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Analysis of Run-off-road Safety-critical Events in Virginia

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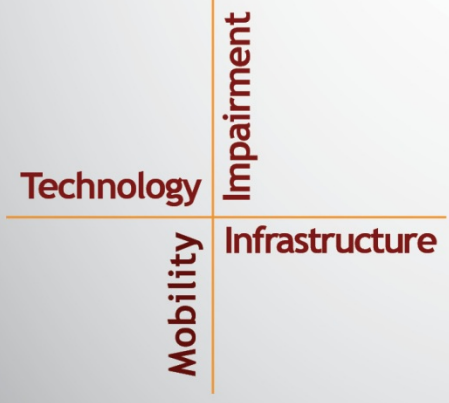

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EXECUTIVE SUMMARY

Run-off-road (ROR) crashes account for a large proportion of fatalities on U.S. roadways. ROR crashes usually involve a single vehicle and occur when the vehicle departs the roadway and then strikes an object. In order to prevent traffic fatalities, it is important to examine the precipitating factors associated with ROR crashes. As crashes are rare events, ROR events that did not result in crashes are also useful to analyze. Teens in particular are vulnerable road users whose crash risk may be reduced by a detailed assessment of the contributing factors leading to ROR events. With greater understanding of these contributing factors, this report will lead to the development of countermeasures based on the commonly observed contributing factors present in these events.

The research presented here analyzed data from three sources: police-reported data from ROR crashes involving teens in Virginia, and data from two naturalistic driving studies conducted with teens in Virginia (the Supervised Practice Driving Study and the Driver Coach Study). The data from the police reports were provided by the Virginia Department of Motor Vehicles (DMV) and Virginia Department of Transportation (VDOT). The naturalistic driving data were drawn from two previous studies conducted by the principal investigator. The data from the two naturalistic studies were combined into one dataset for the analysis.

The two datasets were heterogeneous in terms of the method of data collection and types of ROR events that comprised the majority of cases (e.g., crashes vs. near-crashes). However, results showed several commonalities in ROR events involving teens and the characteristics of these events. For example, most ROR events occurred on dry roads for both datasets. In addition, ROR events were most common on straight roads with level alignment for both datasets. Finally, both datasets showed the highest proportion of ROR events in daylight, followed by darkness without lighting. Speeding was a common driver behavior noted in both datasets but was more common for the naturalistic dataset. Driver secondary tasks were difficult to compare across datasets because police reports often report no secondary task engagement or that it was not applicable to the case, whereas naturalistic driving data allows direct observation of secondary task engagement. Thus, in the DMV data, when secondary task engagement was observed, the most common task was using a cell phone, whereas the naturalistic data showed that talking with a passenger was most common. This may relate to the severity of the events present in the data (i.e., the DMV dataset contained only crashes, whereas the naturalistic dataset contained only some crashes).

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LIST OF ABBREVIATIONS AND SYMBOLS

CRSS	Crash Report Sampling System
DAS	data acquisition system
DMV	Department of Motor Vehicles
DCS	Driver Coach Study
FARS	Fatality Analysis Reporting System
FHWA	Federal Highway Administration
GES	General Estimates System
LDW	lane departure warning
LKAS	lane-keeping assist
MMUCC	Model Minimum Uniform Crash Criteria
MUTCD	Manual on Uniform Traffic Control Devices
NDS	naturalistic driving study
NASS	National Automotive Sampling System
NHTSA	National Highway Traffic Safety Administration
ROR	run-off-road
SHRP 2	Second Strategic Highway Research Program
SPDS	Supervised Practice Driving Study
VDOT	Virginia Department of Transportation
VTRC	Virginia Transportation Research Council
VTTI	Virginia Tech Transportation Institute

CHAPTER 1. INTRODUCTION

Run-off-road (ROR) or roadway departure crashes occur when a vehicle departs the roadway and then strikes an object (McLaughlin, Hankey, Klauer, & Dingus, 2009). For this analysis we also investigated ROR safety-critical events, which included:

- ROR near-crashes: a vehicle nearly departs the roadway or avoids departing the roadway through an evasive maneuver.

- ROR crash-relevant events: a vehicle avoids departing the roadway, but the event is not as severe as a near-crash.

ROR near-crashes and ROR crash-relevant events may provide insight into the contributing factors that may result in ROR crashes, including the ways in which drivers avoid them. In turn, these analyses may inform the development or improvement of countermeasures to prevent fatal ROR crashes. Often, ROR events involve only a single vehicle.

ROR crashes are a critical safety problem on U.S. roadways. According to the Federal Highway Administration, approximately 52% of all traffic fatalities were due to roadway departure. Similarly, ROR crashes account for a large proportion of fatal crashes (Liu & Subramanian, 2009; Liu & Ye, 2011). In the Salem District of southwest Virginia, ROR crashes account for 34% of all crashes and 66% of all fatal crashes (Anne Booker, personal communication, Blue Ridge Transportation Board meeting, 2017). Therefore, a close examination of ROR crashes is of utmost importance for reducing fatalities on Virginia roadways.

Teen drivers are vulnerable road users whose crash risk is significantly higher than other groups (Tefft, 2017). For example, Simons-Morton et al. (2015) found that crash and near-crash rates among teens were over four times higher than the crash and near-crash rates of adults. Previous research supports the notion that teens are especially vulnerable to ROR events in particular. For example, McLaughlin et al. (2009) found that 18- to 20-year-old participants had four times as many ROR events as participants who were 35 years old and older. Adolescent male drivers may be at particular risk of ROR events, as they have shown higher rates of both fatal and non-fatal single-vehicle crashes than other groups (Bingham & Ehsani, 2012). In a set of crashes involving negotiating curves, traveling off the right edge of the road, or departing the right edge of the road, teens were more likely to commit decision errors immediately prior to these crashes than adults (McDonald, Curry, Kandadai, Sommers, & Winston, 2014). Thus, studying the combination of a vulnerable group (teens) and a type of event that often results in fatalities (ROR events) may yield valuable information enabling the prevention of fatal crashes.

