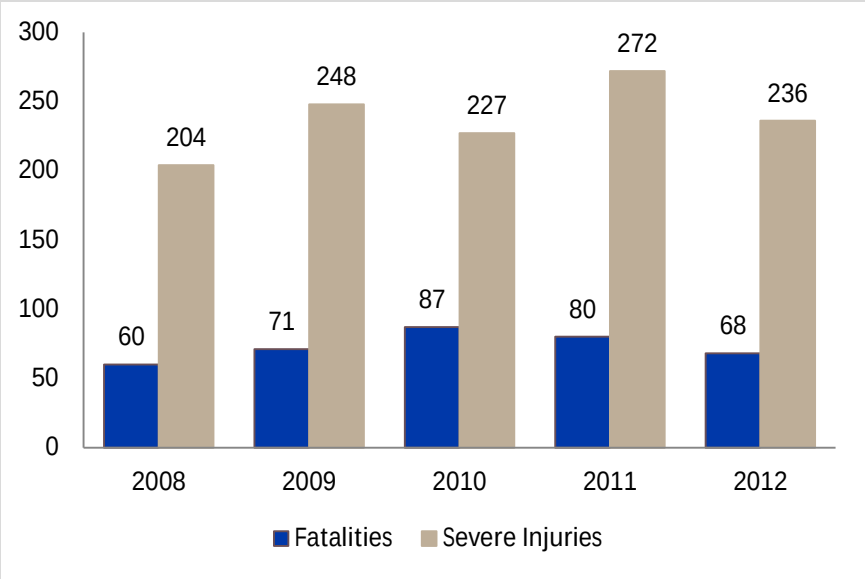
Pedestrians

Crashes involving pedestrians accounted for 68 (7%) of the total fatalities and 236 (3%) of the total serious injuries resulting from crashes occurring in Tennessee in 2012. For comparison, the 2011 national pedestrian related fatality and serious injury percentages were 14% of all fatalities and 7% of all serious injuries resulting from a crash involving a pedestrian.[59] As shown in Figure 35, an increasing trend was observed from 2008 to 2012 for both the number of fatalities involving pedestrians and the number of serious injuries involving pedestrians. Urban areas should receive a focus for pedestrian safety improvements since nationally and in Tennessee they have experienced a higher percentage of fatalities and serious injuries to pedestrians than rural areas.[60] The yearly total number of fatalities and serious injuries over this time period are provided in Figure 35.

Pedestrians must walk in designated areas such as sidewalks and pathways when available along roads; it is unlawful for pedestrians to walk in a road where there are accessible sidewalks and

pathways available. If there are no sidewalks or pathways along a road that is not access controlled, pedestrians should walk on the left side of such a road facing traffic so that they can see any sudden dangers coming towards them. Pedestrians should also walk in single file and not side by side of each other on such roads. Motorists should yield to pedestrians crossing at intersections, even at ones where marked cross walks do not exist. Pedestrians as well as bicyclists are prohibited from using interstates and most other access controlled highways (Tennessee Code Annotated §55-8-127).

Figure 35 - Fatalities and Serious Injuries involving Pedestrians (2008-2012)



Source: TDOSHS[61]

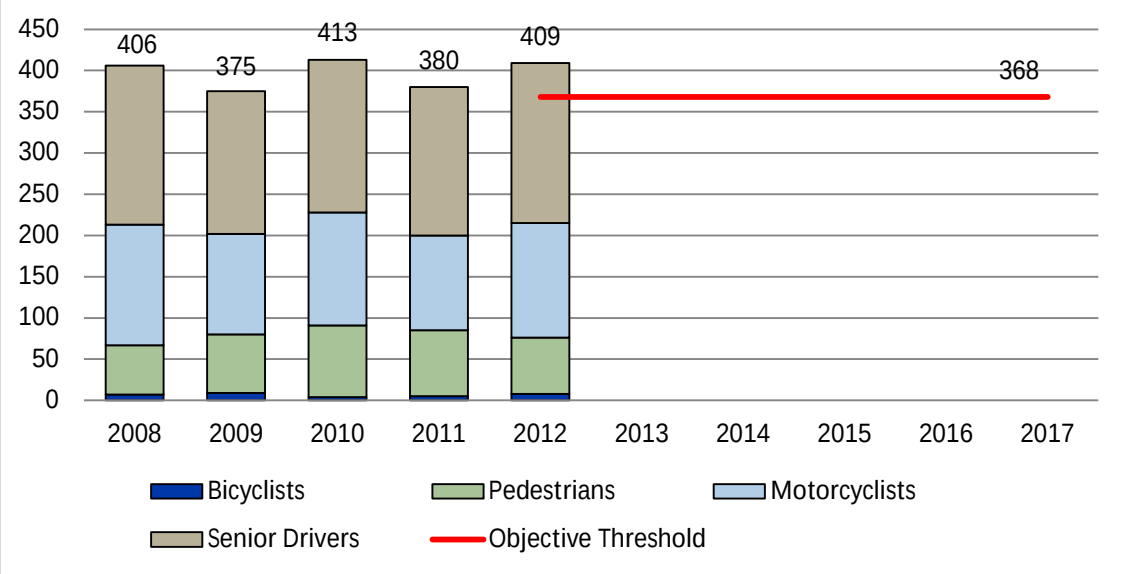
Goal and Objectives

Emphasis Area Goal: Create safer roadway environments for travel by vulnerable user.

Emphasis Area Objective(s): Fatalities: Reduce the total number of fatalities involving these vulnerable road users by 10% within the next five years.

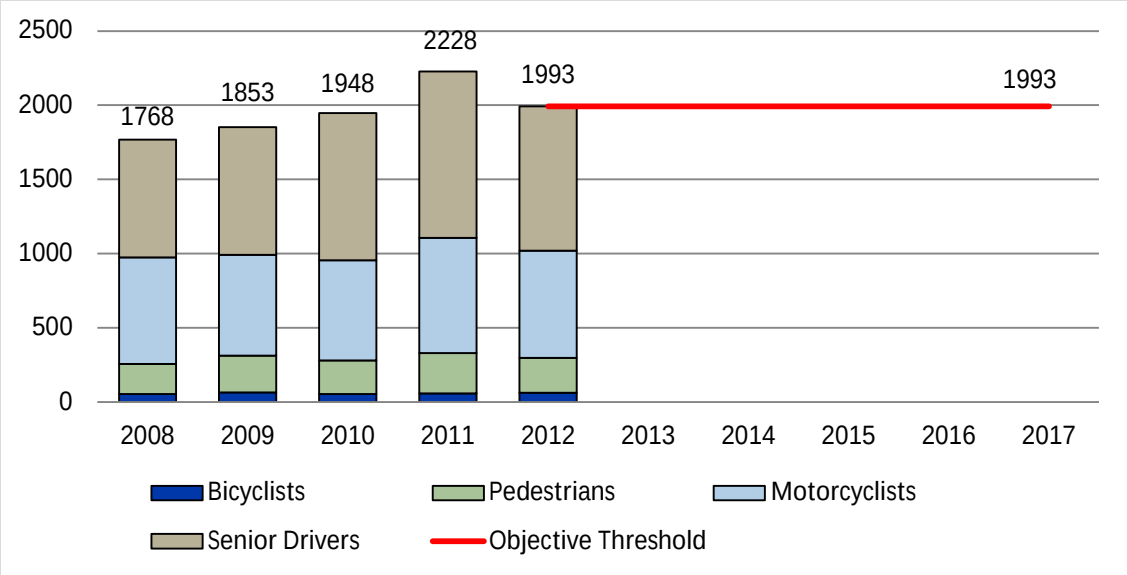
Serious Injuries: Reduce the current trend of increasing serious injuries by not exceeding the 2012 total value of 1,993 for these groups.

Figure 36 - Vulnerable Road Users Emphasis Area Fatality Objective



Source: TDOSHS[62]

Figure 37 - Vulnerable Road Users Emphasis Area Serious Injury Objective



Source: TDOSHS[63]

Strategies and Countermeasures

The following strategies and countermeasures are targeted at improving roadway conditions and driver behavior for a safer transportation system for vulnerable road users. These strategies and countermeasures will be applied statewide as appropriate and will be coordinated with the short-term and long-range transportation needs of the Tennessee's MPOs and RPOs. In recognition of

the data analysis presented in this plan for senior drivers and pedestrians, effort will be focused to best address their specific needs where possible. There will also be effort in general to identify, through additional data analysis and agency coordination, rural areas that present a greater need for application of these strategies and countermeasures. In regard to pedestrians specifically, attention will be paid to urban areas with higher occurrence of pedestrian related crashes.

Strategy 1 - Improve infrastructure for bicyclists and pedestrians.
1.1 Maintain, improve, and install bicycle and pedestrian facilities through bicycle and pedestrian specific projects and in conjunction with other roadway and safety improvement projects.
1.2 Classify roadway types around the state that are at higher risk for bicycle and pedestrian crashes. Implement infrastructure strategies to make improvements on these roadways before bicycle and pedestrian fatalities or serious injury crashes occur.
1.3 Coordinate with MPOs, RPOs, cities and counties across the state to ensure that roadway policies and projects prioritize safety for all modes, especially bicyclists and pedestrians. Encourage the adoption and utilization of Complete Streets policies.
1.4 Design and construct bicycle and pedestrian facilities in accordance to current applicable laws and regulations, utilizing best practices, guidance, and standards published by TDOT, FHWA, other government agencies, and organizations of transportation professionals.
1.5 Continue to implement Safe Routes to Schools projects to improve bicycle and pedestrian infrastructure utilized by students.

Strategy 2 - Increase awareness of vulnerable road users.
2.1 Continue to support federal, state and local Safe Routes to School Programs which teach students how to safely walk and bicycle to school and raise awareness for motorists about traveling safely through school zones.
2.2 Encourage drivers' education classes that teach motorists to look for and share the road safely with vulnerable user groups. Work with institutions of higher learning to create classes on campuses.
2.3 Promote bicycle and pedestrian laws such as: Share the Road, Give 3 Feet When Passing, Bicycles May Use Full Lane, and Yield to Pedestrians in Crosswalks. Develop public information and education campaigns targeting all drivers - especially distracted drivers - as well as continuing ongoing campaigns for motorcycle safety awareness, sharing the road with non-motorized users, and other highway safety issues.
2.4 Continue to offer, encourage, and endorse bicycle and pedestrian safety education through written materials, web based information, training courses, and pre-established initiatives.

Strategy 3 - Improve safety of vulnerable road users on existing routes.
3.1 Coordinate with transit operators to place transit stops near intersections so that transit users can safely and legally access the transit stop.
3.2 Ensure that all modes have safe alternative routes during construction, including routes for bicyclists and pedestrians.

Strategy 4 - Increase the effectiveness of enforcing current laws protecting vulnerable road users.
4.1 Increase enforcement of distracted driving laws.
4.2 Provide law enforcement agencies training about the laws that apply to bicyclists and pedestrians and sharing the road with bicyclists and pedestrians. Include information on ticketing and the adjudication process.
4.3 Encourage officers to enforce laws pertaining to bicycle and pedestrian travel by recognizing law enforcement efforts at the annual Tennessee Lifesavers Conference.
4.4 Enforce school zone speed limits. School zone speeds/enforcement/education is an important strategy to keep children safe on the way to/from school.

