



**Virginia Commonwealth University
Transportation Safety Training Center
Virginia Multi-disciplinary Crash Investigation Team**

Report Number 198 – December 2006

ABSTRACT

The crash described in this report occurred when a car and a pickup started from a stopped position side by side in adjacent left turn lanes. They began traveling onto a road that narrowed from two lanes to one lane, both vehicles accelerating and the drivers jockeying for the lead position. The car cut into the pickup's lane and the vehicles struck right front corner to left rear corner. The pickup slid off the right side of the road and struck a utility pole. The car veered into the opposing lanes and struck a minivan traveling down the hill in the opposite direction. After colliding head on, the two vehicles rotated and came to rest nearly side by side. The three occupants of the car all perished, including a 22 month old child who was improperly secured in a child restraint not designed for her size. In addition to the fatalities, this crash resulted in two injured drivers and extensive property damage.

This crash report illustrates the need for proper restraint use by all occupants in motor vehicles, including the correct use of child safety restraints, and the importance of wearing safety belts when a vehicle is equipped with an airbag. Additionally, the dangers of aggressive driving and the need for sufficient warning on merging roadways are discussed.

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SYNOPSIS

<u>Day, Time, Season:</u>	Friday, 11:32 a.m., Spring
<u>Road/Weather:</u>	Urban primary road; dry and clear
<u>Vehicles Involved:</u>	2005 Mercury Sable four door sedan 1990 Ford Ranger Pickup 1999 Plymouth Voyager Minivan
<u>Summary:</u>	The Sable and the Ranger began moving from stopped positions at a traffic signal. They were side by side in adjacent left turn lanes turning into a road that narrowed from two lanes to one. The vehicles collided. The Ranger then slid off the road and struck a pole. The Sable slid into the opposing lanes and struck the Voyager head-on.
<u>Severity:</u>	Three fatalities, personal injuries and extensive property damage. Traffic blocked.
<u>Probable Cause:</u>	Aggressive driving, speeding and failure to yield right of way.
<u>Significant Points:</u>	The dangers of aggressive driving; proper use of safety belts in airbag equipped vehicles and proper use of child restraints; design and marking of roadways with merging traffic.

