



**Virginia's Long-Range Multimodal
Transportation Plan
2007-2035**

SAFETY

**Prepared for:
Office of Intermodal Planning and Investment
October 2009**

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ABBREVIATIONS AND ACRONYMS

AAA	American Automobile Association
DOE	Department of Education
DMV	Department of Motor Vehicles
DOT	Departments of Transportation
DRTP	Department of Rail and Public Transportation
FARS	Fatal Accident Reporting System
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GHSA	Governors Highway Safety Association
GPS	Global Positional System
HSIP	Highway Safety Improvement Program
IPM	Implementation Process Model
MPO	Metropolitan Planning Organizations
NCHRP	National Cooperative Highway Research Program
NHTSA	National Highway Traffic Safety Administration
RNS	Roadway Network System
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users
SHSP	Strategic Highway Safety Plans
STARS	Strategically Targeted and Affordable Roadway Solutions
STIP	Statewide Transportation Improvement Programs
TIP	Transportation Improvement Programs
TREDS	Traffic Records Electronic Data System
TSP	Transportation Safety Planning
USDOT	United States Department of Transportation
VASAP	Virginia Alcohol Safety Action Program
VDH	Virginia Department of Health
VGINS	Virginia Geographic Information Network System
VSP	Virginia State Police
VTRC	Virginia Transportation Research Council

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ISSUE DEFINITION

A fundamental responsibility of Virginia's transportation agencies and officials is to provide for the safety of the traveling public. Traffic safety challenges such as increasing travel, changes in vehicle design and size, changes in driver population, increased driver distraction, and increasing truck travel heighten the need for significant safety improvements. In the past, safety as it relates to transportation-planning meant achieving a trip purpose without incurring personal harm or damage to property. However, in more recent years, safety has been defined much more broadly than focusing on geometric and operational improvements. Efforts have focused on enforcement, education, emergency services, and engineering (the four E's of safety).

The more broadly defined approach to transportation safety is called Transportation Safety Planning (TSP). The Federal Highway Administration (FHWA) defines TSP as the integration of safety considerations into the transportation planning process at all levels, specifically the Strategic Highway Safety Plans (SHSP), Statewide Transportation Improvement Programs (STIP), Transportation Improvement Programs (TIP), and long range transportation plans that state Departments of Transportation (DOTs) and Metropolitan Planning Organizations (MPOs) are required to prepare and update periodically.¹

Virginia's SHSP is a comprehensive, collaborative, and data-driven approach to highway safety. The TSP and SHSP processes are based on bringing together all safety partners to ensure a coordinated effort toward improving surface transportation safety. This white paper outlines the role of transportation safety in VTrans2035, summarizes safety conditions and trends in Virginia, discusses Virginia's leadership roles in safety, and describes safety priorities and opportunities for the future.

WHY IS THIS ISSUE IMPORTANT?

Reducing Human Toll

Each year more than 40 thousand people die in crashes on the Nation's roadways and millions more sustain injuries that require an emergency department visit. For individuals ages 4 through 34, motor vehicle crashes are now the leading cause of death, taking more lives than heart disease, cancer, stroke, homicide, suicide, drowning, poisoning, falls, fire, HIV, or diabetes.² Across all ages, motor vehicle crashes were the tenth leading cause of all deaths in Virginia in 2006.³ These fatalities and serious injuries are avoidable and must be a top priority in transportation planning.

¹ <http://www.fhwa.dot.gov/planning/scp/>

² NHTSA National Center for Statistics and Analysis. Motor Vehicle Crashes As a Leading Cause of Death in the United States, 2005/

³ Virginia Department of Motor Vehicles. Traffic Crash Facts, 2008.

It's the Law

Safety has progressively gained importance in transportation planning legislation. In 1998 the Federal transportation bill TEA-21 identified “safety and security” as one of seven priority factors in statewide and metropolitan planning processes. The 2005 Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users (SAFETEA-LU) further elevated safety by separating it as an individual planning factor, establishing the highway safety improvement program (HSIP) as a new “core” funding program, and requiring each state to develop and implement a strategic highway safety plan or SHSP.