Strategy 5 - Assess growing needs and concerns of vulnerable road users.
5.1 Conduct bicycle and pedestrian count programs as part of turning movement count collections and other count efforts to contribute to the knowledge base of bicycle and pedestrian usage in the state and to assist with bicycle and pedestrian crash rate calculation.
5.2 Support research of bicycle and pedestrian safety issues in Tennessee.
5.3 Investigate the need to analyze bicycle and pedestrian crash data, especially on state routes, associated with a nearby transit stop to determine if specific improvements may be needed for safe access to transit facilities.

Strategy 6 - Improve and strengthen laws pertaining to vulnerable road users.
6.1 Strengthen the Due Care law to ensure that aggressive driving against non-motorized roadway users is illegal and enforceable.
6.2 Issue citations in school zones for speeding and use fines for bicycle and pedestrian safety education in school zones.
6.3 Amend legislation so that bicyclists may use either the left or right hand to signal a right turn.
6.4 Strengthen the 3-Foot law (Jeff Roth and Brian Brown Bicycle Protection Act) to make it easier for law enforcement to cite and enforce the law.
6.5 Pursue legislation to allow restricted licenses for medically at-risk drivers.
6.6 Amend legislation to better address distracted drivers and pedestrians.

Strategy 7 - Pursue programs in accordance with NHTSA Highway Safety Program Guideline No. 13 to reduce the frequency and severity of crashes involving senior and medically at-risk drivers and pedestrians.
7.1 Provide senior driver and medically at-risk driver training for local TDOSHS license examiners.
7.2 Pursue legislation to require in-person driver license renewal and vision testing for older drivers every five years starting at age 75.
7.3 Pursue educational and public relations programs to educate, inform and encourage mature and senior drivers (ages 55 or older) to participate in Tennessee's Yellow DOT program.
7.4 Encourage efforts to link seniors to transit systems with infrastructure for adequate accessibility and increased awareness of public, nonprofit, and private transportation alternatives to driving.
7.5 Investigate a communications and educational plan for assisting local entities in the deployment of the guidelines and recommendations to accommodate older drivers and pedestrians.

Walk with Me Tennessee

SafeRoutes
Tennessee Safe Routes to School

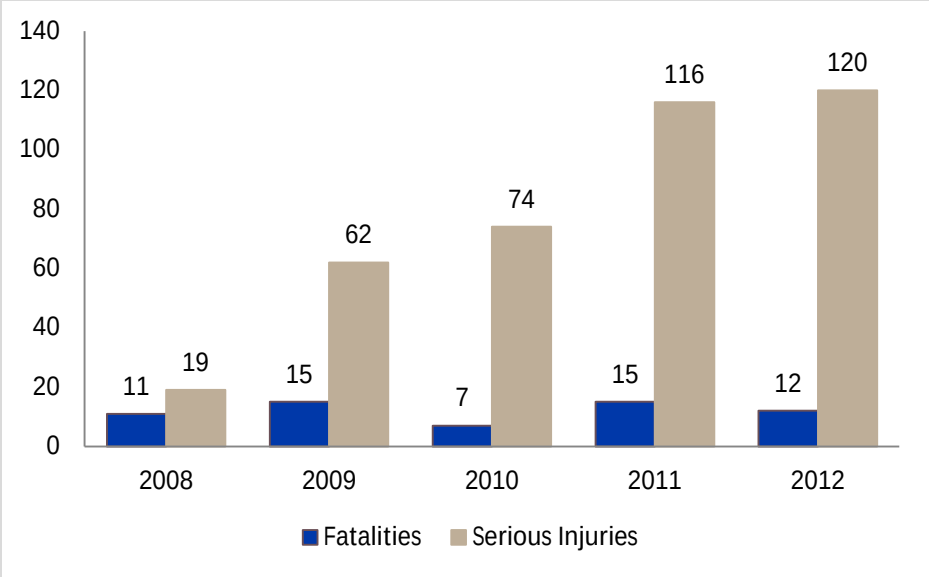
OPERATIONAL IMPROVEMENTS EMPHASIS AREA PLAN

Work Zone Safety

Congestion will continue to grow as vehicle miles of travel increase on Tennessee roadways. Work zone activity is expected to increase with many highways that are aging and in need of repair, which results in an increasing exposure to motorists and highway workers. The majority of road work now takes place on existing roads that are carrying traffic and often congested. Work zones on freeways now account for an estimated 24% non-recurring delays.[64] A combination of recent studies indicates that approximately 50% of all highway congestion is attributed to non-recurring conditions, such as traffic incidents, weather, and work zones.[65]

Figure 38 shows the total number of fatalities and serious injuries occurring in work zones from 2008 to 2012. As shown in the figure, the number of fatalities occurring in work zones has remained fairly constant while the number of serious injuries in work zones over that same time period has steadily increased. In 2012, crashes occurring in work zones accounted for 1% of the total fatalities and 2% of the total serious injuries occurring on Tennessee roadways. Nationally, work zone related fatalities account for 2% of the total fatalities in 2011.[66]

Figure 38 - Work Zone Related Fatalities and Serious injuries (2008-2012)



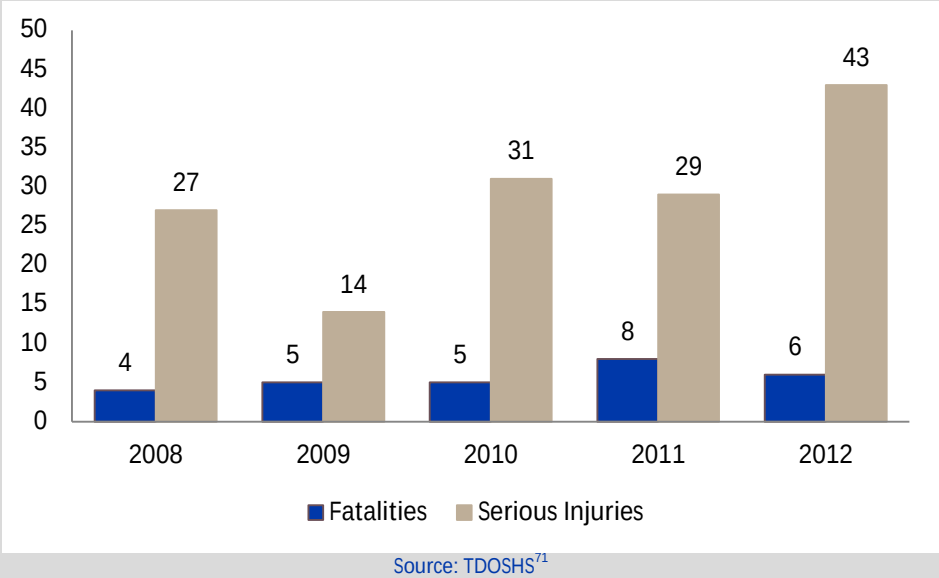
Source: TDOSHS[67]

TDOT places emphasis on addressing the broader impacts of work zones through the development of policies and guidelines that target the key areas of safety, operations, congestion, public information, and outreach. The *TDOT Work Zone Safety and Mobility Manual* defines the processes by which major aspects of applicable work zones are established. The manual promotes coordination between all organizations involved in work zone development and provides guidance for implementation of the requirements set forth in *The Final Rule on Work Zone Safety and Mobility*.[68] Proactively managing traffic during construction is necessary to minimize traffic delays, maintain motorist and worker safety, complete roadwork in a timely manner, and maintain access for businesses and residents.

Incident Management

A combination of recent studies indicate that approximately 50% of all highway congestion is attributed to non-recurring conditions, such as traffic incidents, weather, road maintenance, and special events.[69] Incidents such as vehicle crashes, stalled vehicles, highway facility failure, and weather related road hazards have the potential for danger to travelers on Tennessee's roadways. Such incidents and roadway conditions create a temporary work zone and can lead to extensive delays and large roadway queues, increasing the probability of the occurrence of a crash or a secondary crash. The Federal Highway Administration estimates that approximately 20% of highway crashes are secondary incidents and that 18% of these result in fatal crashes.[70] Figure 39 shows data indicating the total number of fatalities and serious injuries occurring as a result of secondary crashes from 2008 to 2012. As shown in the figure, the number of fatalities resulting from secondary crashes has remained fairly constant while the number of serious injuries over that same time period has increased.

Figure 39 - Secondary Crash Fatalities and Serious injuries (2008-2012)



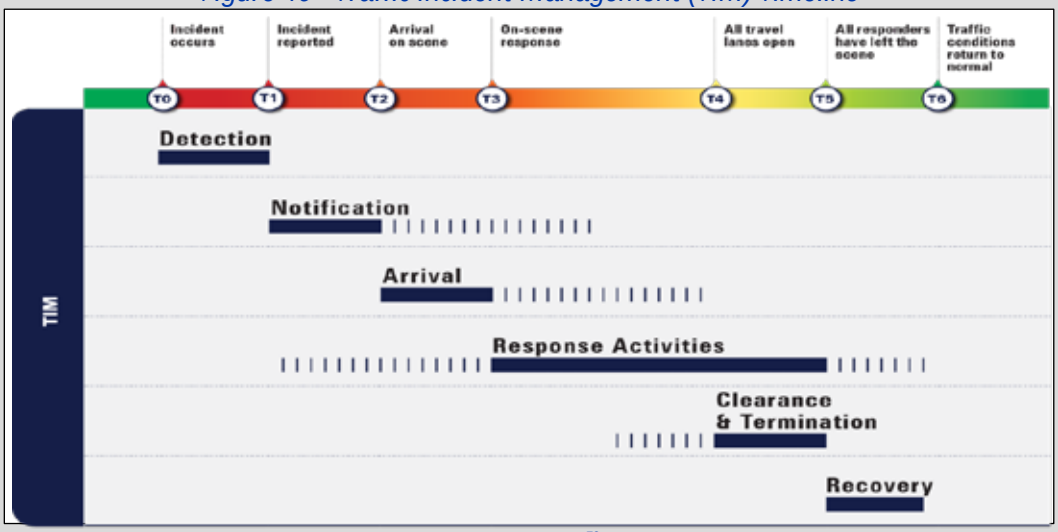
Source: TDOSHS[71]

Enhanced Reference Markers (ERM), also referred to as Emergency Reference Markers, are placed along controlled access highways to provide precise route, direction and mile marker location each two-tenths of the mile to motorist for travel information and for use in reporting emergencies to 911 Centers, the Department of Transportation, and other response agencies. The precise information provided by ERM is essential in timely response to crashes and other major incidents to assure proper resources are dispatched to the correct location as quickly as possible.

Timely action by emergency responders is a key factor in minimizing injury and potential fatalities. Coordination, communication, and collaboration among all agencies that respond to vehicle emergencies are essential. Quick clearance practices adopted by law enforcement, fire, emergency medical service (EMS), rescue squads, and transportation agencies can reduce hazards for responders by reducing the time emergency personnel are exposed to dangerous highway conditions in performance of their essential duties and rescue activities.

Emergency response to highway incidents has reached a high level of importance in Tennessee, with great emphasis on safe, quick clearance of lane closing and road closing crashes. This is accomplished through partnerships and coordination between agencies from transportation, law enforcement, fire and rescue, EMS, and the towing and recovery industry using the established Traffic Incident Management (TIM) process. As shown in Figure 40, the TIM encompasses all aspects of incident response from the occurrence of the incident to the return of normal conditions to the incident affected area. Also, milestones are set within the timeline to isolate certain activities to analyze the efficiency and effectiveness of methods used. Incident response partners are continually developing methods to improve emergency response in efforts to reduce fatalities and to provide safe working conditions for responders and a safe travel environment for motorists.