For the present study, data from ROR events were provided by the Virginia Department of Motor Vehicles (DMV). Data access was facilitated by the Virginia Transportation Research Council (VTRC), who granted permission through the Virginia DMV's Crash Analysis Tool (also referred to as TREDS). These data comprise police-reported crashes, including those that occurred in the Salem area. The Virginia DMV data use a coding system similar to those used for the national crash and fatal crash databases, the National Automotive Sampling System (NASS) General Estimates System (GES; now Crash Report Sampling System, or CRSS) and Fatality

Analysis Reporting System (FARS), respectively (see National Highway Traffic Safety Administration, 2012).

Naturalistic driving studies offer another way to evaluate ROR events and their contributing factors. These studies involve instrumenting participants' vehicles with cameras and other data collection equipment to capture real-time events and a variety of driver performance metrics (e.g., Dingus et al., 2015). The Virginia Tech Transportation Institute (VTTI) recently conducted two naturalistic driving studies that gathered data in the Salem district area: the Supervised Practice Driving Study (SPDS; Ehsani et al., 2017) and the Driver Coach Study (DCS; Klauer et al., 2017). These studies each collected naturalistic driving data from 90 parents and 90 teenagers, and provide two other sources of data containing ROR events in addition to the DMV dataset.

Like the DMV data, the naturalistic driving studies were originally coded based on the structure of FARS and CRSS. Thus, the two naturalistic datasets are easily combined or compared with the DMV dataset. However, naturalistic data have grown in size and detail to allow for information about precipitating events to be assessed. For example, naturalistic data allow several types of distraction to be observed prior to any safety-critical event through the examination of video data and coding using trained data analysts. These contributing factors are much more difficult to capture in police-reported data (such as the DMV data used here). It has been reported that police reports infrequently provide information regarding driver state, condition, or environmental/road conditions at the time of the collision (Shinar, Treat, & McDonald, 1983). In addition, naturalistic driving studies provide the benefit of capturing events that are not reported to police, such as unreported minor crashes, as well as near-crashes and crash-relevant events.

CHAPTER 2. METHODS

DATASETS

Data were gathered from three sources:

- Virginia DMV (2012 crash data)
- VTTI SPDS (2011–2014 naturalistic driving data)
- VTTI DCS (2013–2015 naturalistic driving data)

While both NDS data sources contained data spanning several years, it was decided to only use 2012 data from the DMV since this was the only year that was included in both datasets and to minimize any coding schemes that may have changed in the DMV crash data across years. While the Virginia DMV data contained fatal crashes, the naturalistic data did not. The lack of fatalities in the naturalistic data was expected, as fatalities are rare events in naturalistic driving studies. Similarly, due to the different methods of data collection (i.e., video observation vs. police reports) the two naturalistic studies included near-crashes and crash-relevant events, whereas the Virginia DMV data did not (see below).

Virginia DMV/VDOT Crash Data

Existing data from all ROR crashes from 2012 were gathered using the Virginia DMV and Virginia Department of Transportation (VDOT) Tableau Crash Analysis Tool. These data comprise only police-reported crashes and utilize the same coding as the GES. Therefore, no near-crash or crash-relevant events are present in the DMV dataset. Drivers were between 15 and 19 years old. The data were coded prior to obtaining them from the Virginia DMV/VDOT.

Crash severity for ROR events was coded using the KABCO scale from the Model Minimum Uniform Crash Criteria (MMUCC; VDOT, 2017; NHTSA, 2019). This coding system is the same as that used in the FARS coding manual from 2012 (NHTSA, 2012). This scale classifies crashes as fatal (K) if the death of the person involved (e.g., driver, passenger, pedestrian) occurred within 30 days of the crash. If the crash was not fatal, crash severity is coded as one of the following: serious injury (A), minor/possible injury (B), no apparent injury (but possible injury (C), or no injury (property damage only, O). Event frequencies of each type of crash severity are presented in Table 1.

Table 1. Frequency of crash severity types for ROR events in the DMV dataset (2012).

Crash Type	Frequency	Percent
Fatal	18	0.8%
Serious Injury	222	9.3%
Minor/Possible Injury	496	20.8%
No Apparent Injury	180	7.6%
No Injury (driver only)	1,462	61.5%
Not Provided	1	0.0%
Total	**2,379**	**100.0%**

All other variables in the DMV dataset were coded similarly to the naturalistic datasets described below, unless otherwise noted.

Supervised Practice Driving Study (SPDS)

The SPDS dataset comprises naturalistic driving data from 90 parents and 90 teenagers from Montgomery, Roanoke, Pulaski, and Bedford Counties in southwest Virginia (Ehsani et al., 2017). Participants were between the ages of 15.5 and 16.1 years old. They were enrolled for 21 to 23 months and data collection spanned from 2011 to 2014. Data from the SPDS were collected using a data acquisition system (DAS) similar to one used in the Second Strategic Highway Research Program (SHRP 2) and described in detail in Dingus et al. (2015). The DAS had four cameras, which provided views of the driver's face, forward roadway, rear roadway, and instrument panel (including hands, steering wheel, and center console). The DAS also provided driving data via multi-axis accelerometers, lane position sensors, GPS, and the vehicle network. Data were coded by trained analysts at VTTI.

Driver Coach Study (DCS)

As in the SPDS, the DCS also collected data from 90 parents and 90 teenagers from Montgomery, Roanoke, Pulaski, and Bedford counties in southwest Virginia (Klauer et al., 2017). Teenagers were 16 and 17 years old. In contrast to the SPDS, the DCS participants were enrolled for 15 to 16 months, and data collection spanned from 2013 to 2015. To collect naturalistic driving data, the DCS used a version of the DAS called the MiniDAS. The MiniDAS collected the same information from the vehicles as the DAS in the SPDS. Data were coded similarly to the SPDS by trained analysts at VTTI. Data coding is described in further detail below.

Combined Naturalistic Driving Data (SPDS and DCS)

The SPDS and DCS data were combined into a single naturalistic driving dataset for comparison to the Virginia DMV/VDOT crash data. Naturalistic driving data events were classified as crashes, near-crashes, or crash-relevant. A crash was defined as "any contact with an object, either moving or fixed, at any speed in which kinetic energy is measurably transferred or dissipated" (Klauer et al., 2017). Near-crashes were defined as any event that required a rapid evasive maneuver by any party involved in the event (the participant, another driver, animal,

pedestrian, etc.) in order to avoid a crash. Crash-relevant events included elevated g-force events, which comprised changes in acceleration due to late braking, swerving, fast starts, and sharp turns. These events are described further in Klauer et al. (2017). The frequency of each type of ROR event (crash, near-crash, and crash-relevant) for the combined naturalistic driving data is displayed in Table 2. The DMV data are also displayed in this table for reference, although these data contain only crashes.