In addition to SAFETEA-LU, on February 14, 2007, an update to the Statewide Transportation Planning, Metropolitan Transportation Planning, Final Rule (23 CFR 450) was issued. The legislation states that the statewide and metropolitan transportation plans should be consistent with the SHSP. The Final Rule encourages a safety element of the long-range plan that is consistent with the SHSP. Also, the STIP is expected to reflect capital and safety projects that are included in the SHSP.

The changes introduced in TEA-21, and updated in SAFETEA-LU and the Final Rule were designed to strengthen the linkage between safety and the transportation planning process. They require safety be explicitly engrained in the planning processes undertaken by state DOTs, MPOs, local governments, and other safety stakeholders.

Cost Advantage of Safer Roads

Traffic crashes and fatalities have serious economic implications. The loss of life, income or ability to work substantially impacts the local community in medical costs, lost wages, insurance costs, taxes, emergency management services, and property damage. Traffic crashes also place additional stress on emergency and medical services. The estimated economic cost for motor vehicle fatalities in Virginia totaled nearly \$1.2 billion in 2006. Injury costs in the state were \$2 billion and property damage only crashes totaled \$810 million.⁴

The transportation network plays an important role in the economic vitality of a state, region, city, or county. Traffic crashes adversely affect the operation of the transportation system causing congestion and travel delays that impact the movement of goods and people. These costs are difficult to estimate but have major economic implications. The 2008 AAA study, *Crashes vs. Congestion: What's the Cost to Society?*, concludes that the cost of traffic crashes in the urban areas studied is nearly two and half times the cost of congestion, and that the 40 to 50 percent of all nonrecurring congestion is associated with traffic incidents.⁵ Safer roads have the potential to yield cost benefits by decreasing crashes, reducing congestion, and increasing travel time reliability.

A safe and efficient system saves lives and protects the traveling public. Federal mandates require state DOTs and MPOs to incorporate safety into the transportation planning process.

⁴ Costs based on the National Safety Council's annual cost estimates.

⁵ AAA and Cambridge Systematics. *Crashes vs. Congestion – What's the Cost to Society*, 2008.

There are a number of economic benefits to a safe transportation system. Virginia's thriving economy depends on its transportation to safely and efficiently move people and goods.

WHAT ARE CURRENT SAFETY CONDITIONS AND PERFORMANCE IN VIRGINIA?

From 2006 to 2008, an average of 144,126 crashes, 936 fatalities, and 70,433 injuries occurred in the commonwealth annually.⁶

VDOT's Transportation Performance Report (TPR) includes the following safety performance measures⁷ (The most recent TPR update is based on data through 2007. Where applicable data available from the 2008 Virginia Traffic Crash Facts is cited):

- Statewide Highway Fatalities and Fatality Rate:
 - In 2008, there were 821 fatalities on Virginia's roadways, an decrease of 205 from 2007 and the lowest level in over a decade.
 - Virginia's highway fatality rate decreased in 2008 to 1.00 per 100 million vehicle miles traveled but remained below the national average (1.27).
- Statewide Highway Crashes and Crash Rate:
 - For 2008, the number of crashes decreased to 135,282 from 145,405 in 2007. In 2007, the crash rate per 100,000 residents decreased to 1,885.
- Number of Transit Crashes:
 - Transit crashes have trended upward over the past several years. In 2007, 228 transit crashes resulted in 8 fatalities, which compares to a yearly average of 7 per year.
- Number of Aviation Crashes:
 - Aviation crashes have been stable over the past several years. In 2007, 35 aviation crashes resulted in 10 fatalities, equal to the annual average over the last 5 years.

According to the USDOT Fatal Accident Reporting System (FARS), nearly two thirds of Virginia motor vehicle fatalities occur on rural roadways.

The *2008 Virginia Traffic Crash Facts* indicates that 43 percent of all traffic fatalities and 10 percent of all injuries were alcohol related. Twenty-three percent (80) of the total individuals killed in alcohol related crashes (354) were between the ages of 20 and 25. Pedestrians were killed in 9 percent of all traffic fatalities and 2.5 percent of the injuries were to pedestrians. Nearly 3 percent of all crashes involved commercial vehicles.