Figure 40 - Traffic Incident Management (TIM) Timeline



Source: FHWA[72]

TDOT places emphasis on developing partnerships with local, state and federal agencies to improve communication, cooperation, and coordination during major highway incidents. These collaborations have led to the adoption of FHWA's training and program enhancements derived from the Strategic Highway Research Program – Part 2 (SHRP2) initiatives. This has led to the creation of programs, such as TDOT's Protect the Queue Program, that look to increase the amount of trained and qualified personnel responding to an incident, establish better protocols to communicate between partners, and promote additional measures that will increase safety of motorists and responders within the affected area or improve the efficiency of clearing the incident.

Since 1999, the TDOT HELP program, which operates in Chattanooga, Knoxville, Memphis, and Nashville, has been a core component of the TDOT SmartWay Program. The purpose of SmartWay is to reduce traffic congestion, problems caused by congestion, and to improve operational efficiency, effectiveness, and safety on Tennessee's transportation system. HELP supervisors and operators work closely with local towing and recovery companies to ensure the safety of the public, which is their first priority, and to implement quick clearance of the roadways. The HELP Program will continue to be an important countermeasure for addressing traffic congestion and providing quick response for closed travel lanes, traffic control during major incidents, and queue protection operations.

To assist first responders in their job of saving lives in the event of an emergency on Tennessee's roadways, the Tennessee General Assembly passed a bill in 2012 creating a Tennessee Yellow DOT program (HB 2296). Tennessee is currently one of 10 states whose Department of Transportation is affiliated with a Yellow DOT program. This program is geared towards mature and senior drivers (ages 55 or older); however, anyone can participate in this program. The Tennessee Yellow DOT program is designed to alert first responders at the scene of a vehicle incident or other medical emergency on Tennessee's roadways that vital medical information is available in the vehicle's glove compartment, as indicated by a Yellow DOT decal on the vehicle's driver's side rear window. On motorcycles, the decal should be placed on the "triple tree" of the motorcycle frame and the packet is placed in the saddle bag/compartment. The information in the yellow packet can mean the difference between life and death in the "Golden Hour" immediately following a serious incident or emergency. Because the program is focused on senior drivers, it will be an important countermeasure to address the increased number of fatalities and serious injuries in this age group as required by Section 148 of MAP-21 for this plan (see page 17 for details).

Goal and Objective

Emphasis Area Goal:

Reduce the number of fatalities and serious injuries through effective, timely emergency response to highway crashes and other lane closing incidents.

Maximize safety in all Tennessee highway work zones for drivers and workers.

Emphasis Area Objective(s):

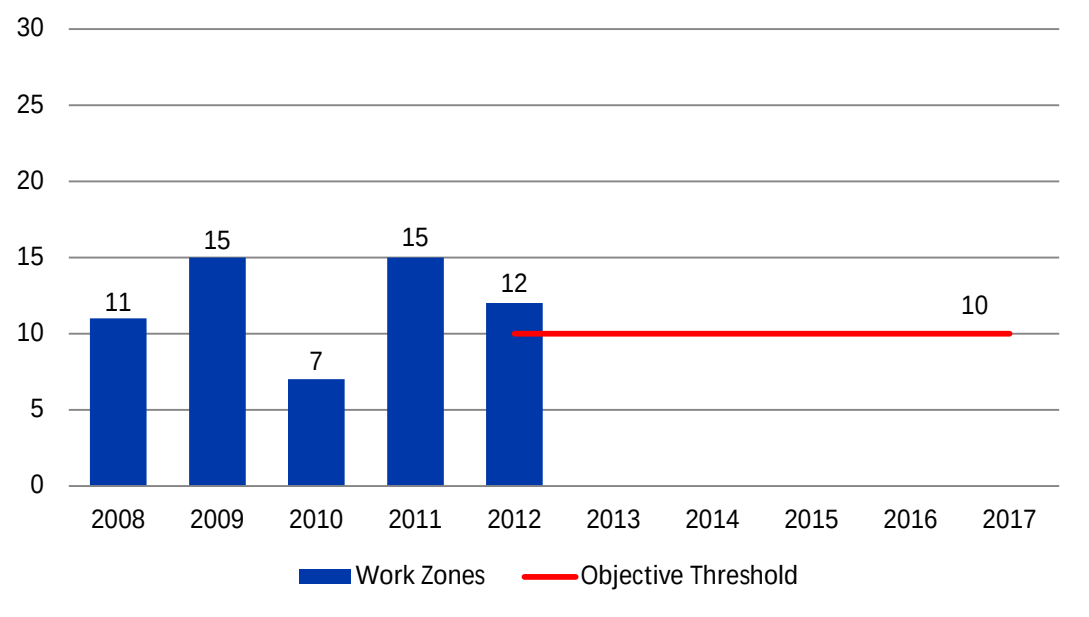
Fatalities: Reduce the number of fatalities occurring in work zones by 10% within the next five years.

Fatalities: Reduce the number of fatalities due to secondary crashes by 10% within the next five years.

Serious Injuries: Reduce the current trend of increasing serious injuries occurring in work zones by not exceeding the 2012 value of 120.

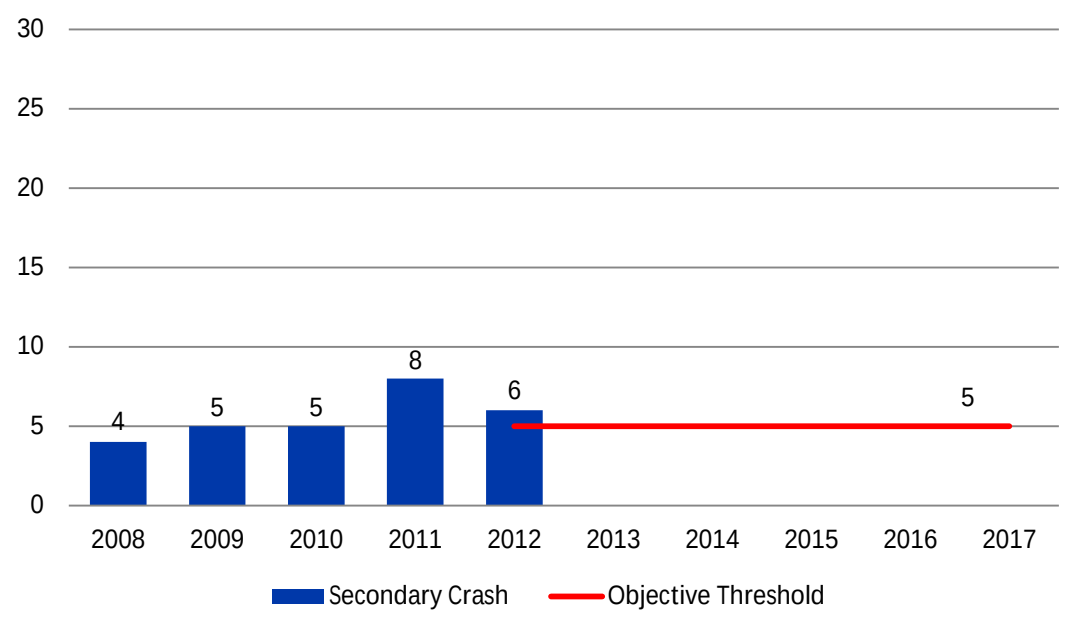
Serious Injuries: Reduce the current trend of increasing serious injuries due to secondary crashes by not exceeding the 2012 value of 43.

Figure 41 - Work Zone Fatality Objective



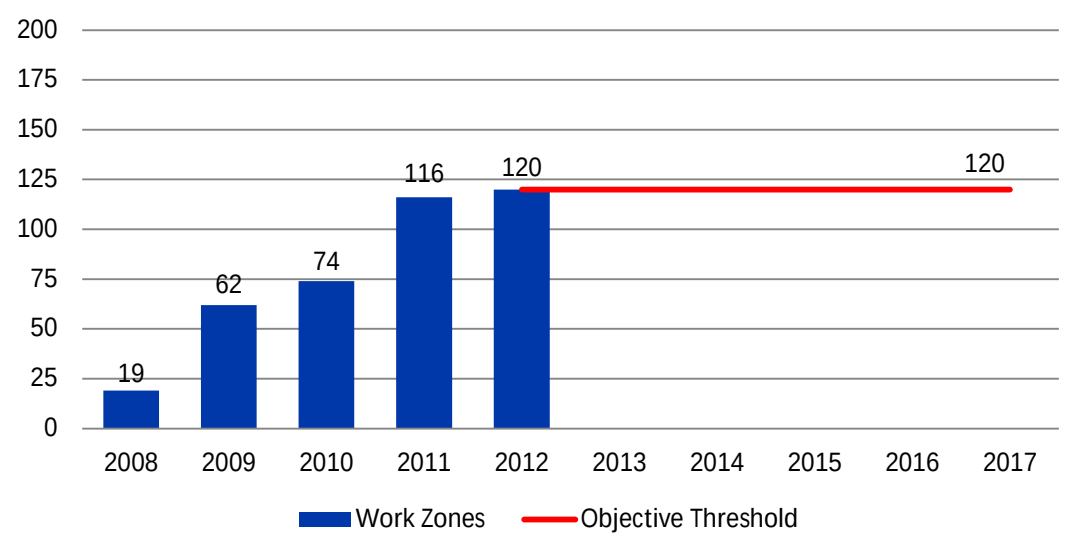
Source: TDOSHS[73]

Figure 42 - Secondary Crash Fatality Objective



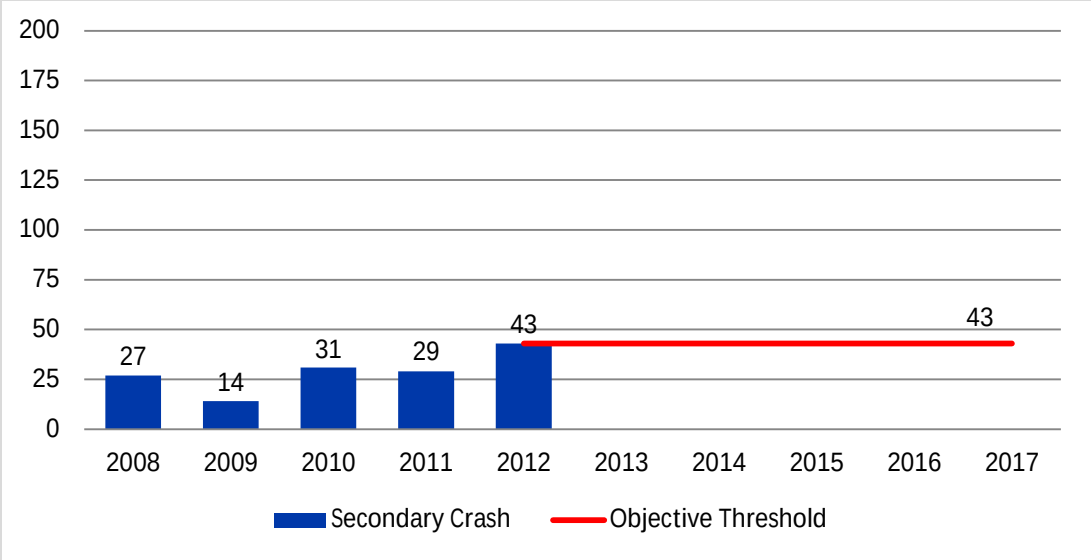
Source: TDOSHS[74]

Figure 43 - Work Zone Serious Injury Objective



Source: TDOSHS[75]

Figure 44 - Secondary Crash Serious Injury Objective



Source: TDOSHS[76]

Strategies and Countermeasures

Strategy 1 - Reduce the number and severity of secondary roadway crashes by effective emergency response.
1.1 TIM Responder Training Program – Equip incident responders such as TDOT's HELP operators and supervisors with a common set of core competencies as part of the FHWA SHRP2 program. Assist them in the areas of responder safety; safe, quick clearances; and prompt, reliable, and interoperable communications.
1.2 TIM Action Plan – Develop an incident response plan as part of the Transportation Systems Management and Operations (TSM&O) strategic plan to promote safe and efficient management and operation on highways to serve the mobility needs of people and freight.
1.3 TDOT Protect the Queue Program – Place emphasis on this program to provide advance motorist information when traffic is slowed or stopped upstream from a highway incident or work zone.