Crash severity in the naturalistic driving dataset was defined according to the levels described in Hankey, Perez, and McClafferty (2016). Level I crashes include those with airbag deployment or any known injury of the driver, other occupants, or of others involved (e.g., a pedestrian). Level II crashes include those that result in at least approximately $1,500 of damage. They are police-reportable crashes. Level III crashes are of minor severity and include those in which "the vehicle makes physical contact with another object or departs the road but sustains only minimal or no damage." Finally, Level IV crashes include minor tire strikes which did not qualify as Level I, II, or III crashes. The criteria listed for each crash level here are summarized. Additional criteria for classification of crashes are available in Hankey et al. (2016). Table 3 displays the severity of each crash in the naturalistic driving dataset.

Table 2. Frequency of each type of ROR event in the naturalistic driving and DMV datasets.

	Frequency		Percent	
Event Type / Dataset	**NDS**	**DMV**	**NDS**	**DMV**
Crash	140	2,379	33.9%	100.0%
Near-Crash	83	0	20.1%	0.0%
Crash Relevant	190	0	46.0%	0.0%
Total	**413**	**2,379**	**100.0%**	**100.0%**

Table 3. Severity of ROR crashes across the combined naturalistic driving dataset.

Crash Type	**Frequency**	**Percent**
Level I – Most Severe	1	0.2%
Level II – Police-Reportable Crash	1	0.2%
Level III – Minor Crash	54	13.1%
Level IV – Low-Risk (e.g., tire strike)	84	20.3%
Not a Crash	273	66.1%
Total	**413**	**100.0%**

COMPARISON OF DMV AND NATURALISTIC DATA

All data were classified according to multiple contributing factors to ROR crashes. Variables coded included driver behavior (or errors; e.g., overcorrection, distraction), surface condition, lighting, and road alignment. ROR events involving distraction as a driver behavior were

categorized further into various types of distraction. All variables and their categorization are listed in Table 4.

Table 4. Classification scheme for each variable (used for all data).

Variable	Categorization	

Driver Behavior (Errors)	• Overcorrection
	• Hit and run/eluding police
	• Failure to maintain control
	• Disregarded traffic signal
	• Avoidance of obstacle
	• Impaired
	• Improper passing
	• Improper turn
	• Speeding
	• Drowsy
	• Aggressive driving
		• Distracted (types of distraction listed below)
		  • No distraction
		  • Talking/singing
		  • Reaching
		  • Adjusting vehicle controls
		  • Eating/drinking
		  • Daydreaming
		  • Cell phone
		  • Radio/CD
		  • Passenger
		  • External distraction

Lighting	• Darkness – not lighted • Darkness – lighted • Dusk	• Daylight • Dawn
Road Alignment	• Grade – Curve • Grade – Straight	• Curve – Level • Straight – Level
Surface Condition	• Sand, dirt, gravel • Slush • Water – standing/moving • Oil/other fluids	• Icy • Snowy • Wet • Dry

The prevalence of ROR events across each category of the four variables was determined and plotted as a percentage of the total events.

CHAPTER 3. RESULTS

SURFACE CONDITION

Figure 1 displays the percentage of ROR events within each surface condition category for the naturalistic and DMV datasets. Both datasets showed that the majority of ROR events were on dry roads. In the DMV sample, 67.8% of all events (crashes) occurred on dry roads. This is in line with naturalistic data showing that 70.5% of events (crashes, near-crashes, and crash-relevant events) occurred on dry roads. There were fewer ROR events on wet roads in the naturalistic dataset (12.8%) than the DMV dataset (27.9%). However, there were more ROR events on icy and snowy roads (4.1% and 8.5%, respectively) in the naturalistic dataset than in the DMV dataset (1.3% and 1.6%, respectively). The sand/dirt/gravel, slush, oil/other, and water-standing/moving categories were uncommon in both datasets (less than 2%).

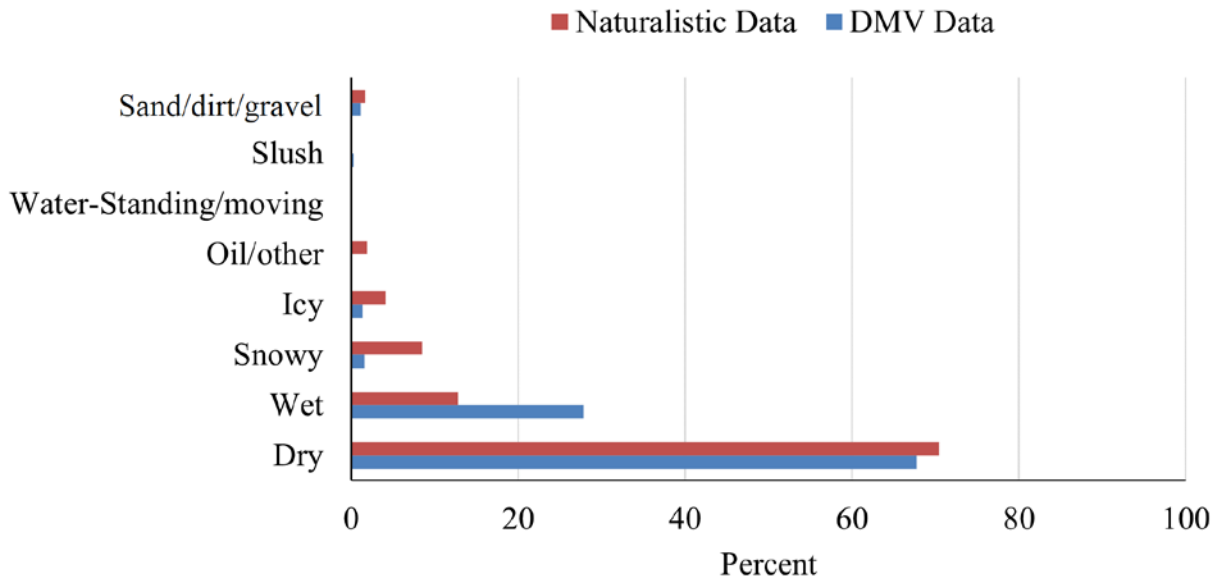


Figure 1. Graph. Percentage of ROR events by surface condition.