⁶ Virginia Department of Motor Vehicles. 2008 Virginia Traffic Crash Facts

⁷ Virginia Department of Transportation, Transportation Performance Report 2007

WHAT ARE THE RECENT TRENDS AND AVAILABLE FORECASTS OF FUTURE SAFETY CONDITIONS AND PERFORMANCE?

As indicated above and shown below in Figures 1-1, 1-2, and 1-3, statewide highway crashes and the corresponding crash rate have trended downward over the last several years. After increasing from 2004 to 2007, in 2008 fatalities dropped to the lowest number in over a decade at 821. Injuries have decreased at a similar rate as crashes from 2004 to 2008.⁸

Figure 1-1. Motor Vehicle Crashes 1999-2008

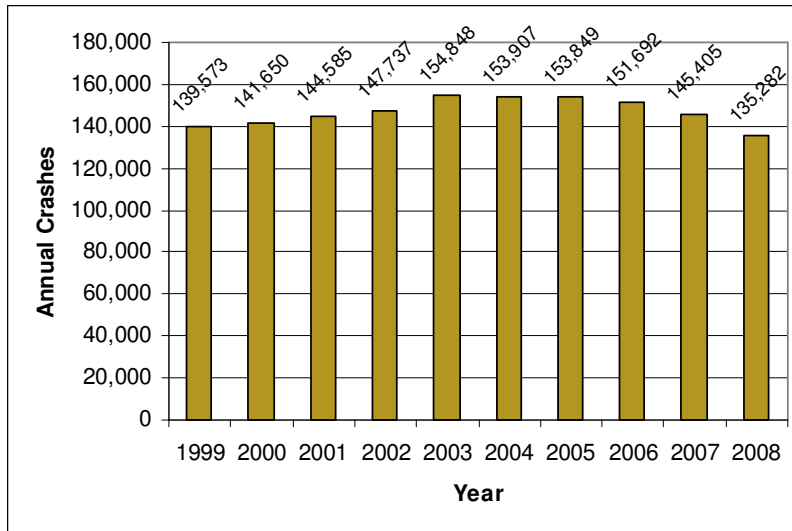


Figure 1-2. Motor Vehicle Fatalities 1999-2008

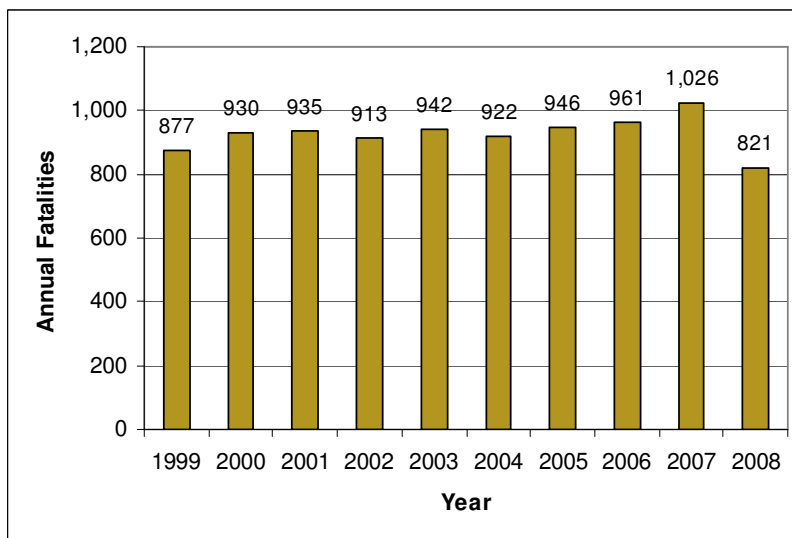
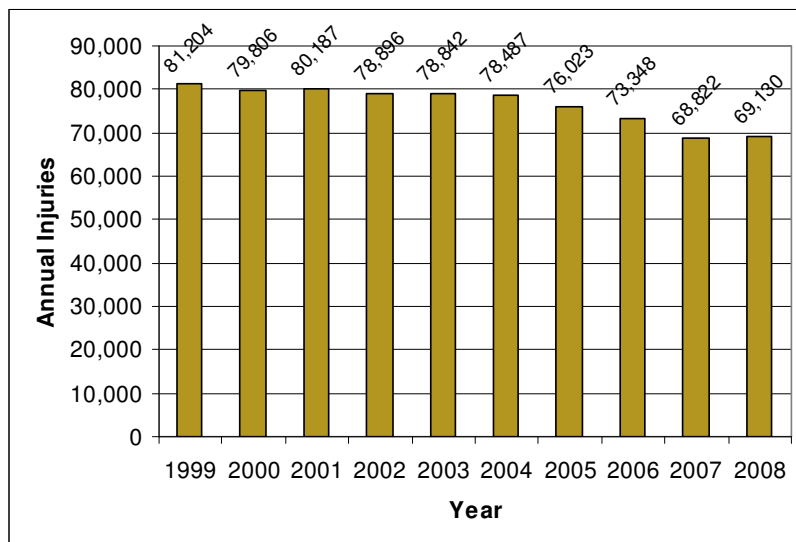