Strategy 2 - Develop inter-agency memorandums of understanding.
2.1 Partner with all state and local jurisdictions to improve emergency response, to provide quick clearance of incidents, and to enhance inter-agency communication.
2.2 Develop inter-disciplinary training and joint exercises through participation in the FHWA SHRP2 training curriculum.

Strategy 3 - Improve incident response and reduce the clearance time for crashes.
3.1 Improve communications between 911 centers and first responders.
3.2 Establish TIM Committees in each county or region of the state.
3.3 Develop plans for, construct, and maintain an incident management test track for the training of first responders to handle a variety of crash scenarios.
3.4 Expand installation of Enhanced Reference Markers (ERM) and expand coverage of TDOT's HELP program on controlled access highways.

Strategy 4 - Reduce the severity and number of crashes occurring in work zones.
4.1 Refine procedures to comply with the Final Rule on Work Zones (23 CFR 630 Subpart J) and the Final Rule on Temporary Traffic Control (23 CFR 630 Subpart K).
4.2 Install truck and trailer mounted attenuators within work zones to increase work zone safety.
4.3 Refine standardized procedures for the use of law enforcement in work zones.
4.4 Develop in-house training program for TDOT staff and related partners with focus on Tennessee procedures.
4.5 Continue and refine standardized inspections for work zones.
4.6 Refine speed limit policies for work zones and improve standard procedures for reducing speed in work zones.
4.7 Enhance visual measures for assisting senior drivers through work zones as recommended in the *Highway Design Handbook for Older Drivers and Pedestrians*.

Strategy 5 - Manage congestion.
5.1 Continue to identify and refine procedures, like night-work, to help reduce congestion.
5.2 Continue improvement of communication of important work zone information and current/upcoming construction work to the public through the use of the 511 system, TDOT web site, and other public information strategies.
5.3 Explore various ITS strategies under the TDOT SmartWay Program to make travel through and around work zones safer and more efficient.
5.4 Continue efforts such as expanded coverage of TDOT's HELP program to reduce the amount and time duration of lane closures when possible.

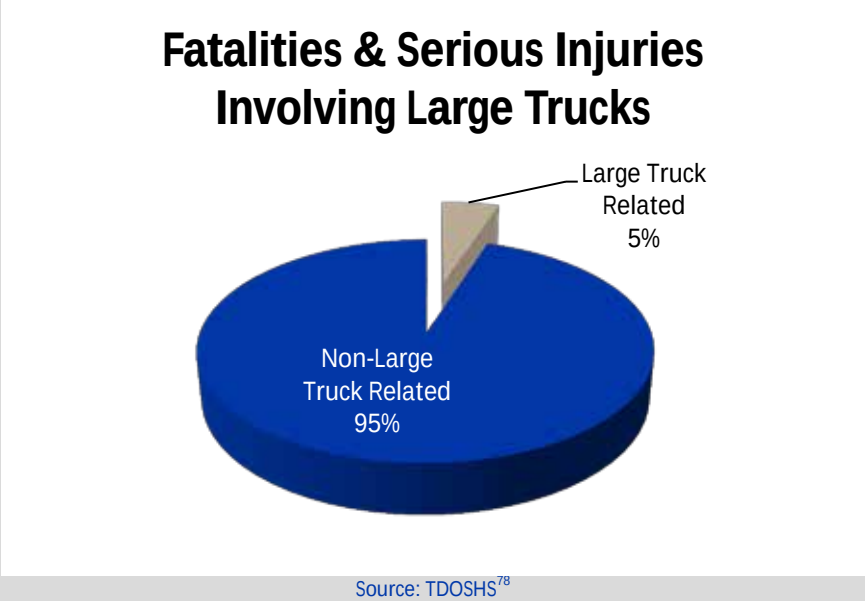
Strategy 6 - Reduce the severity of crashes involving senior drivers.
6.1 Train first responders and law enforcement on implementation of the Yellow DOT Program.
6.2 Educate Senior Drivers on the benefits and use of the Yellow DOT Program.

MOTOR CARRIER SAFETY EMPHASIS AREA PLAN

Background and Overview

Tennessee is acknowledged as a "bridge state" for large trucks traveling through the state and is ranked first nationally in terms of ton-miles of through truck traffic and sixth nationally in total ton-miles of truck shipments.[77] Commercial Motor Vehicles (CMV) engaged in long-haul transportation represents an important segment of Tennessee's freight transportation system. From 2008 to 2012, 482 fatalities and 1,488 serious injuries resulted from crashes involving large trucks. The percentage of serious injuries and fatalities involving large trucks for this period is provided in Figure 45.

Figure 45 - Serious Injuries and Fatalities broken down by vehicle type (2008-2012)



Source: TDOSHS[78]

Large truck crashes, which are quantified per million adjusted commercial vehicle miles traveled (CVMT), trended downward in Tennessee between 2007 and 2009, but increased in 2010 and 2011. Even though the rate is down over 30% since 2007, the recent increases warranted further attention to this focus area.[79]

The Tennessee Department of Safety and Homeland Security's (TDOSHS) mission through education, regulation, and enforcement is to ensure the overall safety and welfare of Tennessee citizens and the state's motoring public. The Commercial Vehicle Enforcement (CVE) Administration Unit of the Tennessee Highway Patrol (THP) is responsible for pursuing the Department's mission with respect to commercial motor vehicles (CMVs). The THP carries out this

mission through its regular law enforcement and educational activities and via the implementation of special initiatives targeting CMV safety issues. These activities include:

- Enforcement of motor vehicle and criminal laws focusing on CMVs
- Regulation of CMVs and other motor carriers through inspections, safety audits, compliance reviews, data collection, and other activities in accordance with the federal Commercial Motor Carrier Safety Assistance Program (Title 49 CFR Part 350)
- Public Education and Awareness programs and activities

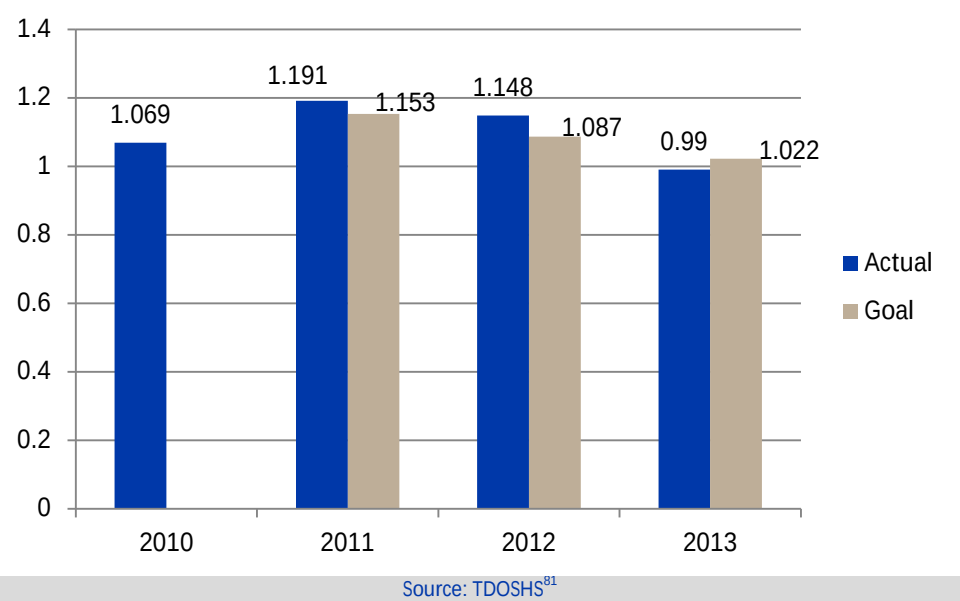
The THP has troopers certified to conduct all levels of the North American Standard (NAS) inspections including inspections of passenger carriers, cargo tanks, and hazardous materials. Unilaterally, and in partnership with the federal and other state governments, THP conducts CMV targeted enforcement and uses public relations and educational programs geared toward both the industry and the general public to increase awareness of CMV safety issues. The THP supervisors will approve overtime to conduct targeted enforcement based on data provided by the Tennessee Department of Safety and Homeland Security Research, Planning, and Development division on the CVE Dashboard. The CVE Dashboard provides monthly snapshots of large truck crash data for each district parsed on: day of week, time of day, functional route, land-use (urban/rural), driver factors, large truck related fatalities and serious injuries, and the number of NAS inspections performed.

Goal and Objective

Emphasis Area Goal: To re-establish the downward trend in large truck crashes experienced in Tennessee to meet or exceed the projected crash rate established by the Tennessee Department of Safety and Homeland Security

Emphasis Area Objective(s): To reduce the rate of large truck crashes to 1.022 per million Commercial Vehicle Miles Traveled (CVMT) by 2014 as projected by the Tennessee Department of Safety and Homeland Security[80]

Figure 46 - Large Truck Crashes per Million CVMT (2010-2013)



Source: TDOSHS[81]

Strategies and Countermeasures

Strategy 1 - Reduce occurrence of CMV crashes.	
1.1 Conduct enforcement by troopers emphasizing targeted locations and times based on large truck crash locations, times, and driver factors identified in the most recent CVE Dashboard.	
1.2 Make contacts with commercial vehicles and passenger vehicles driving dangerously in the vicinity of commercial vehicles. Emphasize public campaigns such as the "Teens and Trucks" program alerting of the dangers of aggressive driving in the vicinity of commercial vehicles.	
1.3 Initiate FMCSA's SmartPark Project at a pilot interstate location utilizing ITS solutions to inform truckers of the locations and availability of public and private truck parking to reduce truck parking on interstate ramp shoulders.	

Strategy 2 - Improve CMV safety inspections.
2.1 Install Performance-Based Brake Tester (PBBT) machines at a greater number of inspections stations since these machines yield a much higher vehicle out-of-service rate than traditional pushrod travel measurements.
2.2 Install Smart Roadside Inspection Systems (SIRIS) at more inspection stations. Smart Roadside Inspection System (SIRIS) devices use infrared measurements of tires, wheels, and brake and axle assemblies to assist troopers in identifying vehicles that may need a North American Standard Level I inspection.
2.3 Improve and update scales located at interstate weigh stations.