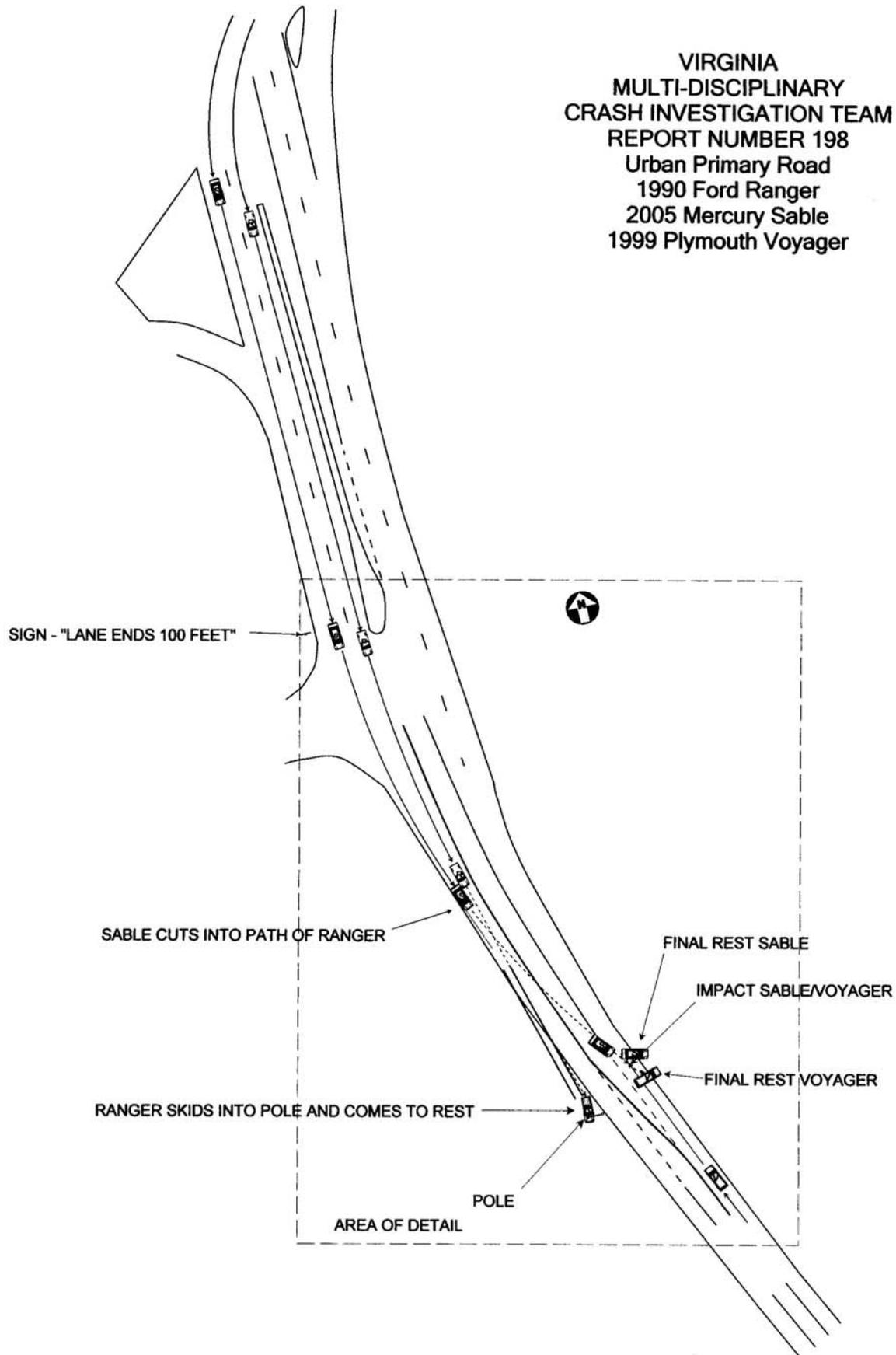
CRASH DESCRIPTION

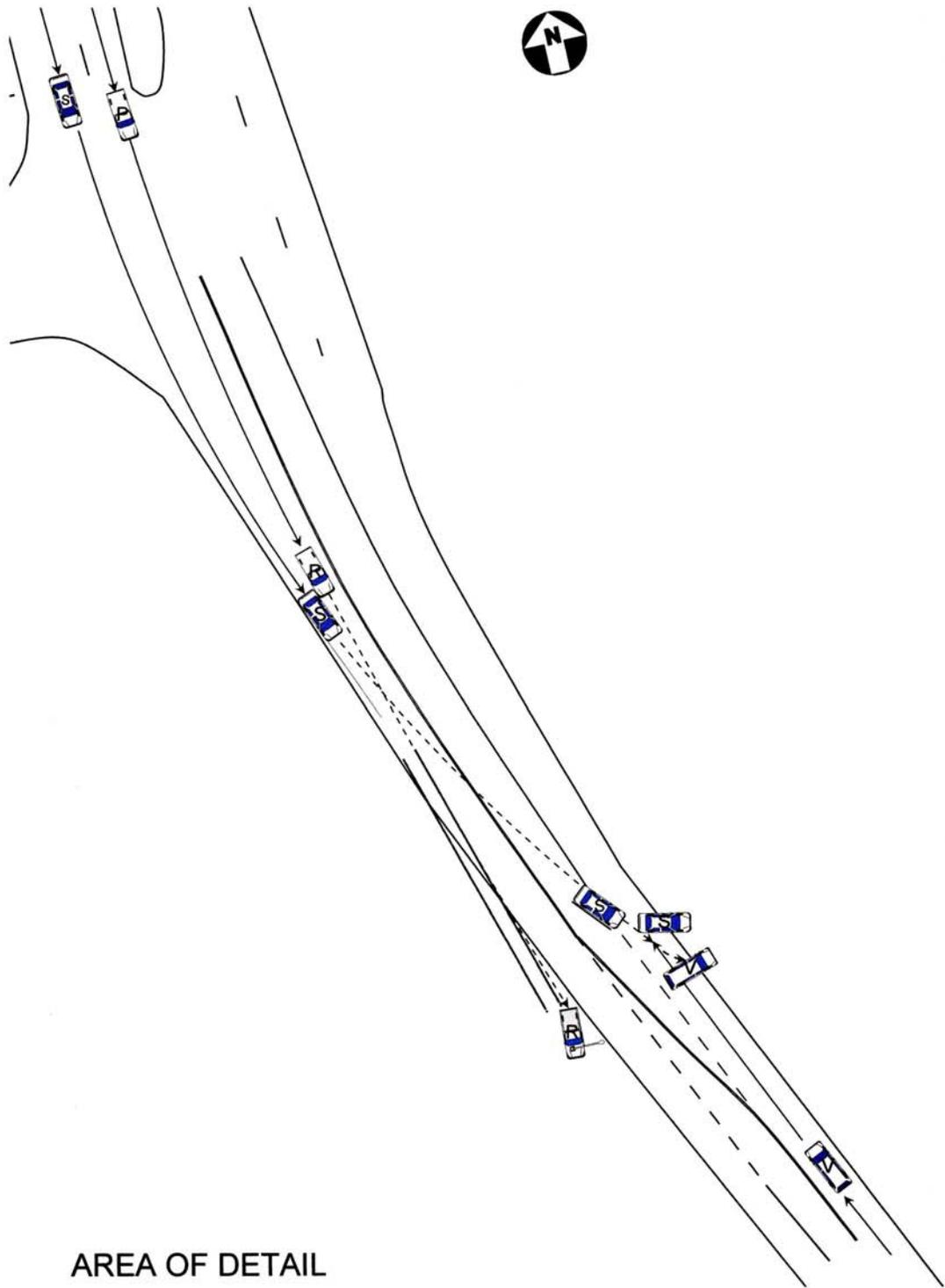
On a clear Friday morning in May at 11:32 a.m., a 2005 Mercury Sable and a 1990 Ford Ranger pickup truck were stopped at a traffic signal in adjacent travel lanes assigned to traffic turning left. Both vehicles had been traveling west on a four lane divided primary highway and were turning left onto the southbound lanes of a divided primary business route. For the first 540 feet of the southbound lanes, the road consisted of two asphalt-paved lanes with two intersections, one an exit ramp from the eastbound primary road and the second, an intersection with a city street. Just beyond the second intersection, the right lane merges left into a single lane. This section of roadway curves to the left and is on a slight upgrade. Prior to the second intersection, the southbound lanes are separated from the northbound lanes by a concrete median. This median has a section of curb and grass at the end to provide for a left turn lane for the northbound lane. After the two southbound lanes merge into one, the roadway becomes a two lane urban street with double solid yellow lines separating southbound from northbound traffic. The shoulder for both directions of travel is gravel and grass.

The Ranger driver, a 33 year old male who was wearing his lap/shoulder restraint, was headed towards his nearby home. The Sable driver was a 38 year old female who lived in a nearby county. She was accompanied in the right front passenger seat by a 21 year old woman, her son's fiancée, who was approximately 30 weeks pregnant. Both women had fastened their lap/shoulder restraints behind their respective seats. The passenger's 22 month old daughter sat in the rear seat behind the driver. She was restrained in a backless booster seat designed for larger children. Both the lap and the shoulder portions of her safety belt were threaded through the lap belt guide of the booster seat, leaving her upper body unrestrained.

When the signal changed for these vehicles to move, both drivers took off quickly in an attempt to gain the lead position. The vehicles accelerated heavily, creating enough noise to attract the attention of two witnesses who were washing a vehicle in front of their place of employment. The Sable in the right lane was in the process of passing the Ranger and, as the rear of her car came even with the front of the Ranger, she began cutting to the left as the pavement narrowed. The left rear corner of the Sable and the right front corner of the Ranger collided, sending both out of control. The Ranger skidded off the right edge of the pavement, struck and severed a light pole and came to rest atop the base of the pole. The Sable started to rotate counter clockwise and crossed the center lines of the road.