ROADWAY DESCRIPTION

Roadway types were also divided into categories according to whether they allowed one- or two-way travel, and whether they were divided. This resulted in the categories listed in Figure 2:

- Unknown
- No lanes
- Not divided – Center, 2-way left turn lane
- One-way, not divided
- Two-way, divided, positive median barrier
- Two-way, divided, unprotected median
- Two-way, not divided

Slight differences in coding schemes between the two datasets resulted in small dissimilarities between the categories included in each variable. For example, the "No Lanes" category was only used in the naturalistic dataset, and it accounted for 12.1% of the ROR events in that dataset. This category included safety-critical events that occurred in parking lots, which are often considered either private property and/or do not meet the police accident report criteria of property damage greater than $1,500. Additionally, the DMV dataset contained a category for two-way divided roads with an unprotected median, which accounted for 11.3% of ROR events in that dataset. The naturalistic dataset did not specify roadways for this category. Despite these differences, the remaining distributions of roadway types were similar across both datasets. The vast majority of ROR events occurred on two-way roads that were not divided across both datasets (74.8% for DMV and 65.4% for naturalistic).

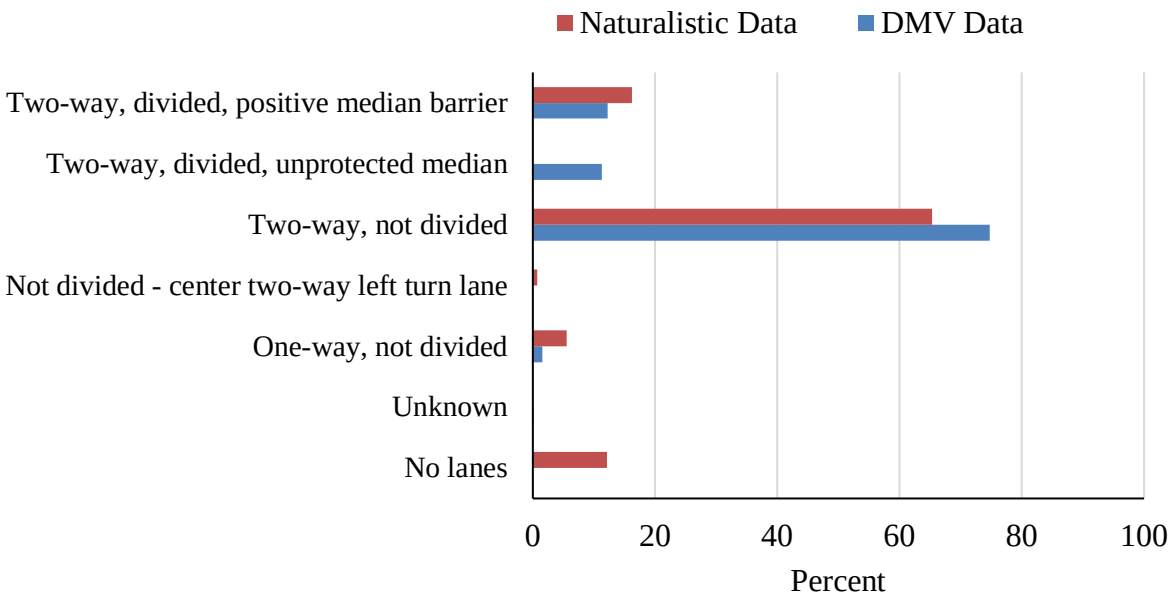


Figure 2. Graph. Percentage of ROR events by lane category.

ROAD ALIGNMENT

Figure 3 displays the percentage of ROR events that occurred under each road alignment condition across the two datasets. Straight, level roads showed similar percentages of ROR events across both datasets (34.1% for naturalistic and 33.2% for DMV). Straight, level roads were also the alignment category under which ROR events were most commonly observed. Graded, curved roads were second most common; a higher percentage of ROR events was seen on these roads in the naturalistic sample (29.8%) compared to the DMV sample (23.5%). The DMV sample showed a greater percentage of ROR events on curved, level roads (26.7%) compared to the naturalistic sample (18.9%). Finally, graded, straight roads showed the fewest ROR events when both samples were combined. The naturalistic sample showed a greater percentage of ROR events on graded, straight roads (15.7%) compared to the DMV sample (11.1%). ROR events on other types of roads, such as hillcrests and dips, were each less than 2% of total ROR events for both datasets. Thus, these categories are not represented in Figure 3.