Strategy 3 - Increase inspections and training for CMV hazardous material safety.
3.1 Conduct yearly intrastate/interstate hazardous material bulk/non-bulk inspection strike forces on commercial motor vehicles (trucks) by the THP at each of the following locations: Nashville, Memphis, Knoxville, Chattanooga, and Department of Energy/Oak Ridge. Place emphasis on such inspections around holiday periods such as Fourth of July, Labor Day, and Memorial Day to check for fireworks or other undeclared explosives.
3.2 Provide on-the-job training to certified inspectors, by conducting hazardous material inspections on bulk and non-bulk transporters during hazardous material strike forces. Provide a refresher course for all certified hazardous material troopers during calendar year 2014. Provide a refresher course for the North American Standard Inspection Level VI certified troopers during calendar year 2014.
3.3 Conduct North American Standard Level I hazardous materials inspections statewide on rental trucks and intermodal containers for undeclared fireworks.

IMPLEMENTATION AND EVALUATION PLAN

Effective implementation is necessary to achieve the Plan's goal to reduce fatalities and serious injuries. To achieve the Plan's stated goals of a 10% reduction in fatalities and a reduced trend in the number of serious injuries over the next five years, the following annual improvements are required:

- A statistical reduction in the current recorded number of fatalities that must average 2.6% annually over the next five years
- No increase in serious injuries from the current number of serious injuries as an average over the next five years

This will require routine collaboration between stakeholders, constant communication between teams, data collection and analysis, and support from executive leadership. This will be accomplished with four basic steps:

1. Development and execution of emphasis area action plans
2. Coordination of the SHSP with other transportation and safety plans
3. Development and execution of a marketing strategy
4. Monitoring progress and evaluating results

These steps and the fundamentals of implementing the SHSP will follow the current editions of the *Strategic Highway Safety Plan Implementation Process Model* and the *Strategic Highway Safety Plan Evaluation Process Model* published by FHWA. The SHSP program coordinators will follow these guidelines to implement and evaluate the Plan.

Action Plans

Each emphasis area champion is responsible to provide an action plan for their respective emphasis area. Action plans are not included in the SHSP document but are important to effective implementation of the Plan. Each action plan will determine the data requirements and resources necessary to achieve the Plan's goals and objectives for the emphasis area. It will identify the funding source for each countermeasure. Action plans also define the tracking measures to be performed and their frequency. TDOT will monitor the performance of the SHSP by review of action plans each year. When appropriate, updates to action plans will be requested from emphasis area champions. A report summarizing the progress of each action plan will be provided to the Executive Leadership and the Steering Committee annually by the program coordinators.

Plan Coordination

The SHSP is Tennessee's comprehensive transportation safety plan. Federal law requires Tennessee to coordinate this plan with the Highway Safety Performance (HSP) Plan, data collection, and information systems. The Statewide Transportation Improvement Plan (STIP), Metropolitan Transportation Plans, and Local Major Thoroughfare Plans should be developed in coordination with the SHSP. At a minimum, those plans must include high level goals, objectives, and strategies that are consistent with the SHSP.

To facilitate coordination with other Transportation Plans, the following steps will be performed:

1. Each of the twelve Regional Planning Organizations (RPO's), eight Metropolitan Planning Organizations (MPO's), and three Transportation Planning Organizations (TPO's) will be included as Safety Partners for the Plan.
2. Any RPO or MPO/TPO wishing to serve on the Steering Committee will be included upon request.
3. The Plan will be distributed to each RPO, MPO, and TPO following each update.
4. Updates to all transportation plans by each planning organization will explicitly address safety, and allow participation by SHSP Steering Committee members to align projects with goals of the plan.
5. At each update to the SHSP, the STIP will be reviewed to confirm consistency between plans and to identify components of the STIP for inclusion in the SHSP update.

To facilitate coordination with other safety programs and plans, the following steps will be performed:

1. Highway Safety Improvement Program (HSIP) – The SHSP will be used as a tool for selecting and prioritizing projects under the HSIP.
2. Highway Safety Performance (HSP) Plan – The GHSO will ensure that emphasis areas and action plans are consistent between the two plans at each update to the SHSP and the HSP.
3. Commercial Vehicle Safety Plan (CVSP) – The CVSP will address behavioral safety elements from the current SHSP in each update to the CVSP.
4. Tennessee Highway Patrol Strategic Plan – The SHSP will be consistent with the goals and objectives of this strategic plan.
5. Traffic Records Plan (TRCC) – The TRCC will continue to update the Tennessee Traffic Records Strategic Plan in accordance with 23 USC 408.

Additionally, the goals, strategies, and countermeasures of each plan will be aligned with the SHSP for consistency.

Marketing and Communication

Marketing benefits implementation of the SHSP in many ways. It increases awareness of the vision, mission, and goals of the Plan, which is directed at reducing fatalities and serious injuries on our roadways. It is a useful tool to educate community leaders on their role in saving lives. Marketing can change the attitudes and behaviors of roadway users by recruiting them into the effort of saving lives as a team.

The SHSP includes the basic framework for a marketing strategy for creating, communicating, delivering, and exchanging information about transportation to the public, stakeholders, and elected officials. Upon approval of the SHSP, the following action items will be implemented to provide awareness of the existence of the updated SHSP and effectively communicate the principals of the Plan.

- Press releases shall be issued to provide information regarding the updated SHSP and its availability.
- A copy of the updated SHSP will be conveyed to the Tennessee Metropolitan Planning Organizations (MPO's), Transportation Planning Organizations (TPO's), and Regional Planning Organizations (RPO's) for their use and distribution to local municipalities and agencies.
- A web link to a digital version of the updated SHSP will be provided on TDOT's website.

Evaluation and Update

To obligate funds under the Highway Safety Improvement Program (HSIP), Tennessee must evaluate the SHSP on a regular and recurring basis to ensure the accuracy of data and priority of chosen strategies. To meet this requirement, the 2014 SHSP includes a two-tiered approach.

Evaluate and Update the SHSP – Periodically, the Steering Committee will meet to review current safety data and to evaluate emphasis areas for past performance and future goals. The evaluation process will follow the current edition of the Strategic Highway Safety Plan – Evaluation Process Model. The Plan will be updated at each review period, which will be no greater than five years following adoption of the most current plan. If changes in legislation, plan performance, or crash data warrant, the Plan's Executive Leadership will direct an update to the SHSP, regardless of the planned update schedule.

Monitor Action Plans Annually – During interim years between scheduled plan updates, TDOT will monitor the performance of each action plan. The Plan Coordinator will assemble current crash statistics and distribute to each of the emphasis area leaders with a request for an updated plan and summary of the performance of the previous action plan. A summary of action plan reports provided by emphasis area leaders will be distributed to Executive Leadership and the Steering Committee for comment. Any necessary revisions to action plans will be requested at that time. This structured annual monitoring plan will also satisfy the terms of the current stewardship agreement between TDOT and FHWA, which requires a two-year plan interval.

The Plan's success will be measured at the time of evaluation and updated by a statistical comparison of actual data to the Plan's Goal Statement and the goals and objectives of each emphasis area. Performance metrics will be tied directly to specific strategies and countermeasures as appropriate. This will illustrate how targeting safety improvements with specific strategies can yield positive results and will be the basis for future strategies to maximize results. In some instances, it may reveal strategies or countermeasures that are not effective and should be eliminated from future plans. In order to perpetuate lessons learned, results of the evaluation will be reported in the subsequent plan update.

OTHER RESOURCES

1. *State of Tennessee 2014 Highway Safety Performance Plan*, Governor's Highway Safety Office, Tennessee Department of Transportation (July 2013) https://tntrafficsafety.org/sites/default/files/HSPP_final_2014.pdf

2. State of Tennessee Motor Carrier Safety Assistance Program Commercial Motor Vehicle Safety Plan, Fiscal Year 2014, Tennessee Highway Patrol, Tennessee Department of Safety

3. *Strategic Highway Safety Plans – A Champion's Guidebook to Saving Lives*, Second Edition (March 2013, Report No. FHWA-SA-12-034)

4. *Strategic Highway Safety Plan Implementation Process Model, The Essential Eight – Fundamental Elements and Effective Steps for SHSP Implementation* (June 2010, Report No. FHWA-SA-10-024) http://safety.fhwa.dot.gov/hsip/shsp/fhwasa10024cd/

5. *Strategic Highway Safety Plan Evaluation Process Model* (March 2013, Report No. FHWA-SA-12-035) http://safety.fhwa.dot.gov/hsip/shsp/epm/ovrvw.cfm

6. MAP-21 – Moving Ahead for Progress in the 21st Century, Highway Safety Improvement Program (HSIP), Strategic Highway Safety Plan (SHSP) Interim Guidance, FHWA Office of Safety (April 5, 2013) http://www.fhwa.dot.gov/map21/guidance/guideshsp.cfm

7. MAP-21 – Moving Ahead for Progress in the 21st Century, Highway Safety Improvement Program (HSIP), MAP-21 Interim Eligibility Guidance (September 24, 2012) http://www.fhwa.dot.gov/map21/guidance/guidehsip.cfm

8. *Toward Zero Deaths: National Strategy on Highway Safety* http://safety.fhwa.dot.gov/tzd/

9. *TDOT Work Zone Safety and Mobility Manual* (November 9, 2007) http://www.tdot.state.tn.us/Chief_Engineer/assistant_engineer_design/design/TDOTWorkZoneSafetyMobilityManual.pdf

10. *Highway Design Handbook for Older Drivers and Pedestrians* (FHWA-RD-01-103)(May 2001) http://www.fhwa.dot.gov/publications/research/safety/humanfac/01103/

11. Tennessee Highway Patrol Strategic Plan 2013-2014

12. Tennessee Transportation Assistance Program (TTAP) http://ctr.utk.edu/ttap/

13. Tennessee Integrated Traffic Analysis Network (TITAN) http://www.tn.gov/safety/titan.shtml

14. Enhanced Tennessee Roadway Information Management System (ETRIMS) https://e-trims.tdot.tn.gov/Account/Logon

15. NHTSA Highway Safety Program Guideline No. 13 – Older Driver Safety (DOT HS 812 007D, April 2014)

GLOSSARY OF ACRONYMS AND TERMS

A & I: US Department of Transportation-Federal Motor Carrier Safety Administration-Analysis and Information website.

AASHTO: American Association of State Highway and Transportation Officials.

Active Railroad Crossing: An at-grade railroad crossing that uses signals to inform road users of the approach or presence of rail traffic at such crossings. Signs and pavement markings are also used to identify such crossings.

Administrative per se: This term describes the laws establishing an administrative process so that the responsible state agency can suspend a driver for a BAC violation even if the court does not convict him or her on the corresponding DUI offense.

Aggressive Driving: Operating a motor vehicle in a selfish, pushy, or impatient manner, often unsafely that directly affects other drivers.

Alcohol Involvement: Alcohol involved fatal crashes and fatalities reflect those where a driver or a non-occupant with a positive alcohol result was involved or where the investigating officer reported alcohol involvement.

ANSI: American National Standards Institute is a private, non-profit organization that oversees the voluntary consensus standards for products, services, processes, systems, and personnel in the United States, and the organization coordinates United States standards with international standards so that American products can be used worldwide.

BAC: Blood Alcohol Concentration is measured as a percentage by weight of alcohol in the blood (grams/milliliter). A positive BAC level (0.01 g/ml and higher) indicates that alcohol was consumed by the person tested. In Tennessee, a BAC level of 0.08 g/ml or more indicates that the person was intoxicated.

Bicyclist: A person riding a vehicle consisting of a tubular metal frame mounted on two (or more) large, spoked wheels, one behind the others, and equipped with handlebars, a saddle like seat, and foot or arm pedals.

CDL: Commercial Driver License

Child Restraint Device: An object or system used by children in a vehicle to prevent or minimize injury and to prevent ejection during a crash. Common objects include child safety seats, booster seats, and seat belts.