VIRGINIA
MULTI-DISCIPLINARY
CRASH INVESTIGATION TEAM
REPORT NUMBER 198
Urban Primary Road
1990 Ford Ranger
2005 Mercury Sable
1999 Plymouth Voyager





AREA OF DETAIL

As the Sable and the Ranger were making the left turn onto the business primary road, a 77 year old male was driving his 1999 Plymouth Voyager minivan northbound on the same road, on his way to a local restaurant where he often went for lunch. He was wearing his lap/shoulder belt. He had just completed a left curve at the top of the hill and was traveling downhill in the opposite direction of the other two vehicles. After the first collision, the Sable entered the Voyager's lane of travel while rotating counter-clockwise. The car driver steered to her right to correct for the rotation, attempting to keep it facing southbound as she crossed into the northbound lane of travel. These two vehicles struck front to front with the Sable at a slight angle. There was slightly heavier damage to the right front of the car and the right front of the minivan. After maximum engagement, they separated. The Sable rotated counter-clockwise toward the shoulder, with both front tires on the east shoulder and both rear tires in the northbound lane. The minivan rotated clockwise and ended up in a similar position approximately 10 feet south of the car.

In addition to the men washing cars in a company lot near the crash site, numerous others witnessed the crash. They stopped, notified authorities for emergency help, and attempted to aid the victims. Police, rescue and fire units arrived shortly thereafter. The Sable driver died at the scene from multiple blunt force traumas. Her front passenger was transported to a nearby hospital and also died from multiple blunt force traumas less than an hour later. The young child was transported to the same hospital as her mother, suffering blunt force trauma to her head, back (including fractured neck vertebrae) and torso. When it became apparent that she would not survive, she was transported to a nearby large city with a transplant center. She remained on life support until her family requested that it be removed; she became an organ donor upon the family's consent. The minivan driver was critically injured, with fractures to his ribs and pelvis, as well as some heart trauma. He was transported to a local hospital for treatment of life-threatening injuries. The pickup driver suffered a laceration that required four stitches. He was transported to a local hospital, treated and released.

REMARKS

Due to the serious nature of this crash, two State Police Divisional Crash Team members responded to assist the city police. They measured the scene using an electronic total station to document road features, the placement of evidence and the final resting positions of the vehicles. The State Trooper leading the reconstruction of this case contacted the Virginia Multi-disciplinary Crash Investigation Team (VMCIT), requesting technical assistance. The Trooper assigned to the VMCIT responded and met with the City Detective assigned to the case. Since this crash involved a child fatality, the VMCIT decided to investigate further.



Photo 1: View looking north, direction the Voyager was traveling. Note the back of the sole advisory sign for southbound traffic, just north of the intersection on the left.

Upon viewing the scene just after the crash, the Trooper noted that the lane line markings for this primary business route were faded and worn from traffic volume. Due to population

increases in the area and changes in traffic patterns, the primary business route has experienced a high volume of traffic passing through the signalized intersection with the major east-west primary road. For vehicles turning onto the southbound lanes of the business route, there was only one warning sign advising motorists that the right lane ended within 100 feet. While drivers familiar with the intersection could plan ahead for the merge, those newer to the area could easily be caught off guard and have difficulty managing the merge in heavy traffic conditions while also watching for traffic from the eastbound merging lane and the intersection on the right.

After the crash, the city employed an engineering consulting firm to review the roadway and make recommendations. Some of the recommendations have already been implemented: 1) additional advance warning signs indicating the right lane ends 300 feet and 200 feet have been installed, 2) a speed limit “35 MPH” sign and a graphic warning “no U turn” sign have been installed.



Photo 2: View looking south, after additional warning signs and repainted pavement markings were added.