Figure 1-3. Motor Vehicle Injuries 1999-2008

⁸ Virginia Department of Motor Vehicles. 2008 Virginia Traffic Crash Facts



A similar trend can be seen in regional crashes and crash rates. In Virginia’s metropolitan areas, both the number of fatalities and the fatality rates have trended downward in Northern Virginia but upward in the Richmond and Hampton Roads areas.

Virginia’s SHSP is a data driven process based on analysis of conditions and trends and identifies the following ongoing priority areas for improving safety on all public roadways:

Human Factors Emphasis Area

- Driver Behavior
- Special Users
- Pedestrian and Bicyclist Safety

Environmental Emphasis Area

- Intersection Safety
- Roadway Departures
- Work Zone Safety
- Pedestrian and Bicycle Safety

Fundamental Emphasis Area

- Traffic Records
- Transportation Safety Planning

Trends show that these emphasis areas are a growing concern for Virginia and should continue to be addressed in the state's multimodal transportation plan. Examples of relevant data include:

Safety Belts

Wearing a safety belt is the single most effective safety tool for reducing vehicle fatalities. In 2008, 60% of the 821 persons killed in vehicles equipped with safety belts were not wearing them. Safety belt usage has increased considerably over the past 20 years, and after a relatively stagnant period between 2005 (80.4%) and 2007 (79.9%), preliminary survey results indicate additional usage increase in 2009.

Pedestrian and Bicycle Safety

In 2008, 76 pedestrians and 14 bicyclists died in motor vehicle crashes. That year, 1,696 pedestrians and 716 bicyclists were injured. Pedestrian and bicycle deaths and injuries have declined in recent years.

Intersection Safety

Intersections are prone to crashes because vehicles, pedestrians, and bicyclists encounter a number of conflict points. The SHSP targets a reduction in intersection crashes citing an average of 173 deaths and 26,721 injuries occurring as a result of intersection crashes. These intersection crashes include crashes within 150 feet of VDOT-maintained intersections, plus all angle crashes in towns and cities on non-VDOT-maintained roadways.

Roadway Departures

Motorists are particularly at risk when their vehicles leave the designated travel lanes or roadway. About half of VDOT system road departure crashes occur on rural undivided roadways. Annual deaths from roadway departure crashes in Virginia averaged 406 from 2001 to 2005. During that same period, an average of 13,931 injuries occurred annually.

Work Zone Safety

Work zone safety is a critical due to the presence of construction workers and equipment. From 2001 through 2005, there were 6,564 crashes statewide reported in work zones resulting in 3,478 injuries. Focusing on high-volume, high-speed work zones and reducing driver inattention are all necessary to reduce work zone crashes.

Other trends that stand to impact the safety conditions on Virginia's roadways include:

Aging Population

As the population ages, the needs of senior drivers have become a priority. Senior drivers develop driving challenges including eyesight weakness, cognitive impairment, dementia, slowing reflexes, hearing loss, and prescription drug interactions. On average, drivers over age

70 experience approximately 110 deaths and 6,100 injuries from motor vehicle crashes statewide each year.⁹ Senior drivers are identified as a targeted special users group in Virginia's SHSP. Strategies to reduce older driver crashes include upgrading traffic signage, pavement markings, and traffic signals to improve visibility for older drivers. The state is also developing a number of transportation programs for seniors.