Citation: A written order issued, in lieu of a physical arrest or issuance of a warrant, for a violation of law, ordinance, or regulation, which requires the accused person's signature. The order also requires the person to appear in a designated court or government office at a specified date and time. (See also Uniform Citation)

CMV: A Commercial Motor Vehicle is any motor vehicle operated in intrastate, interstate, or foreign commerce.

CODES: The Crash Outcome Data Evaluation System is a collaborative approach to generating medical and financial outcome information relating to motor vehicle crashes and using this outcome-based data as the basis for decisions related to highway traffic safety.

Collision: A road vehicle crash other than an overturning crash in which the first harmful event is a collision of a road vehicle in transport with another road vehicle, other property, animal or pedestrian.

Complete Streets: Transportation policy and design approach that encourages streets to be planned, designed, operated, and maintained to enable safe, convenient and comfortable travel and access for users of all ages and abilities regardless of their mode of transportation, which could include walking, bicycling, driving automobiles, riding public transportation, or delivering goods.

Construction/Maintenance Zone: An area, usually marked by signs, barricades, or other devices indicating that highway construction or highway maintenance activities are ongoing.

CSD: Context Sensitive Design is a collaborative, interdisciplinary approach that involves all stakeholders to develop a transportation facility that fits its physical setting and preserves scenic, aesthetic, historic, and environmental resources, while maintaining safety and mobility.

Crash: An event that produces injury and/or property damage, involves a motor vehicle in transport, and occurs on a traffic way or while the vehicle is still in motion after running off the traffic way.

Crash Rate: The number of crashes per million vehicle miles traveled. A crash rate may be calculated for non-motorized modes using alternate methodologies.

Cushion of Safety: The area around your vehicle you want to keep free of other vehicles, pedestrians, and fixed objects.

CVC: Commercial Motor Vehicle Crash.

CVE Dashboard: A report on large truck crashes generated by the Tennessee Department of Safety and Homeland Security (TDOSHS) Records and Statistical Management team which shows crashes by day of the week, time, location, causation factor, and inspection data for each Tennessee Highway Patrol (THP) district.

CVSP: Commercial Vehicle Safety Plan developed and is maintained by the Tennessee Department of Safety and Homeland Security in coordination with the Federal Motor Carrier Safety Administration to target CMV safety issues.

D-16: A reference to the Manual on Classification of Motor Vehicle Traffic Accidents which promotes uniformity and comparability of motor vehicle traffic accident statistics that are being developed in federal, state, and local jurisdictions.

D-20: A reference for the Data Element Dictionary for Traffic Records Systems which provide a common set of coding instructions for data elements related to highway safety, driver licensing, and vehicle registration.

Defensive Driving: Driving to save lives, time, and money in spite of the conditions around us and the actions of others.

Driver's License Suspension/ Revocation/ Cancellation: The temporary loss of driving privileges, which may be regained after the requirements for reinstating the privileges are met.

DUI: Driving Under the Influence of alcohol or drugs is a crime that can result in fines, suspension or revocation of driver's license, or jail time.

DWI: Driving While Intoxicated refers to driving while impaired by alcohol or drugs (may be used interchangeably with DUI).

DWS, DWR, or DWU: These acronyms refer to "driving while suspended," "driving while revoked," and "driving while unlicensed." The term is used to denote the DWS, DWR, or DWU citation (a moving violation) and/or the license status of the driver at the time of a crash or other event.

Economic Loss: The total monetary cost of a motor vehicle crash, including continuing or future expenses to be incurred because of the crash. Included in these losses are lost productivity, medical costs, legal and court costs, emergency service costs, insurance administration costs, travel delay, property damage, and workplace losses.

Ejection: Refers to occupants being totally or partially thrown from the vehicle as a result of an impact or rollover.

ERM: Enhanced Reference Markers (also referred to as Emergency Reference Markers) are signs placed along access controlled facilities every 0.2 of the mile displaying the direction of travel and mile marker location.

Excessive Speeding: Fifteen (15) mph or more in excess of the Speed Limit in a commercial vehicle per Rules of Tennessee Department of Safety and Homeland Security Driver Control Division, Chapter 1340-1-4, Tennessee Driver Improvement Program (not defined for non-commercial vehicles but traffic moving violation points for speeding is based on the amount in excess of the speed limit).

FARS: The Fatality Analysis Reporting System contains data on a census of fatal traffic crashes within the 50 States, the District of Columbia, and Puerto Rico. To be included in FARS, a crash must involve a motor vehicle traveling on a traffic way customarily open to the public and result in the death of a person (occupant of a vehicle or a non-occupant) within 30 days of the crash.

Fatal Crash: A police-reported crash involving a motor vehicle in transport on a traffic way in which at least one person dies within 30 days of the crash.

Fatal Injury: Any injury that results in death within 30 days of the crash.

Fatality: Any death resulting from a fatal injury.

Fatality Rate: The number of persons killed per 100 million vehicle miles traveled.

Five-year Moving Average: Statistical tool to evaluate trends and changes in traffic records by computing the average for a given year (abscissa) and the previous four-years for a five-year average value (ordinate). This methodology reduces the effects of isolated catastrophic events, weather, and other random influences.

FMCSA: Federal Motor Carrier Safety Administration is an agency within the United States Department of Transportation that regulates the trucking industry within the United States, and its mission is to prevent commercial vehicle-related crashes, fatalities, and injuries.

FHWA: Federal Highway Administration is an agency within the United States Department of Transportation that supports state and local governments in the design, construction, and maintenance of the Nation's highway system (Federal Aid Highway Program) and various federally and tribal owned lands (Federal Lands Highway Program).

GDL: Graduated Driver License

GHSO: Governor's Highway Safety Office

GIS: A Geographic Information System is a collection of computer software, hardware, data, and personnel used to store, manipulate, analyze, and present geographically referenced information.

GPS: A Global Positioning System is a Government-owned system of 24 Earth-orbiting satellites which transmit data to ground-based receivers and used to determine the precise position of vehicles on the ground. It provides extremely accurate latitude/longitude ground position.

GVWR: The Gross Vehicle Weight Rating is the maximum rated capacity of a vehicle, including the weight of the base vehicle, all added equipment, driver and passengers, and all cargo loaded into or on the vehicle. Actual weight may be less than or greater than GVWR.

HB: House Bill of the Tennessee General Assembly

High-Risk Driver: A driver persistently engaging in a range of behaviors such as impaired driving, non-use of seat belts, speeding and running red lights that increase their probability of being involved in collisions resulting in fatalities and/or serious injuries.

High Risk Rural Road: Any roadway functionally classified as a rural major or minor collector or a rural local road with significant safety risks.

Highway: A public way for purpose of vehicular travel, including the entire area within the right-of-way (Urban areas – highway or street, in rural areas – highway or road).

HSP: Highway Safety Performance Plan prepared and updated by the Governor's Highway Safety Office is the Tennessee action plan for distribution and prioritization of federal safety funds, to address behavior aspects of highway safety.

Ignition Interlock: A device that renders a car inoperative unless one or more preconditions are met. In DUI driver-control programs, the typical ignition interlock device requires the driver to give a breath sample which is then analyzed for the presence of alcohol. If there is alcohol present (above some minimum threshold value), the car will not start. Other variations are used to ensure that an individual does not operate the vehicle, or is the only operator of a vehicle.

Incident: An event occurring by chance or arising from unknown causes, for example, unawareness. An unexpected happening causing loss or injury which is not due to any fault or misconduct on the part of the person injured, but from the consequences.

Injury: Bodily harm to a person.

Injury Crash: A police-reported crash that involves a motor vehicle in transport on a travel way in which no one died but at least one person was reported to have: (1) an incapacitating injury; (2) a visible but not incapacitating injury; (3) a possible, not visible injury; or (4) an injury of unknown severity.

Intersection: An area that contains a crossing or connection of two or more roadways not classified as driveway access and within the prolongation of the lateral curb lines. If no curb exists, it is the area within the extension of the lateral boundary lines of the roadway of two joined traffic ways.

Interstates: Limited access divided facilities of at least four lanes designated by the Federal Highway Administration as part of the Interstate System.

Large Trucks: Trucks (single unit trucks and truck tractors) over 10,000 pounds gross vehicle weight rating

Linear Reference System: A method of spatial referencing, in which the locations of features are described in terms of measurements along a linear element from a defined starting point.

MADD: Mothers Against Drunk Driving

MCMIS: Motor Carrier Management Information System. Operated and maintained by FMCSA, MCMIS contains information on the safety fitness of commercial motor carriers and Hazardous Material (HM) shippers subject to the Federal Motor Carrier Safety Regulations (FMCSRs) and the Hazardous Materials Regulations (HMRs). MCMIS is a collection of safety information including state-reported crashes, compliance review and roadside inspections results, enforcement data, and motor carrier census data. The Crash Profiles module uses the MCMIS Crash and Census data to compile and publish the State Profiles and several National reports.

Medically At-risk Driver: A driver that has recognizable cognitive (mental) or functional (physical) impairments that can limit one's ability to safely operate a motor vehicle without compensating for or controlling such impairments through medication or adaptive devices.

Minimum drinking age and zero tolerance laws: These laws make it illegal for anyone under the age of twenty-one (21) to drink alcohol. If someone under age twenty-one (21) is suspected of drunk driving, a BAC of only 0.01 or 0.02 may be enough to revoke the person's license in many states. All states have zero tolerance laws.

MMUCC: Model Minimum Uniform Crash Criteria are a voluntary set of guidelines that help states collect consistent, reliable crash data that are more effective for identifying traffic safety problems, establishing goals and performance measures, and monitoring the progress of programs.

Motorcycles: All motorcycle type vehicles including two and three wheel motorcycles, mopeds, motor scooters, motorbikes, and three and four wheel all-terrain vehicles (ATVs).

MPO: Metropolitan Planning Organizations are created for each "urbanized area" with a population of more than 50,000 people to carry out the transportation planning process required by federal laws and regulations (Title 23 USC 134). MPOs, which include representatives of all local governments, have been established in eleven urbanized areas in Tennessee—Bristol, Chattanooga, Clarksville, Cleveland, Jackson, Johnson City, Kingsport, Lakeway, Knoxville, Memphis, and Nashville.

Motor Carrier: An individual, association, corporation, or other legal entity that controls, operates, or directs the operation of one or more commercial motor vehicles that transport persons or cargo over a road or highway in this state.

MUTCD: Manual of Uniform Traffic Control Devices defines the standards used by road managers nationwide to install and maintain traffic control devices on all streets and highways.

NCUTLO: The National Committee on Uniform Traffic Laws and Ordinances is a private, non-profit membership organization dedicated to providing uniformity of traffic laws and regulations through the timely dissemination of information and model legislation on traffic safety issues

NHTSA: The National Highway Traffic Safety Association, an organization within the US Department of Transportation that is responsible for reducing deaths, injuries and economic losses resulting from motor vehicle crashes. This is accomplished by setting and enforcing safety

performance standards for motor vehicles and motor vehicle equipment, and through grants to state and local governments to enable them to conduct effective local highway safety programs.

Night: From 6 p.m. to 5:59 a.m.