The consultants also recommended two other changes: graphic “yield” pavement markings on the exit ramp from the eastbound primary road where it intersects with the primary business route and a stop bar on the city street at its intersection with the primary business route. These recommendations had not been implemented at the time of the VMCIT’s last visit to the site several months after the crash. On the other hand, the city recently repainted existing pavement markings and replaced the old warning sign for the merge at 100 feet with a new graphic one. The implemented changes have significantly improved the level of safety in this area by delineating the roadway and lanes more clearly and by alerting drivers with repetitive warnings to reinforce the merging action required.

The Ranger was an older model vehicle that displayed a valid safety inspection approval sticker and appeared to be in sound mechanical condition. The license plates had been removed when a VMCIT member inspected it. No defects were noted during the post-crash inspection. Contact damage was noted on the right front corner with paint transfer from the Sable. There was also contact damage consistent with the pole on the right side of the front bumper between the center point and the right headlamp. The pole intruded into the front end of the vehicle almost 11 inches, at a width of over 8 inches.



Photo 3: Front bumper of Ranger

The Sable driver normally drove the car, which was registered to her husband. The safety inspection sticker was unreadable due to the collision damage to the windshield. The Sable was a newer model and the equipment was found to be in good working order. No apparent defects were noted during the post-crash inspection. Slight contact damage on the left rear quarter panel was noted along with paint transfer from the Ranger. Crash damage from the head on collision with the minivan extended across the entire front of the vehicle. The right side sustained almost two and a half feet of crush, while the left side had less intrusion, at just over a foot. The wheelbase of the Sable was shortened on both sides by over 10 inches and the damage configuration indicated that it under-rod the Voyager. The seat belts in both front occupant positions were routed behind the seat backs; then the latch plates were inserted into the buckles.



Photo 4: Front View of Sable

The Voyager, which was driven by its registered owner, displayed valid license plates and safety inspection approval sticker. There were no apparent defects noted during the post-crash inspection. The latch plate for the driver's seat belt was found still inserted in the buckle

and the belts had been cut. The minivan sustained contact damage across the entire front, with 12 inches of collapse on the right side and over nine inches of crush on the left side. The damage configuration was consistent with a slight over-ride of the Sable. The wheelbase, while not significantly altered on the left side, was shortened by over five inches on the right, when the intruding Sable struck the wheel.