Younger Drivers

Drivers are at the highest risk of a crash before age 21. Young drivers have more driving distractions that ever and are more likely to speed. Drivers under the age of 21 are also less likely to wear seat belts and are less experienced drivers. On average, 195 deaths and 21,742 deaths occurred from crashes involving drivers under the age of 21 in Virginia. Major strategies targeted by the SHSP include reviewing current Standards of Learning for driver education, seeking legislation to implement a full Graduated License Program, implementing stronger peer safety education programs, and increasing enforcement for speed and safety belt violations around high schools.

Motorcycles

Related to mode of travel, mirroring national trends, the number of motorcycles on Virginia's roadways has increased dramatically in recent years. Motorcyclist fatalities contributed heavily to Virginia's overall fatality rate, as 79 motorcyclists were killed in 2008.

WHAT ARE VIRGINIA'S CURRENT LEADERSHIP ROLES AND UNIQUENESS?

Virginia is unique and/or plays a leadership role in a number of areas related to safety.

Strategic Highway Safety Plan

Through the SHSP, Virginia has adopted a multi-disciplinary approach including engineering, education, enforcement, and emergency management strategies to reduce the number of injuries and deaths due to motor vehicle crashes. The SHSP is a comprehensive source for safety conditions and performance on all public roads and presents the combined efforts of Virginia's safety partners to improve transportation safety in the commonwealth.

The Plan establishes a shared vision for transportation safety. Virginia's Surface Transportation Safety Executive Committee leads the effort and has united a number of safety partners. The Surface Transportation Safety Executive Committee is comprised of the following agencies:

- Commission of the Virginia Alcohol Safety Action Program (VASAP),
- Department of Education (DOE),
- Department of Health (VDH),
- Department of Motor Vehicles (DMV),
- Department of Transportation (VDOT), and
- Virginia State Police (VSP).

⁹ Virginia Department of Motor Vehicles, *Citizen Services System and Centralized Accident Processing System*.

The committee is co-chaired by VDOT and DMV representatives. Ad hoc membership includes:

- Department for the Aging,
- Department of Rail and Public Transportation (DRPT),
- Federal Highway Administration (FHWA),
- Federal Motor Carrier Safety Administration (FMCSA),
- National Highway Traffic Safety Administration (NHTSA), and
- Virginia Transportation Research Council (VTRC).

The Surface Transportation Executive Committee is charged with integrating and coordinating all transportation safety programs. The committee establishes statewide surface transportation goals and objectives and prepares and updates the SHSP. The SHSP identifies and prioritizes all opportunities to improve highway safety. Over 120 strategies using education, engineering, enforcement, and emergency response to save lives and prevent injuries are identified in the SHSP under three areas: human factors, environmental, and fundamental areas including traffic records and transportation safety planning.

The SHSP uses a data driven approach to identify the areas most significant to Virginia's safety issues. Using this approach helps decision makers prioritize various efforts and resources. Decision makers are able to better identify local agencies and MPOs to target funding distributions for optimal results. Areas that contribute the greatest to the safety issues identified in the SHSP can receive resources proportionate to their needs. In the past, resources were allocated based on population or other factors.

Asset Management

Virginia has established itself as a leader in asset management. A number of asset management initiatives provide for a safer transportation system and address relevant SHSP priority areas such as traffic records, bicycle and pedestrian safety, older driver safety, intersection safety, and roadway departures.

Maintaining transportation infrastructure improves the safety of the system and has the potential to reduce the number of crashes caused by dangerous roadway conditions. Pavement and bridge conditions are especially important to transportation safety. VDOT produces annual reports on asset conditions, and more detailed biennial reports with prediction of needs and detailed condition data.

VDOT is utilizing its asset management system to target safety improvements. Strategically Targeted and Affordable Roadway Solutions (STARS) is a safety and congestion program that partners state, planning district and local transportation planners, traffic engineers, safety engineers and operations staff to identify "hot spots" along roadways where safety and congestion problems overlap and are suitable for short term operational improvements. Factors such as the condition of pavement or pavement markings are used to prioritize the hot spot locations identified by the STARS program.