North American Standard Inspection Level I: An inspection by qualified commercial vehicle enforcement officers that includes examinations of a commercial driver's license; medical examiner's certificate and Skill Performance Evaluation (SPE) Certificate (if applicable); alcohol and drugs, driver's record of duty status as required; hours of service; seat belts; vehicle inspection reports(s) (if applicable); brake systems; coupling devices; exhaust systems; frames; fuel systems; lighting devices (headlamps, tail lamps, stop lamps, turn signals, and lamps/flags on projecting loads); securement of cargo; steering mechanisms; suspensions; tires; van and open-top trailer bodies; wheels, rims, and hubs; windshield wipers; emergency exits and/or electrical cables and systems in engine and battery compartments (buses); and Hazardous Materials/Dangerous Goods (HM/DG) requirements as applicable. HM/DG required inspection items will be inspected by certified HM/DG inspectors.

North American Standard Inspection Level III (Driver/Credential Inspection): An examination by commercial vehicle enforcement officers that includes as minimum requirements, where applicable, examinations of the driver's license; medical examiner's certificate and Skill Performance Evaluation (SPE) Certificate; record of duty status; hours of service; seat belts; vehicle inspection report; and requirements for Hazardous Materials/Dangerous Goods (HM/DG). Those items not indicated in this inspection procedure shall not be included on this level of inspection.

North American Standard Inspection Level VI (Transuranic Waste and Highway Route Controlled Quantities (HRCQ) of Radioactive Material): An inspection of select radiological shipments by commercial vehicle enforcement officers certified in this level of inspection which includes procedures, enhancements to the North American Standard Level I inspection, radiological requirements, and the North American Standard Out-of-Service Criteria for Transuranic Waste and Highway Route Controlled Quantities (HRCQ) of Radioactive Material. As of January 1, 2005, all vehicles and carriers transporting HRCQ are regulated by the U.S. Department of Transportation and are required to pass this inspection (previously the U.S. Department of Energy (DOE) voluntarily complied with this inspection requirement). Select radiological shipments include HRCQ of radioactive material as defined by Title 49 CFR Section 173.403 and DOE transuranic waste.

NSSP: National Student Safety Program is the youth program of the American Driver and Traffic Safety Education Association (ADTSEA) that encourages and assists students through the initiation and implementation of safety activities within their respective schools and communities.

Open container laws: Prohibit drivers and passengers from having an alcoholic beverage open in a vehicle. The federal government has encouraged all states to enact open container laws by linking highway funding to the implementation of such laws. So far, about thirty states have adopted open container laws.

Older Drivers: Drivers, licensed or unlicensed, that are of age 65 and older (synonymous with Senior Drivers).

Passive Railroad Crossing: An at-grade railroad crossing consisting of signs and pavement markings only to identify the location of the crossing and to advise road users to slow down or

stop before the crossing as necessary to yield to any rail traffic occupying or approaching near the crossing.

Pedestrian: A person traveling on foot; a walker. Also includes those using assistance for mobility, such as manual or motorized wheelchairs, walkers and other mobility aids.

Preventable Collision: A vehicle collision (crash) in which the driver fails to do everything reasonable to avoid it.

Property-Damage-Only Crash: A police-reported crash involving a motor vehicle in transport on a traffic way in which no one involved in the crash suffered any injuries.

Queue: A line (backup) of vehicles awaiting their turn to proceed.

Reckless Driving: Operating a motor vehicle with a willful and wanton disregard for the safety of persons or property.

RITA: Research and Innovative Technology Administration is an agency within the United States Department of Transportation that coordinates its research programs and is charged with advancing the deployment of cross-cutting technologies to improve our Nation's transportation system.

Roadway Departure Crash: A vehicle crash resulting from any departure of a vehicle from a travel lane (left or right).

Rollover: A rollover is defined as any vehicle rotation of 90 degrees or more about any true longitudinal or lateral axis. Includes rollovers occurring as a first harmful event or subsequent event

ROW: Right of Way

RPM: Raised Pavement Marker

RPO: Rural Planning Organizations are created under the Tennessee Department of Transportation's (TDOT) Long Range Transportation Plan to assist in identifying and evaluating regional transportation priorities in Tennessee's rural areas. Twelve (12) RPO's, which involve local officials in the areas they represent, are established throughout the rural areas of Tennessee. These RPO's are identified as Center Hill, Dale Hollow, East Tennessee North, East Tennessee South, First Tennessee, Middle Tennessee RPO, West Tennessee RPO, Northwest Tennessee, South Central East, South Central West, Southeast Tennessee, and Southwest Tennessee.

Rumble Strips: Rumble strips are raised or grooved patterns on the road shoulder that provide both an audible warning and physical vibration to alert drivers that they are leaving the road.

Rural Area: All territory outside the boundaries of incorporated cities/towns regardless of population density.

Rur. Art.: Rural Arterial

Rur. Col.: Rural Collector

Rur. Int.: Rural Interstate

Rur. Loc.: Rural Local

SADD: Students Against Drunk Driving

Safety Edge: A modified edge strike-off attached to an asphalt paver which produces a 30 degree slope from edge of pavement. It results in a pavement edge that is far less likely to contribute to a crash should a vehicle cross over the edge of pavement. It also produces better compaction at the edge of pavement.

SafetyNet: A Federal Motor Carrier Safety Administration (FMCSA) database management system that allows entry, access, analysis, and reporting of data from driver/vehicle inspections, crashes, compliance reviews, assignments, and complaints.

Saturation Blitzes: Heavy enforcement with checkpoints and roving saturation patrols and extensive publicity. Example "Click It or Ticket" enforcement blitzes, in July and November, respectively.

Secondary Incident Crash: A highway crash that occurs at the end of a queue of traffic that results from vehicle crashes, stalled vehicles, construction work zones, highway facility failure, weather, etc.

Senior Drivers: Drivers, licensed or unlicensed, that are of age 65 and older (synonymous with Older Drivers).

Serious Injury: Any incapacitating injury to a person that occurs as a result of a crash.

SHRP2: Second Strategic Highway Research Program was created by Congress to address the challenges of moving people and goods efficiently and safely on the Nation's highways. This research program addresses four (4) strategic focus areas: Safety, Renewal, Reliability, and Capacity.

Sobriety Checkpoints: Temporary operations in which law enforcement officers stop or restrict the movement of some or all traffic to examine and ensure compliance with driving under the influence laws in order to advance legitimate state interests in promoting highway safety.

Traffic way: Any road, street, or highway open to the public as a matter of right or custom for moving persons or property from one place to another.

TDOSHS: Tennessee Department of Safety and Homeland Security

TDOT: Tennessee Department of Transportation

Teen Driver: Drivers, licensed or unlicensed, that are of age 13 through 19.

THP: Tennessee Highway Patrol

TIP: Transportation Improvement Program

TITAN: The Tennessee Integrated Traffic Analysis Network is a suite of tools developed for the electronic collection, submission and management of all crash data in Tennessee. It consists of a centralized data and document repository for public safety information managed by the Tennessee Department of Safety.

Title 23 CFR 630: Federal legislation governing preconstruction procedures for federally funded projects including work zone safety (Subpart J) and temporary traffic control devices (Subpart K).

Title 23 CFR 646: Federal legislation governing requirements for federally funded projects involving railroads.

Title 49 CFR 350: Federal legislation establishing the Commercial Motor Carrier Safety Assistance Program.

TPO: Transportation Planning Organization has the same functions as a Metropolitan Planning Organization (MPO). The Knoxville Urban Area MPO, for example, is now known as the Knoxville Regional TPO.

Traffic Incident Management (TIM): The planned and coordinated program process to detect, respond to and remove traffic incidents and restore traffic capacity as safely and quickly as possible. This coordinated process involves a number of public and private sector partners including: Law Enforcement, Fire and Rescue, Emergency Medical Services, Transportation, Public Safety Communications, Emergency Management, Towing and Recovery Hazardous Materials Contractors, and Traffic Information Media.

TRCC: Traffic Records Coordinating Committee is a multi-modal group with members from FHWA, FMCSA, NHTSA, and RITA that works to improve the collection, management, and analysis of traffic safety data at the State and Federal level.

TRSC: Tennessee Regional Safety Council is a tax-exempt nonprofit organization that offers a wide range of vehicle specific safety courses and human resource and workplace safety courses within the State of Tennessee.

TTAP: The Tennessee Transportation Assistance Program is the state's Local Technical Assistance Program (LTAP) center.

Uniform Citation: A form promulgated by the Tennessee Department of Safety as authorized by Tennessee Code Annotated (T.C.A.) §55-10-208, which may be issued by all law enforcement officers in the state of Tennessee.

Urban Area: Incorporated cities/towns with populations greater than 2,500 within its boundaries.

Urb. Art.: Urban Arterial

Urb. Col.: Urban Collector

Urb. Int.: Urban Interstate

Urb. Loc.: Urban Local

Vehicle Safety Restraints: A system or device for restraining an occupant in a vehicle to prevent or minimize contact with the vehicle interior components and/or prevent ejection during a crash. Common systems and/or devices include seatbelts, child safety seats, and airbags.

VMT: Vehicle Miles Traveled represents the total number of vehicle miles traveled by motor vehicles on all public roadways within Tennessee.

Work Zone: The area between the first advance warning sign and the point beyond the utility or construction zone where traffic is no longer affected. See construction/maintenance zone.

Young Driver: Drivers, licensed or unlicensed, that are of age 15 through 24.

Zero Tolerance: In cases of DUI, the right to convict minors with virtually any amount of alcohol in the bloodstream. In many cases, this amounts to a BAC of .01%, much less than the legal limit for adults.

LIST OF SOURCES

1. Data was obtained from a query summary provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on October 23, 2013. The complete query summary is provided in the Appendix. All data provided pertaining to 2011 and 2012 is preliminary. The query pulled from the following resources: TITAN, NHTSA, FARS, TN FARS, TDOT, and a safety belt use statewide observational survey results June 2012. For more information, visit the following websites:

   http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx
   http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/47_TN/2011/47_TN_2011.htm
   http://www.tdot.state.tn.us/hpms/

2. See note 1.

3. Data was obtained from a query summary provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on July 1, 2013. Vehicle Miles Travel (VMT) in 100 million VMT from TDOT HPMS System. The complete query summary is provided in the Appendix. For more information, visit the following website:

   http://www.tdot.state.tn.us/hpms/

4. Data was obtained from a query summary provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on October 23, 2013 and November 6, 2013. The complete query summaries are provided in the Appendix. All data provided pertaining to 2011 and 2012 is preliminary. The queries pulled from the following resources: TITAN, NHTSA, FARS, TN FARS, TDOT, and a safety belt use statewide observational survey results June 2012. For more information, visit the following websites:

   http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx
   http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/47_TN/2011/47_TN_2011.htm
   http://www.tdot.state.tn.us/hpms/
   http://www.tn.gov/safety/stats/CrashData/InjuryCode.pdf

5. Source for the national annual cost figure: http://safety.fhwa.dot.gov/facts_stats/

6. Source for Tennessee crash figure: TDOSHS:
   http://www.tn.gov/safety/stats/CrashData/CrashType.pdf

Source for Tennessee hospitalization costs: Tennessee Department of Health, Division of Policy, Planning and Assessment, Office of Health Statistics (received 2/4/14).
Source for cost per crash: National Safety Council
http://www.nsc.org/news_resources/injury_and_death_statistics/Pages/EstimatingtheCostsofUnintentionalInjuries.aspx