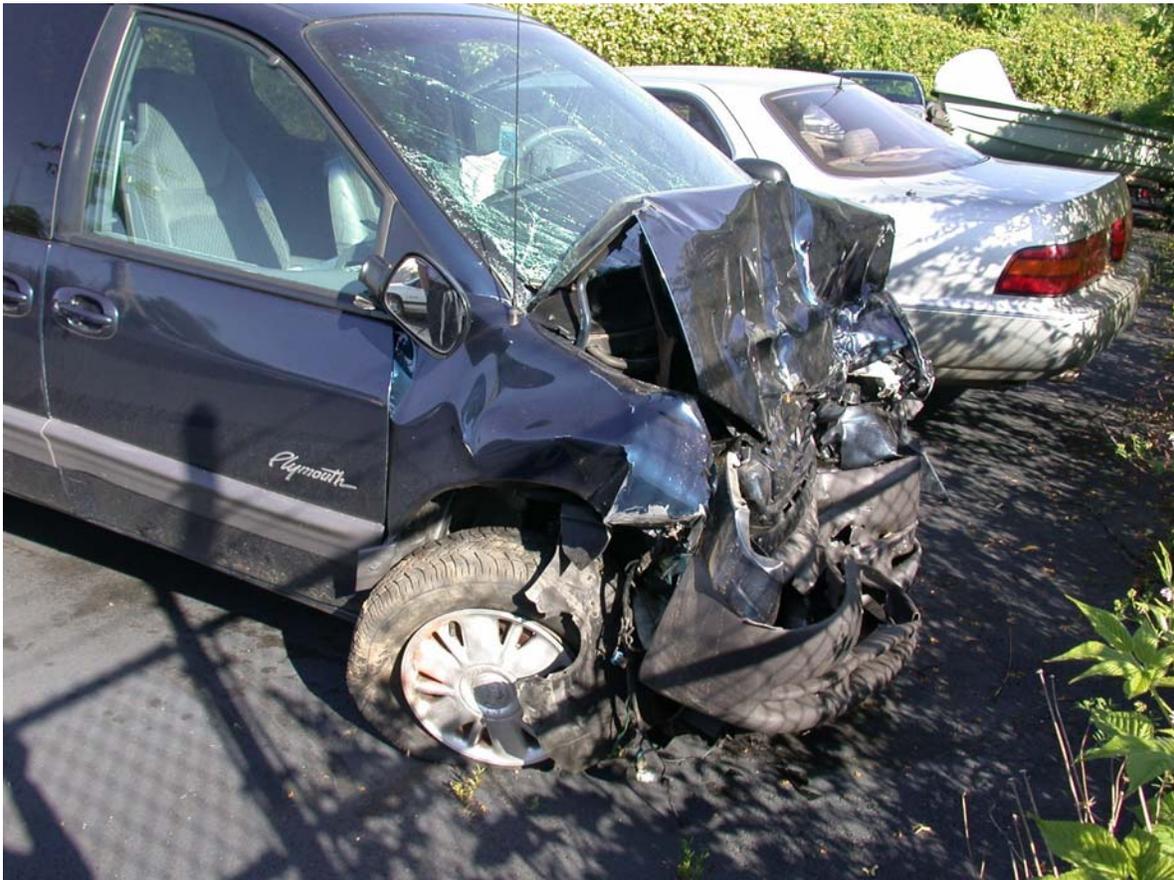


Photo 5: Damage to Voyager

The Sable driver lived in a nearby rural county and came into town every Friday to run errands and pay bills. She was familiar with the area and the road. This driver had only one conviction on her driving record, failure to have current county or city tags for her vehicle. She had no history of crashes or speeding violations. However, her actions leading up to the crash are indicative of aggressive driving.

Aggressive driving can be defined as “a combination of unsafe and unlawful driving actions that show a conscious and willful disregard for safety” (Smooth Operator, 2005). Aggressive driving behaviors can include: failing to yield the right of way, following too closely,

unsafe lane changes, improper passing, speeding, disobeying traffic signs and signals and reckless driving. Aggressive driving behaviors are estimated to factor into about two-thirds of all highway fatalities, according to the National Highway Traffic Safety Administration. Initially identified as a problem in congested urban areas, especially in Northern Virginia, the problem is now widespread in the Commonwealth. In 1997, a number of law enforcement agencies began to coordinate their efforts to deal with aggressive drivers in the Washington, D.C. area. The Smooth Operator program has since expanded to a multi-faceted effort that includes law enforcement agencies, the media, hospitals and government organizations. The current approach employs public awareness and education campaigns combined with selective law enforcement efforts. Evaluations of the program for 2005 revealed an increase in awareness of aggressive driving behaviors, as well as significant increases to the number of drivers issued citations or warnings for aggressive driving (Smooth Operator, 2005). Unfortunately, the Smooth Operator program is presently limited to Washington D.C. and surrounding localities in Virginia and Maryland. It has not been implemented in the region of Virginia where this crash occurred.

The Sable driver was turning onto a road where she knew that her lane of travel would shortly merge into the left lane. She accelerated sharply through the intersection and tried to pass the pickup truck to her left. As he also accelerated, she did not back off and seek opportunities to merge behind him into the lane. Instead, she chose to continue accelerating in an attempt to get ahead of him, even though her lane was beginning to narrow. When she was almost past the pickup, she began to cut over into his lane. She may have misjudged the difference in velocity between her vehicle and the truck and pulled left in the belief that she was clear. Such misjudgments can easily occur when one vehicle is overtaking another, especially at higher speeds and with the driver in a stressful situation. On the other hand, the Sable driver's previous aggressive actions indicate that she may have been intentionally trying to force the other vehicle to slow and let her in, believing that he would understand the threat of collision and comply by slowing to avoid it.