VDOT is also incorporating safety improvements into maintenance activities. The department conducts a roadway safety assessment when a road is up for resurfacing or other maintenance. If safety problems are identified, low cost countermeasures are implemented during the resurfacing work. The department is making an effort to train employees on the process and make it a cultural norm.

Virginia Performs Initiative

The commonwealth is a leader in the U.S. in statewide performance reporting as evidenced by the Virginia Performs effort. The comprehensive and highly accessible nature of the performance dashboard provides safety related performance data to a variety of stakeholders and interest groups.

The Virginia Performs initiative is a valuable source of information on the performance of the transportation system. VDOT has established measures directly related to the safety of the transportation system. The agencies in the Transportation Secretariat ensure that Virginia has a transportation system that is safe, enables easy movement of people and goods, enhances the economy and improves our quality of life. Key objectives directly related to safety include decreasing the number of traffic fatalities and improving highway safety. The VDOT Performs Dashboard is a resource for detailed data, trends, and measures by road system and district. Safety related measures on the dashboard include:¹⁰

- Traffic crashes,
- Traffic crash-related injuries,
- Traffic crash-related fatalities, and
- Work zone crashes.

The dashboard indicators provide crash, injury, and fatality statistics based statewide or by district. Data can also be viewed by county or city. Data for interstate, primary, secondary, and urban road systems can be queried. Crashes, injuries, and fatalities can be viewed by four focus areas: intersections, bicycle/pedestrians, roadway departures, or work zones. Data is provided on the dashboard in rolling 12- month totals or three-year rolling averages.

Improving Crash Data

The SHSP also identified two special emphasis areas that are fundamental to transportation safety: traffic records and transportation safety planning. Traffic records are the foundation for a data driven planning process. Effective decisions that target a multidisciplinary approach to road safety require crash data, emergency services response data, hospital patient and injury data, and citation and adjudication data. Transportation safety planning provides the foundation for a systemwide, multimodal approach to safety. Therefore both traffic records and transportation safety planning should be fundamental themes in VTrans2035.

Crash data is now available for all state and local roadways. In 2008, the commonwealth implemented the Traffic Records Electronic Data System (TREDS) an electronic crash data

¹⁰ <http://dashboard.virginiadot.org/>

system, housed at DMV, that allows officers to enter crash report data at the site of the crash. The system allows the officer to record the X and Y coordinates of the crash with a Global Positional System (GPS) receiver. The crash report information is immediately downloaded to the state database and located on the Roadway Network System (RNS). Virginia is also in the process of developing the Virginia Geographic Information Network System (VGINS) to include centerline data for all roadways, including local data. Crash data for state and local roadways from 2008 forward will be available after the system is implemented in 2010.

Highway safety is an important priority to Virginia's leadership. The state has a shared vision for safety. A number of agencies are highly involved in the SHSP process and provide support to initiatives that promote the goals of the SHSP. Reliable, comprehensive data is needed to address adequately safety challenges from a data driven perspective. Improving crash data systems is a priority for the commonwealth. A more comprehensive data system will help the state identify local agencies and regions resources should be distributed to for safety improvements.

Next-generation Technologies and IntelliDrivesm

VDOT is actively involved in the United States Department of Transportation's (USDOT) IntelliDrivesm initiative, formerly known as Vehicle Infrastructure Integration (VII). IntelliDrivesm relies on next generation technologies and applications with and between vehicles, roadways, and devices (such as consumer electronics) in the vehicle to achieve transformational safety, mobility, and environmental improvements. VDOT maintains an active role in national IntelliDrivesm working groups, and the Commissioner is a member of the Executive Leadership Team. VDOT is also the lead state for the IntelliDrivesm Pooled Fund Study (PFS) to develop applications that will support the national deployment of an IntelliDrivesm system. VDOT is expanding its involvement beyond the working groups by establishing its own IntelliDrivesm program to improve operations, mobility, and safety on Virginia's roadways.

The IntelliDrivesm safety features are built on the realization that even last second warnings could give drivers enough time to react and avoid a collision. Some IntelliDrivesm safety options include:

Signal and Stop Sign Violation Warning - Drivers who are at risk of violating a red signal light or a stop sign receive a visual, haptic (physical), and/or audible warning from on-board equipment.