7. 2009 SHSP data was obtained from the 2009 State of Tennessee Strategic Highway Safety Plan. 2014 SHPS data was obtained from query summaries provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on October 23, 2013 and on February 10, 2014. The complete query summary is provided in the Appendix. All data provided pertaining to 2011 and 2012 is preliminary. The query pulled from the following resources: TITAN, NHTSA, FARS, TN FARS, TDOT, and a safety belt use statewide observational survey results June 2012. For more information, visit the following websites:

   http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx
   http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/47_TN/2011/47_TN_2011.htm
   http://www.tdot.state.tn.us/hpms/

8. The five-year moving averages shown were established using query summary data referenced in note 4.

9. See note 1.

10. The percentages shown were established using query summary data provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on October 23, 2013 and February 10, 2014. The complete query summaries are provided in the Appendix. All data provided pertaining to 2011 and 2012 is preliminary. The queries pulled from the following resources: TITAN, NHTSA, FARS, TN FARS, TDOT, and a safety belt use statewide observational survey results June 2012. For more information, visit the following websites:

    http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx
    http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/47_TN/2011/47_TN_2011.htm
    http://www.tdot.state.tn.us/hpms/
    http://www.tn.gov/safety/stats/CrashData/InjuryCode.pdf

11. See note 10.

12. Data was obtained from a query of the NHTSA-FARS database performed by the Tennessee Department of Safety and Homeland Security, Research, Planning and

Development Division on November 26, 2013. The complete query summary is provided in the Appendix. For more information, visit the following websites:

http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx

13. Data was obtained from a query summary provided by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on January 14, 2014. The complete query summary is provided in the Appendix. The queries pulled from the following resources: NHTSA-FARS, TITAN, and TDOSHS. For more information, visit the following websites:

http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx
http://www.fhwa.dot.gov/map21/guidance/guideolder.cfm

14. Percentages based on fatalities per roadway functional classification obtained from query (October 31, 2013) of NCSA Data Resource Website Fatality Analysis Reporting System (FARS) Encyclopedia (http://www-fars.nhtsa.dot.gov//QueryTool/QuerySection/SelectYear.aspx) for Tennessee. Urban-Principal Arterial-Other Freeways or Expressways was combined with Urban Interstates for fatality totals. Urban-Minor Arterial and Urban-Other Principal Arterial combined into Urban Arterial for fatality totals. Rural-Principal Arterial-Other and Rural-Minor Arterial combined into Rural Arterial for fatality totals. Rural-Major Collector and Rural-Minor Collector combined into Rural Collector for fatality totals.

15. Fatalities per roadway functional classification obtained from query (October 31, 2013) of NCSA Data Resource Website Fatality Analysis Reporting System (FARS) Encyclopedia (http://www-fars.nhtsa.dot.gov//QueryTool/QuerySection/SelectYear.aspx) for Tennessee. Fatality totals for Urban Interstate, Urban Arterial, Rural Arterial, and Rural Collector are detailed in note 14. Vehicle Miles Traveled by Functional System obtained from TDOT Highway Performance Monitoring System website:
http://www.tdot.state.tn.us/hpms/

16. The requirement for states to use field observations and available work zone crash data to manage work zone safety can be found in the *Code of Federal Regulations* 23 CFR 630.1008(c).

17. State of Tennessee Senate Bill 2236 (SB2236) passed by the 107th General Assembly and signed into law February 28, 2012 to amend Tennessee Annotated Code Title 55, Chapter 10 relative to motor vehicle accident reports. The amendment is effective January 1, 2015. Source for details:

http://www.tn.gov/sos/acts/107/pub/pc0531.pdf

18. See note 1 for the data source reference. The percentage shown pertaining to teen drivers is represented by data provided for drivers ages 13 through 19.

19. Data was obtained from two NHTSA publications: *Seat Belt Use in 2011 – Use Rates in the States and Territories* (DOT HS 811651); and *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), pages 196-197, Table 128: Traffic Safety Laws as of June 2011.

20. See note 1.

21. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 121, Table 85: Passenger Car and Light Truck Occupants Killed or Injured, by Age and Restraint Use.

22. See note 1.

23. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 99, Table 62: Driver Involvement Rates per 100,000 Licensed Drivers by Age, Sex, and Crash Severity (Note: 20 year olds are included in the teen involvement fatality percentage).

24. See note 1.

25. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), pages 166-167, Table 117: Persons Killed, by State and Highest Driver Blood Alcohol Concentration (BAC) in the Crash.

26. See note 1.

27. Data was obtained from NHTSA publication, *Distracted Driving 2010* (DOT HS 811650), page 2, Table 1: Fatal Crashes, Drivers in Fatal Crashes, and Fatalities 2010.

28. Source is from Carnegie Mellon University press release dated March 5, 2008: "Study Shows Listening to Cell Phones Significantly Impairs Drivers". For more information, visit the following website:

http://www.cmu.edu/news/archive/2008/March/march5_drivingwhilelistening.shtml

29. Source is from National Safety Councils' (NCS) report, *State of the Nation of Cell Phone Distracted Driving* (copyright 2012). The figure NCS estimates in the report are 24% of all crashes in 2010. For more information, visit the following website:

    http://iiky.org/documents/Distracted_Driving-State_of_the_Nation_NSC.pdf

30. Data was obtained from a query of the NHTSA-FARS database performed by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on December 11, 2013. The complete query summary is provided in the Appendix. For more information, visit the following website:

    http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx

31. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), pages 174-175, Table 121: Speeding-Related Traffic Fatalities, by State and Roadway Function Class.

32. See note 1.

33. See note 1 for fatalities involving Alcohol Impaired Driving, Teen Drivers, and Unrestrained Vehicle Occupants. See note 30 for fatalities involving Aggressive Driving.

34. See note 1 for serious injuries involving Alcohol Impaired Driving, Teen Drivers, and Unrestrained Vehicle Occupants. See note 30 for serious injuries involving Aggressive Driving.

35. See note 10.

36. Data obtained from FHWA website:

    http://safety.fhwa.dot.gov/roadway_dept/

37. See note 10.

38. Data obtained from two sources:

    - FHWA website: http://safety.fhwa.dot.gov/intersection/
    - NHTSA publication: *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 62, Table 32: Vehicles involved in Crashes by Relation to Junction, Traffic Control Device, and Crash Severity.

39. See note 1.

40. Data obtained from two sources:

http://safetydata.fra.dot.gov/OfficeofSafety/Publicsite/Query/AccidentByRegionStateCounty.aspx

- NHTSA publication: *Traffic Safety Facts 2011* (DOT HS 811754), page 90, Table 54: Persons Killed or Injured, by Person Type and Injury Severity

41. See note 1.

42. Source for total mileage and vehicle miles traveled on interstate highways and freeways in Tennessee:

http://www.tdot.state.tn.us/longrange/adt/2012ADTBook.pdf

43. See note 42.

44. Sources for 13.7% of the national population in 2012 are aged 65 years and older:

http://www.census.gov/prod/2014pubs/p25-1140.pdf
http://www.census.gov/prod/2014pubs/p25-1141.pdf

45. Source for this age group to increase to more than 20% by 2030:

https://www.census.gov/population/projections/data/national/2012/summarytables.html

46. See note 10 for data source reference for historic data shown. The projection shown is based on fatalities and serious injuries from only known historic datasets.

47. See note 10.

48. The percentages shown were established using query summary data referenced in note 10.

49. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 99, Table 62: Driver Involvement Rates per 100,000 Licensed Drivers by Age, Sex, and Crash Severity. The number of licensed drivers by age and sex for 2011 can be obtained from FHWA.
http://www.fhwa.dot.gov/policyinformation/statistics/2011/pdf/dl20.pdf

50. Data obtained from two sources:

http://www.nhtsa.gov/staticfiles/nti/older_drivers/pdf/Older_People_811873.pdf
https://www.census.gov/population/projections/data/national/2012/summarytables.html

51. See note 1.

52. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 90, Table 54: Persons Killed or Injured, by Person Type and Injury Severity.

53. See note 1.

54. The statistic was obtained from the Motorcycle Awareness Foundation of Tennessee website. For more information, please visit the following website:

http://www.maft.us/about-motorcycle-awareness.html

55. Data obtained from the National Conference of State Legislatures document, *Encouraging Biking and Walking, The State Legislative Role*, by Douglas Shinkle and Anne Tiegen published November 2008. For more information, please visit the following website:

http://www.ncsl.org/documents/transportation/encouragingbicyclingwalking.pdf

56. See note 55.

57. See note 52.

58. See note 1.

59. See note 52.

60. Sources for urban locations experiencing higher percentages of pedestrian fatalities and pedestrian serious injuries:

http://www-nrd.nhtsa.dot.gov/Pubs/811888.pdf
http://tntrafficsafety.org/data-statistics
http://www-nrd.nhtsa.dot.gov/departments/nrd-30/ncsa/STSI/47_TN/2011/47_TN_2011.htm

61. See note 1.

62. See note 1 for data source reference for historic data shown.

63. See note 1.

64. Source for delay due to work zones on freeways:

http://ops.fhwa.dot.gov/wz/resources/facts_stats/delay.htm

65. Source for the percentage of highway congestion due to non-recurring conditions:

http://ops.fhwa.dot.gov/program_areas/reduce-non-cong.htm

66. Data was obtained from NHTSA publication, *NHTSA Traffic Safety Facts 2011* (DOT HS 811754), page 96, Table 60: Persons Killed in Work Zones, by Roadway Function Class and Person Type.

67. See note 1.

68. Final Rule on Work Zone Safety and Mobility was published in the *Federal Register* (Vol. 69, No. 174, page 54562) on September 9, 2004 with an effective date October 12, 2007.

http://www.gpo.gov/fdsys/pkg/FR-2004-09-09/pdf/04-20340.pdf

69. See note 65.

70. Several sources site these statistics on secondary incident crashes:

- National Traffic Incident Management Coalition brochure, December 2004 – Revision II
- "Relationship Between Volume-to-Capacity Ratios and Accident Rates" by Min Zhou and Virginia P. Sisiopiku, *Transportation Research Record 1581*, Washington, D.C., 1997, pages 47-52
- "ITS Impacts on Safety and Traffic Management: An Investigation of Secondary Crashes" by Matthew G. Karlaftis, Steven P. Latoski, Nadine J. Richards, and Kumares C. Sinha; *ITS Journal*, 1999, Volume 5, pages 39-53:

  http://ntl.bts.gov/lib/jpodocs/repts_te/14296_files/14296.pdf

71. Data was obtained from a query of the NHTSA-FARS database performed by the Tennessee Department of Safety and Homeland Security, Research, Planning and Development Division on December 12, 2013. The complete query summary is provided in the Appendix. For more information, visit the following website:

http://www-fars.nhtsa.dot.gov/QueryTool/QuerySection/SelectYear.aspx

72. Source is from FHWA SHRP2 Tim Training brochure.

73. See note 1 for Work Zone related fatalities.

74. See note 71 for Secondary Crash fatalities.

75. See note 1 for Work Zone related serious injuries.

76. See note 71 for Secondary Crash serious injuries.

77. Source is from the report, *I-40 Trucking Operations and Safety Analysis and Strategic Planning Initiatives,* by Robert E. Stammer, Jr., Ph.D, PE, published April 2010. For more information, visit the following website:

http://www.memphis.edu/ifti/pdfs/cifts_i40_trucking.pdf

78. See note 1.

79. Source for large truck crashes in Tennessee:

https://ai.fmcsa.dot.gov/CrashStatistics/rptsummary.aspx

80. Data was obtained from the *Tennessee Motor Carrier Safety Assistance Program, Commercial Vehicle Safety Plan, FY 2014*, page 6.

81. See note 80.