The driver of the Ford pickup, a local construction worker, was also familiar with the area. He lived near the crash site and stated that he was headed home at the time. He had a poor driving record, with five speeding convictions in the previous four years, as well as convictions for reckless driving in a parking lot, failure to obey a highway sign, improper registration, improper equipment and failure to wear a seat belt. He also exhibited aggressive driving behavior just prior to the crash. Although he had the right of way in the left lane, he accelerated

quickly after the light changed in order to gain headway on anyone who might try to pass him on the right. He did not slow when it became apparent that another vehicle was trying to move ahead and pass. Thus, the two vehicles became involved in an impromptu race in which neither driver would admit defeat. Indeed, the two parking lot witnesses who observed the crash had initially looked up and thought that they were watching a race. Based on the length of skid marks and crush damage to the vehicle from impact with wooden light pole, the VMCIT determined that the pickup was traveling at about 50 mph. When the Sable driver attempted to pull in front of the pickup, the Ford driver did not have enough time or distance to respond and avoid the collision.

The pickup driver wore his lap/shoulder belt and consequently was not seriously injured during the initial collision or the secondary impact with the light pole. The front seat occupants of the Sable were in different circumstances. The driver was only 5 feet in height and she had her seat pulled close to the steering wheel and dash. Additionally, she was also overweight, weighing approximately 285 pounds. Her pregnant daughter-in-law was about 6 inches taller and weighed about 200 pounds. Both women had fastened their lap/shoulder restraints behind their respective seats. Their reason for declining to wear the belts is unknown, but the driver's husband reported that they fastened the belts behind the seat to keep the seat belt light and bell warnings from activating when the car was started and running. Their actions reveal a conscious decision to avoid using the restraints, rather than an unconscious forgetful act of omission. As a consequence, both were thrown to the left during the first collision and then forward with great force during the frontal collision with the minivan. Their bodies were in close proximity to the airbags as they deployed. While airbags can be life-saving devices during such collisions, they are designed to work in conjunction with belt systems, not alone. Injuries from sitting too close to airbags may be severe, especially to unbelted individuals, and airbags do not prevent occupants from being tossed around the interior of a vehicle during a crash sequence. In the Sable, neither woman had burns or abrasions on their faces from contact with the airbags; however, both died from blunt force trauma that occurred as their moving bodies contacted the rapidly inflating airbags and interior components of the vehicle. The driver also suffered fractures to her right thigh and left ankle from contact with the steering wheel and parts under the dash. Had they been belted, these women would not have been projected into the airbags and dash area with as much force, increasing their likelihood of survival.



Photo 6: Back of Sable driver's seat with belt routed behind seat and buckled.

By contrast, the 77 year old Chrysler driver wore his safety belt. His vehicle was also equipped with an airbag that deployed during the frontal collision. Upon impact, he was thrown forward but was restrained by the lap and shoulder portions of the belt. He fractured his pelvis and several ribs, injuries that are typical in this type of crash and are common among older drivers with more fragile bones. He also suffered a heart injury, which would have occurred as a secondary effect—the ribs protecting his chest were stopped by the safety belt but his internal organs continued to move forward, striking the interior chest walls. This is an example of the “internal collision” that occurs during crashes. Despite the severity of the collision and his injuries, the energy forces of this crash were dispersed enough by the belts and the airbag that this elderly driver survived the same impact forces that killed two younger women.

The 22 month old girl positioned behind the Sable driver was sitting in a belt-positioning backless booster seat. At her age and size, 28 pounds and 31 inches, she would have been safest in a forward facing convertible child safety seat or a high back booster seat with an internal harness. The five point restraint systems found in these types of seats would have provided much more energy dispersion across the upper and lower parts of her developing body. If the backless booster that was used had been installed correctly, she would have at least had a belt

passing across her chest from left to right, providing her some upper body protection. Tragically, both the shoulder and lap portions of her safety belt had been threaded through the lap belt guides molded into the seat. This left the child with only a lap restraint holding her in place. During the collision, that belt stretched some as she began to move forward. When the stretching stopped the forward movement of her pelvis, her head and torso snapped forward, while her legs and hips, below the belt, also continued forward. Her body dynamics resembled a jack-knife type of maneuver. She hit her head on the back of the driver's seat, causing a basilar skull fracture and a fracture of the first cervical vertebra, along with other spinal fractures. An internal harness would have prevented the intense forward movement and allowed the energy of the collision forces to be spread out over a greater area across her developing skeletal frame. She may well have survived this crash.