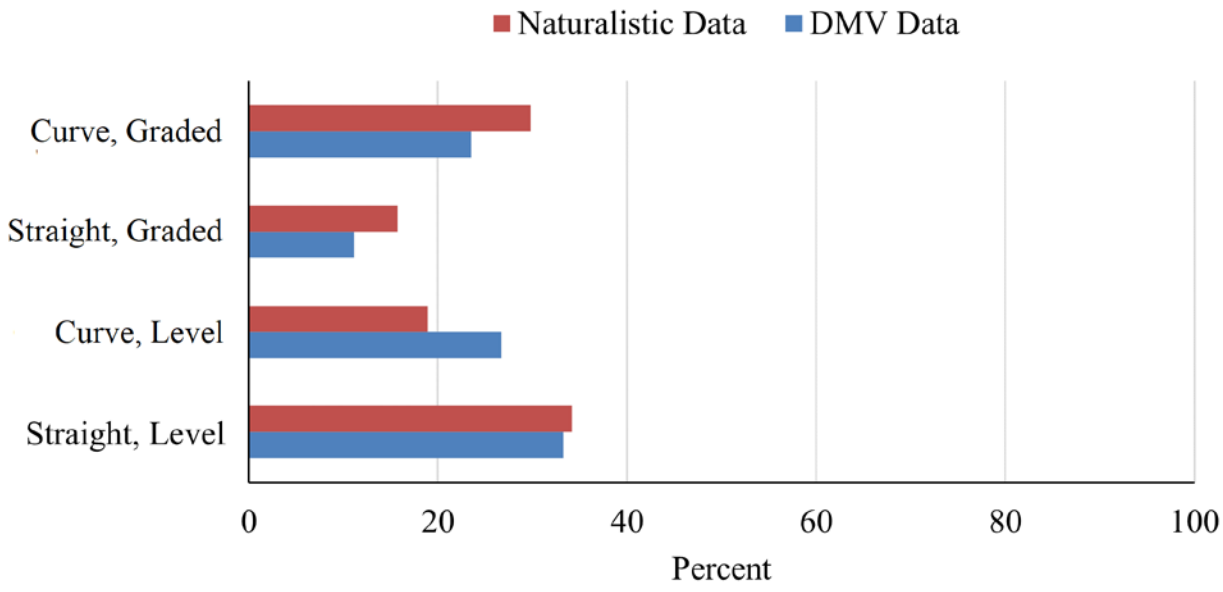


Figure 3. Graph. Percentage of ROR events by road alignment.

LIGHTING

Figure 4 displays the percentage of ROR events that occurred under each lighting condition across the two datasets. Most ROR events occurred in daylight for both datasets, although the percentage occurring in daylight was greater for naturalistic data (81.1%) than for DMV data (57.4%). Darkness without lighting was the second most common condition under which ROR events occurred for both datasets. However, DMV data showed a greater percentage of events under these conditions (33.1%) compared to naturalistic data (10.7%). Naturalistic data showed 5.8% of ROR events occurred in darkness with lighting, and this was similar to the DMV data, which showed 4.8%. A similar percentage of ROR events occurred at dusk across both datasets (1.9% for naturalistic data and 2.8% for DMV data). Finally, the fewest ROR events occurred at dawn for both datasets (less than 1% for naturalistic data and 1.9% for DMV data).

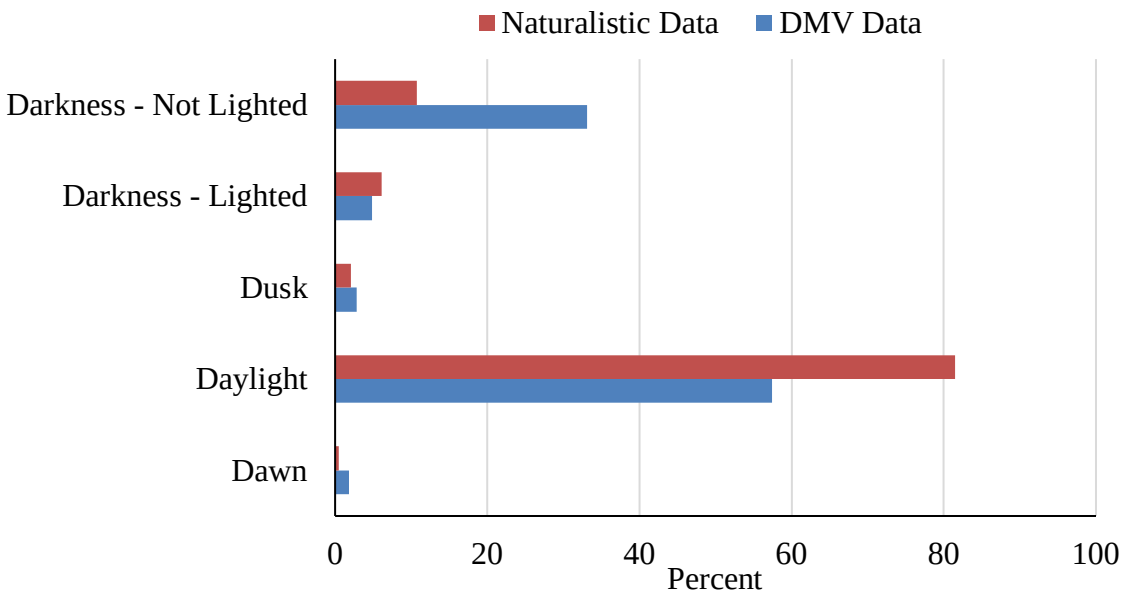


Figure 4. Graph. Percentage of ROR events by lighting condition.

DRIVER BEHAVIOR

Figure 5 displays the percentage of ROR events that occurred while the driver was engaging in various types of behavior across the two datasets. In the DMV dataset, the most commonly observed driver behavior was failure to maintain control of the vehicle (60.6%). This category was not present in the naturalistic dataset. The most commonly observed driver behavior in the naturalistic dataset was speeding (24%), while the DMV dataset showed speeding as the second most commonly observed driver behavior (14% of ROR events). Compared to the naturalistic dataset, avoidance of an obstacle was more common in the DMV dataset (8.8% for DMV and 2.7% for naturalistic data). This was also true for drowsiness (5.8% for DMV data and 1.5% for naturalistic data) and impairment (3.6% for DMV data and less than 1% for naturalistic data).