Curve Speed Warning - If the vehicle's speed is higher than recommended for the curve, the system warns the driver to slow down, or the vehicle can take preventative action.

Collision Warning and Crash Mitigation - IntelliDrivesm provides warnings to drivers who are approaching a slowed or stopped object too rapidly, or following a vehicle too closely. If a vehicle traveling ahead suddenly decelerates, the driver is notified so they are aware of the deceleration even if visibility is limited by weather conditions or obstructed by large vehicles. The system also warns drivers of impending side or rear-impact collisions, or when they are about to drift out of their lane. In the event of an impending crash, the car may take actions to reduce crash severity, such as tightening seat belts, deploying air bags, and/or moving seats back.

Road and Travel Condition Warning - The driver receives up-to-the-minute information about road, weather, and travel conditions in the local area—such as crashes, work zones, slippery road conditions, detours, traffic congestion, weather, parking restrictions, turning restrictions, and other situational elements that may have safety implications.

ARE THERE RELEVANT LESSONS FROM OTHERS?

SHSP Implementation Model

The FHWA is developing a SHSP Implementation Process Model (IPM) to help states successfully implement their SHSPs. The IPM identifies model practices and processes that support SHSP implementation. This is not to suggest that one size fits all; each state will be able to review the model elements and determine which are useful for overcoming barriers and implementing its SHSP more effectively. Successful SHSP implementation will result in transportation safety improvements that save lives and reduce injuries.

The IPM is based on wisdom gained through developing and implementing *The Champion's Guide for Developing Strategic Highway Safety Plans* and extensive interviews with “model” states. The interviews highlighted examples of exemplary approaches these states are using to implement their SHSPs.

Safety Performance Measurement

NHTSA and the Governors Highway Safety Association (GHSA) have agreed on a minimum set of performance measures to be used by States and federal agencies in the development and implementation of behavioral highway safety plans and programs¹¹. The initial minimum set contains 14 measures: ten core outcome measures, one core behavior measure, and three activity measures. The measures cover the major areas common to State highway safety plans and use existing data systems. States will set goals for and report progress on each of the 11 core outcome and behavior measures annually, beginning with their 2010 Highway Safety Plans and Annual Reports. States will report the activity measures annually beginning with their 2010 Highway Safety Plans and Annual Reports. States should define and use additional performance measures for their other high-priority highway safety areas as appropriate. NHTSA will use the core measures as an integral part of its reporting to the Congress, the public, and others.

Intersection Safety Research

FHWA is initiating a new research focus area on intersection safety. AASHTO's Strategic Highway Safety Plan identifies "improving the design and operation of highway intersections" as one of its 22 strategies for reducing highway deaths and injuries. The objectives are to facilitate implementation of shorter-term strategies and define and evaluate longer-term, higher-payoff strategies to improve intersection safety. FHWA will identify the most common and severe

¹¹ National Highway Traffic Safety Administration (NHTSA). Traffic Safety Performance Measures for State and Federal Agencies. August 2008.

problems and compile information on the applications and design of innovative infrastructure configurations and treatments at both signalized and non-signalized intersections and at interchanges. This initial effort should reveal strategic operational and research opportunities to further intersection safety.

Context Sensitive Street Design

Some states have developed Practices and techniques that better integrate land use and transportation planning. *Context Sensitive Street Design The Smart Transportation Guidebook*, published in March 2008, was developed through a partnership between Pennsylvania DOT and the New Jersey DOT. The goal of the Guidebook is to integrate the planning and design of our transportation system in a manner that fosters development of sustainable and livable communities. The Guidebook has equal applicability to rural, suburban, and urban areas.

WHAT ARE THE MAJOR OPPORTUNITIES FOR FUTURE INITIATIVES?