Photo 7: Backless booster seat with safety belts threaded through lap guides.

RECOMMENDATIONS

1. In addition to implementing the recommendations made in the consultant’s “Sign and Pavement Marking Plan” the city public works department should:
 - a. Mount warning beacons on the “RIGHT LANE ENDS 300 FEET” sign assembly (W9-1 and W16-2) located on the right of the southbound lanes of the business primary road.
 - b. Install an additional W4-2 (36 inches x 36 inches) and W16-2 (30 inches x 24 inches) sign assembly in the grass median opposite the one on the right shoulder of the southbound lanes (see Figure 1)
 - c. Install horizontal alignment W1-8 (18 x 24 inches) signs at the transition from two lanes to one lane south of the city street intersection.

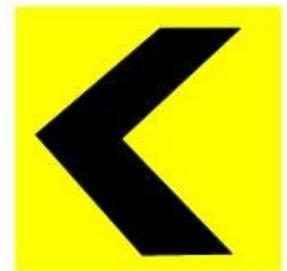
(NOTE: All signs shall conform to the Manual on Uniform Traffic Control Devices)



W4-2



W16-2



W1-8

Figure 1: Warning Signs

2. Education and enforcement measures should be taken to increase the use of safety belts for all occupants of motor vehicles.
 - a. The Department of Motor Vehicles, the Department of Health, and agencies focused on public safety should continue to stress the life-saving and injury reducing capabilities of seat belts and actively promote safety belt use through media campaigns, training, and individual counseling.
 - b. The Department of State Police, local law enforcement agencies and the Department of Motor Vehicles should continue to develop, implement and assess enforcement programs designed to increase safety belt use (including programs like “Click it or Ticket” mobilizations).

3. As recommended in the VMCIT’s *Special Report Number 20: Child Safety Restraint Study*:
 - a. The Virginia Department of Health, the Department of Motor Vehicles and the Department of State Police presently work with other state and local agencies to inform and educate those who transport children about appropriate child safety restraint use. Beyond stressing the importance of using restraints, these groups should continue to emphasize correct selection and installation of seats, along with proper use of internal harnesses and vehicle lap and shoulder belts. Methods for creating greater awareness and improving understanding as well as compliance across all populations should be explored, including working with pediatricians, child advocacy groups, and local communities.
 - b. The Virginia Department of State Police and local law enforcement agencies should include child safety seat information in their basic training and in-service curricula. While not designed to make every officer a specialist, this training should include enough basic information to provide a quick method of visual assessment with regard to whether or not a child appears to be in the correct type of safety device. Officers could then decide whether to look at the restraints more closely and/or take further action if they suspect a violation of the law.

4. Education and enforcement measures should be taken to reduce the frequency of aggressive driving behaviors occurring on Virginia roads, including the expansion of programs like Smooth Operator to additional areas of the Commonwealth where aggressive driving has been specifically identified as a significant problem.
 - a. The Department of Motor Vehicles, the Department of Health, the Department of State Police and agencies focused on public safety should stress the dangers of aggressive driving through media campaigns and training materials. Educational information should help drivers recognize and respond to their own aggressive behaviors as well as those of other drivers. Researchers in transportation safety, psychology and related fields should work to identify and develop ways to eliminate or reduce the underlying causes of such aggression and to counsel or treat individuals at high risk for such behaviors.
 - b. The Department of State Police, local law enforcement agencies and prosecutors should continue to identify, charge and prosecute individuals violating aggressive driving laws under the Code of Virginia (§ 46.2-868.1).

REFERENCES

Federal Highway Administration, U.S. Department of Transportation (2003). *Manual on Uniform Traffic Control Devices for Streets and Highways, 2003 Edition*.

Smooth Operator (2005). The 2005 Annual Report and Campaign Summary.
www.smoothoperatorprogram.com.