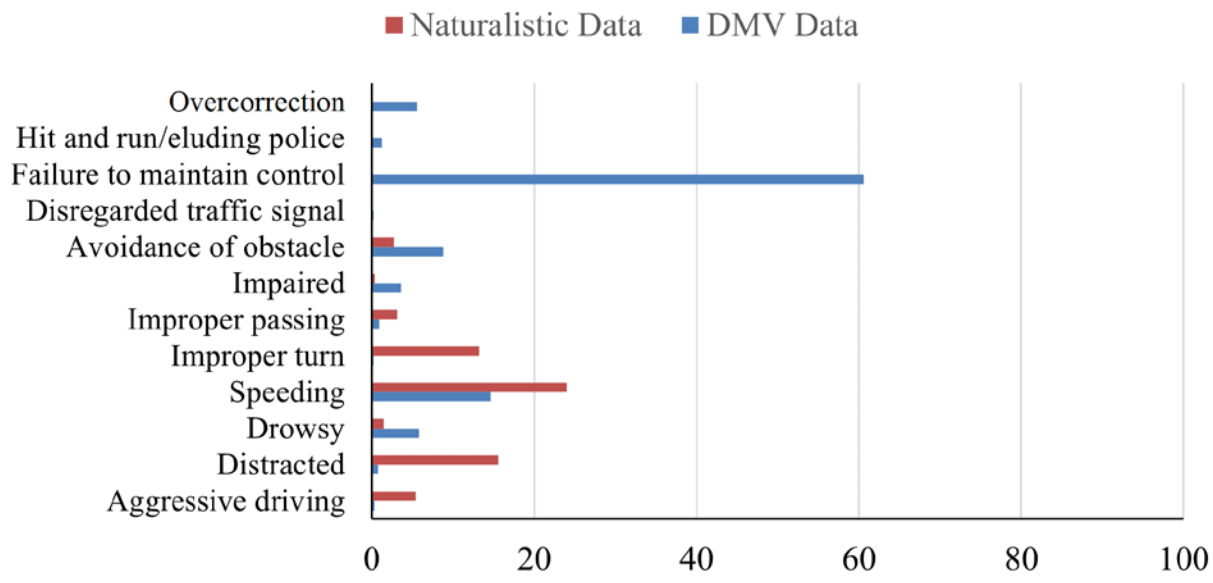


Figure 5. Graph. Percentage of ROR events categorized by driver behavior.

Driver Distraction

Figure 6 displays the percentage of ROR events that occurred under each type of driver distraction across the two datasets. For the majority of the DMV data, distraction was either not applicable (42.7%) or there was no distraction (37.8%). The remainder of the DMV data showed distraction from a cell phone (1.8%), interacting with the radio/CD (1.5%), or interacting with a passenger (1.3%). Finally, adjusting vehicle controls, external distraction, eating/drinking, or daydreaming were each observed in less than 1% of DMV ROR events. There were no instances of talking/singing or reaching in DMV data.

For the majority of the naturalistic data, there was no distraction (40.0%). The most common type of distraction was interacting with a passenger (23.0%), followed by external distraction (8.7%), talking/singing (8.7%), cell phone (6.1%), adjusting vehicle controls (2.2%), reaching (1.5%), eating/drinking (1.0%), and radio/CD (1.0%). There were no instances of daydreaming in the naturalistic data.

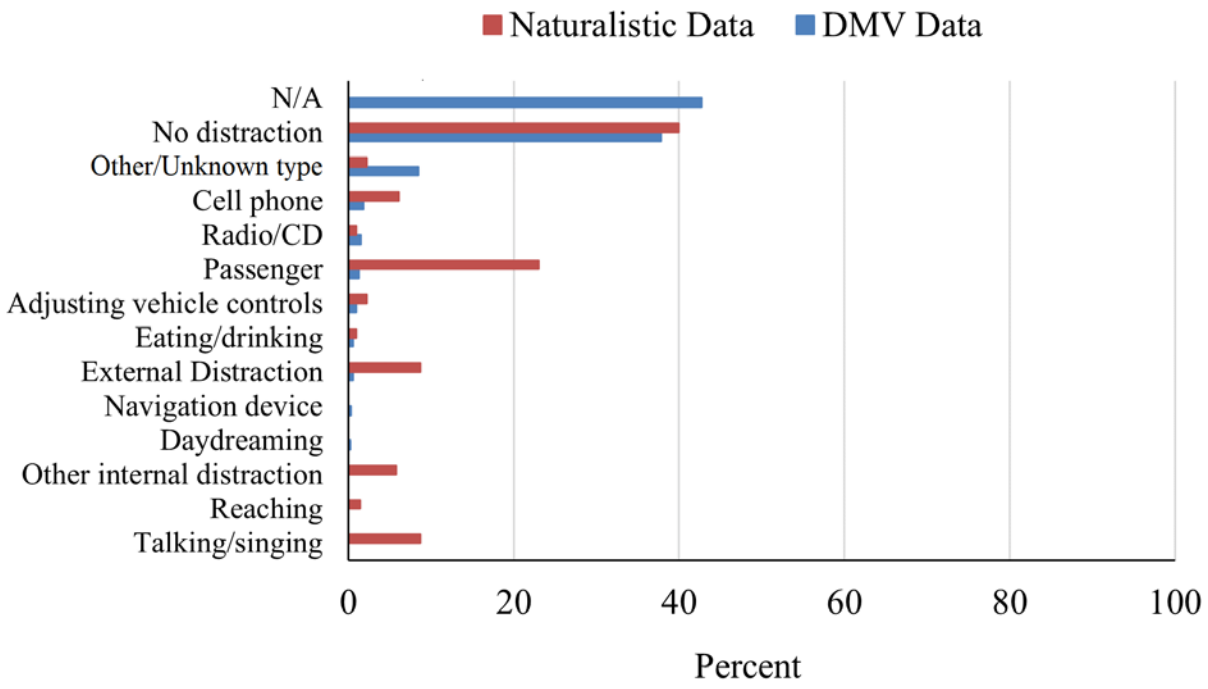


Figure 6. Graph. Percentage of ROR events categorized by distraction behavior.

CHAPTER 4. COUNTERMEASURES

Several countermeasures exist for the prevention of ROR events. These countermeasures can be divided into three categories:

- Infrastructure-based solutions
- Vehicle-based solutions
- Education

The data presented in this report provide evidence for all three of these countermeasure types.

INFRASTRUCTURE-BASED SOLUTIONS

Table 5 displays examples of various infrastructure-based solutions along with their relative cost and timeframe to implement (adapted from Neuman et al., 2003). In addition to the countermeasures presented in Table 5, other recommendations include ensuring that appropriate signage and markings are present at curves. These signs and markings include chevrons, advisory speed signs, and rumble strips. Following the guidance from the Manual on Uniform Traffic Control Devices (MUTCD; 2009) in terms of the standards, guidance, and placement so that drivers have time to anticipate any changes in roadway conditions is also recommended.

Table 5. Classification of strategies according to expected timeframe and relative cost (Adapted from Neuman et al., 2003).