Major opportunities for Virginia to further improve its approaches to safety and implement the SHSP include:

- Integrate the SHSP goals and objectives into the individual agency action plans. Integrating the SHSP goals and objectives into all agencies with highway safety priorities creates a more comprehensive planning process that allows agencies to partner and to leverage resources. Aligning these plans provides a more unified process to reduce administrative burden, ensure unified data and analysis methods, and align scarce resources to more effectively produce safety improvements.
- Promote more focus on safety at the regional and local levels. One-third of Virginia's local jurisdictions have active highway safety commissions. The commissions focus on hot spot identification and countermeasure implementation. The state can encourage local jurisdictions to develop commissions that focus on safety issues.
- Strengthen the link between asset management and safety by incorporating the management of roadway elements into current asset management systems. Cost effective maintenance, rehabilitation, and replacement of roadway elements such as signs, signals, lighting, guardrails, barriers, and pavement markings are vital to maintaining a safe roadway system. This initiative supports the Intersection Safety and Road Departure emphasis areas.
- Implement additional improvements to TREDs, the statewide crash database to which VDOT can link its roadway data. Citation, hospital, and adjudication information can be linked to the crash, driver, and vehicle. Linking these information systems in TREDs will allow the state to connect a crash to the driver, to the vehicles involved, to emergency services provided, and to penalties to driver as a result of the crash. This is a major strategy for the Traffic Records emphasis area.
- Link socio-economic, crash, highway inventory, and traffic information to better understand the causes of non-motorized crashes. This is a SHSP strategy for both the Pedestrian and Bicycle Safety and Traffic Records emphasis areas.
- Develop practices and techniques to better integrate land use and transportation planning.

- Improve Incident Management Programs throughout the state. The National Traffic Incident Management Coalition reports that the likelihood of a secondary crash increases by 2.8 percent for each *minute* the primary incident continues to be a hazard. Causes include the dramatic change in traffic conditions, including the rapid spreading of queue length, and the substantial drop in traffic speed, as well as rubbernecking. Secondary crashes due to congestion resulting from a previous crash are estimated to represent 20 percent of all crashes. Incident management programs prevent secondary incidents by reducing the duration of traffic incidents, and by publicizing the incident using changeable message signs (CMS) and traveler information systems, such as Virginia's 511 program.

WHAT MAY RISE TO TOP PRIORITY IN THE FUTURE?

Virginia's top transportation safety priorities in the future will follow the goal to reduce traffic fatalities and serious injuries. The new federal transportation authorization is expected to continue to raise the priority of safety in planning processes and activities. A number of states have adopted a zero fatality goal. In the near term, the SHSP will be updated to incorporate strategies to best prioritize resources and efforts. The SHSP update will also incorporate new leadership's primary safety goals. As more states move into implementation, the shared experiences and lessons learned will strengthen the overall process.

Virginia's SHSP identified Transportation Safety Planning as a priority area and includes important strategies toward documenting and standardizing the process within the state. This also reflects emphasis at the National level, with such efforts as the soon to be kicked off National Cooperative Highway Research Program (NCHRP) effort focusing on institutionalizing safety in transportation planning processes.

All these efforts rely on accurate timely data. Virginia's SHSP identifies Traffic Records as a priority area and proposes initiatives that will enable Virginia to have a state-of-the-art crash records system that will support the SHSP and its emphasis areas as well as enable all to access data for any safety program. Building on data efforts as described above puts Virginia at the forefront of efforts.

With reduced money for capacity expansion, congestion on Virginia's roadways will increase. With this increase will likely come an increase in crashes particularly at weave and merge points and at bottlenecks where queues can form quickly and unexpectedly. There are several ITS strategies that have been used successfully in other areas to improve safety and should be considered for deployment as appropriate in Virginia:

- Speed Harmonization is geared towards improving traffic flow based on prevailing conditions. A system would typically be deployed where traffic volumes are high. The weather and traffic volumes are monitored and when a disturbance occurs in the traffic flow, the system modifies the speed limits accordingly which provides drivers a quick warning that driving conditions are changing.

- Queue Warning Systems consist of warning signs and flashing lights along a roadway to alert motorists that congestion and queues are ahead. This has proven effective in reducing crashes when deployed prior to locations of recurring congestion.
- Merge Control (also called junction control) is applied at entrance ramps or merge points where the number of downstream lanes is fewer than the number of upstream lanes. Lane control signals are installed over both upstream approaches before a merge. Priority is provided to the facility with the higher volume and a lane drop is given to the lesser volume roadway or approach.