Timeframe for Implementation	Strategy	Relative Cost to Implement and Operate			
		Low	Moderate	Moderate to High	High
Short (<1 year)	Install shoulder rumble strips	✓			
	Install edgeline/centerline rumble strips	✓			
	Enhanced curve sign and delineations	✓			
	Provide enhanced pavement markings (width and retroreflectivity)	✓			
	Remove/relocate objects in hazardous locations	✓			
Medium (1–2 years)	Provide skid-resistant pavements (high friction)		✓		
	Eliminate shoulder drop-off (safety edge)	✓			
	Provide shoulder treatments or four-lane sections at key locations		✓		
	Design safer slopes and ditches			✓	
	Improve roadside hardware			✓	
	Improve barrier and attenuation systems			✓	
Long (>2 years)	Improve horizontal curve geometry				✓

Key strategies for reducing ROR fatalities that have been described include keeping the vehicle from encroaching the roadside, minimizing the likelihood of the vehicle overturning should the vehicle travel off the shoulder, and reducing the severity of the crashes. However, keeping the vehicle on the roadway and preventing the crash from happening is another solution that is being actively explored with the increased prevalence of vehicle technologies.

VEHICLE-BASED SOLUTIONS

Advanced vehicle systems, including lane departure warning (LDW) and lane-keeping assist (LKAS), have become commonplace in newer vehicles as standard features or as part of a package (Consumer Reports, 2019). Scanlon, Kusano, Sherony, and Gabler (2015) found that LDW systems were estimated to reduce the number of road departure crashes by 26.1% and the number of seriously injured drivers by 20.7%. Lane departure prevention systems were estimated to reduce the number of crashes by 32.7% to 37.3% and the number of seriously injured drivers by 26.1% to 31.2%.

However, these vehicle-based systems will only work if lane, center, and edge line markings are present and adequately maintained on the roadways. When infrastructure solutions are combined with technological solutions, crash reductions have the potential to be even greater. When Scanlon, Kusano, and Gabler (2016) examined how the presence of lane markings and expanded shoulders influenced crash rates with LDW and lane departure prevention, they found that these systems could prevent 72% to 78% of crashes and 60% to 65% of cases of serious driver injury.

According to SAE J3048, LDW and LKAS are not explicitly designed to prevent crashes, but they may help reduce the number of ROR crashes that occur. However, there may be unintended consequences. For example, drivers may counter-steer against the torque provided by LKAS, which may have implications for novice drivers when they are learning to drive. The counter-steering method at high speeds is not an appropriate response when experiencing a roadway departure with a pavement edge drop-off; however, the feeling of resistance may be similar.

EDUCATION

For novice drivers, education may be one of the most direct methods of preventing ROR events. Efforts to educate novice drivers on ROR prevention should include content such as:

- Driving at speeds appropriate for weather and visibility conditions (e.g., don't drive too fast on wet roads or don't outdrive your headlights).
- Being aware of advisory speed limits on curves and looking for appropriate signage.
- Understanding the signage expected in/around areas where ROR crashes occur.
- Knowing what actions to take when encountering ROR-related signs such as chevrons (Figure 7), advisory speeds (Figure 8), and object markers (Figure 9).
    - Example: OM3 markers indicate an object or obstruction adjacent to or within the roadway. The stripes sloping **downward** at an angle of 45 degrees point toward the side of the obstruction on which traffic is to pass. For example, if drivers see an OM3-R sign (see Figure 9), they should stay to the left.

Figure 7. Illustration. W1-8 chevron (MUTCD, 2009).

Figure 8. Illustration. W13-1P advisory speed plaque (MUTCD, 2009).

Figure 9. Illustration. OM3 Type 3 object markers: OM3-L (left); OM3-C (center); OM3-R (right) (MUTCD, 2009).

CHAPTER 5. DISCUSSION

OVERVIEW

The present study sheds light on the factors involved in ROR-related crashes, near-crashes, and crash-relevant events for teen drivers using naturalistic driving data and data collected from police crash reports. Many of the variables examined showed similarities across the DMV data (from teen crashes) and naturalistic data (from teen crashes, near-crashes, and crash-relevant events). For example, ROR events occurred in similar surface conditions across both datasets. In particular, both datasets showed similar proportions of ROR events on dry roads (the most commonly observed surface condition). Minor differences were observed along wet, snowy, and icy roads. For example, the DMV dataset showed a greater proportion of ROR events on wet roads compared to the naturalistic dataset, whereas the naturalistic dataset showed greater proportions of ROR events on icy and snowy roads compared to the DMV dataset. Previous research has compared ROR crashes and near-crashes to random baseline driving segments and determined that precipitation and wet roads each increase the likelihood of an ROR event compared to dry conditions (McLaughlin et al., 2009).

The distribution of road types observed in ROR events was also very similar across both datasets, with nearly identical proportions of ROR events occurring on straight, level roads. When compared to one another, the naturalistic dataset showed slightly greater proportions of events on graded, curved and graded, and straight level roads, whereas the DMV dataset showed a greater proportion of ROR events on curved, level roads.

Finally, both datasets showed similarities in terms of the lighting conditions under which ROR events typically occurred. The majority of ROR events happened in daylight or unlighted darkness. All other types of lighting (lighted darkness, dusk, and dawn) also showed similar proportions of ROR events across the two datasets, with fewer than 10% of ROR events occurring under these lighting conditions.

While the environments where ROR events occurred were similar across both datasets, the frequencies of teen driver behaviors were less similar. Distraction from cell phones or passengers was much more common in the NDS data than in the DMV data. There were far more teen driver behaviors observed in the NDS dataset compared to the DMV dataset (e.g., speeding, improper turns, drowsiness). These differences are presumably because the observation of these events by officers at crash scenes may be inherently difficult or impossible. Thus, analyses such as these that make comparisons across crash data and NDS data provide insights into the contributing factors of crashes that are not possible with one dataset alone.

A vast majority of teen ROR crashes evaluated in this study occurred during daylight and on dry roadways when the teen drivers were speeding and/or driving distracted. While there are at least three types of countermeasures for ROR crashes, we would argue that many of the short- and medium-timeframe, low-cost infrastructure countermeasures (e.g., rumble strips, eliminating shoulder drop-offs, and/or removing fixed hazards from the roadside) could be effective against the frequency and severity of teen ROR crashes. In-vehicle technology (lane departure warnings) and education of the risks of distraction can also be implemented to reduce the prevalence of ROR crashes.

Teens who are speeding will need a more comprehensive approach that borrows more equally from the three general countermeasures. Infrastructure, other in-vehicle technologies (e.g., original equipment manufacturer targeted teen safety initiatives), and improved teen driver education of the risks of speeding will all be necessary as teen speeding has been and continues to be prevalent (Ferguson, 2013). Further research will be required to assess the actual effectiveness of these countermeasures for reducing teen ROR crashes.

STRENGTHS AND LIMITATIONS

The power of the DMV crash data is that these numbers represent actual teen crashes, including fatalities, which are not represented in the naturalistic data. However, these data were based on crash reports, which were collected after the events occurred, when it is difficult or impossible to assess the state and behavior of drivers. The true strengths of the naturalistic driving data are the precise observations of teen driver behavior behind the wheel on actual roadways under participants' normal, daily pressures. Some limitations of these data are that the naturalistic data did not contain any fatal crashes. The DMV data contained 19 fatal crashes, and a large proportion of the DMV crashes involved either a serious injury or a minor/possible injury (approximately 30%). There were very few serious crashes observed in the naturalistic data.

Despite these differences in severity, this analysis demonstrates that the environmental conditions in which both the severe ROR teen crashes (DMV data) and the less-severe NDS data teen events are generally similar. The more precise driver behavior identified in the NDS data provides insight into the types of behaviors that are contributing to lower-severity teen events but potentially also provides insight into the more-severe crashes given that all of these types of teen ROR events were shown to be occurring in similar roadway environments. Further research is necessary to confirm that driver behaviors contributing to ROR fatalities and injury crashes are similar to those that contribute to ROR property-damage-only crashes and near-crashes.

CHAPTER 6. CONCLUSIONS

The present study yielded useful insight into ROR events involving teens. Using both naturalistic driving data and crash report data, the present study characterized teen ROR events by road surface condition, road alignment, lighting conditions, driver behavior, and specific types of driver distraction. Despite the heterogeneity between the naturalistic driving study and DMV datasets, the road surface condition, road alignment, and lighting conditions of ROR events were generally similar. Given the prevalence of teen driver speeding behavior and driver distraction in the naturalistic data set, these behaviors may also be contributing to teen ROR fatalities and severe injury crashes. Additional research is needed, but there are potentially several infrastructure, in-vehicle, and educational countermeasures that can reduce the prevalence of teen ROR fatality and injury crashes.

APPENDIX A. VIRGINIA POLICE CRASH REPORT FORM

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

FR300P (Rev 7/07)

Revised Report ○ | 0 7 0 7 A | Page _____ of _____

CRASH

Crash Date MM DD YYYY	Day of Week	MILITARY Time (24 hr clock)	County of Crash	Official DMV Use
○ City of ○ Town of — City or Town Name			Landmarks at Scene	
Location of Crash (route/street)			Railroad Crossing ID no. (if within 150 ft.)	Local Case Number
○ At Intersection With or _____ ☐ Miles ☐ Feet N S E W ○ of			Location of Crash (route/street)	Mile Marker Number / Number of Vehicles

GPS Lat. | GPS Long.

VEHICLE

DRIVER — Driver Fled Scene ○

Driver's Name (Last, First, Middle)					Gender (M) (F)
Address (Street and Number)					
City			State	ZIP	
Birth Date MM DD YYYY	Drivers License Number		State	DL (Y) (N)	CDL (Y) (N)
Safety Equip. Used	Air Bag	Ejected	Date of Death MM DD YYYY	Injury Type	EMS Transport (Y) (N)
Summons Issued As Result of Crash	Offenses Charged to Driver				

VEHICLE

Vehicle Owner's Name (Last, First, Middle)					Same as Driver ○
Address (Street and Number)					
City			State	ZIP	
Vehicle Year	Vehicle Make	Vehicle Model	Disabled ○	CMV ○	Towed ○
Vehicle Plate Number		State	Approximate Repair Cost		
VIN			○ Oversize ○ Cargo Spill		
Name of Insurance Company (not agent)			○ Override ○ Underride		
Speed Before Crash	Speed Limit	Maximum Safe Speed	ALL Passengers Age Count: Under 8 / 8-17 / 18-21 / Over 21		

PASSENGER *(only if injured or killed)*

Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	
Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	
Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	

VEHICLE

DRIVER — Driver Fled Scene ○

Driver's Name (Last, First, Middle)					Gender (M) (F)
Address (Street and Number)					
City			State	ZIP	
Birth Date MM DD YYYY	Drivers License Number		State	DL (Y) (N)	CDL (Y) (N)
Safety Equip. Used	Air Bag	Ejected	Date of Death MM DD YYYY	Injury Type	EMS Transport (Y) (N)
Summons Issued As Result of Crash	Offenses Charged to Driver				

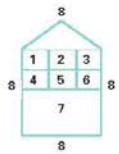
VEHICLE

Vehicle Owner's Name (Last, First, Middle)					Same as Driver ○
Address (Street and Number)					
City			State	ZIP	
Vehicle Year	Vehicle Make	Vehicle Model	Disabled ○	CMV ○	Towed ○
Vehicle Plate Number		State	Approximate Repair Cost		
VIN			○ Oversize ○ Cargo Spill		
Name of Insurance Company (not agent)			○ Override ○ Underride		
Speed Before Crash	Speed Limit	Maximum Safe Speed	ALL Passengers Age Count: Under 8 / 8-17 / 18-21 / Over 21		

PASSENGER *(only if injured or killed)*

Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	
Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	
Name of Injured (Last, First, Middle)					EMS Transport (Y) (N)	Date of Death MM DD YY	
Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)	

Codes



POSITION IN/ON VEHICLE
1. Driver
2-6. Passengers
7. Cargo Area
8. Riding/Hanging On Outside
9-98. All Other Passengers

SAFETY EQUIPMENT USED
1. Lap Belt Only
2. Shoulder Belt Only
3. Lap and Shoulder Belt
4. Child Restraint
5. Helmet
6. Other
7. Booster Seat
8. No Restraint Used
9. Not Applicable

AIRBAG
1. Deployed – Front
2. Not Deployed
3. Unavailable/Not Applicable
4. Keyed Off
5. Unknown
6. Deployed – Side
7. Deployed – Other (Knee, Air Belt, etc.)
8. Deployed – Combination

EJECTED FROM VEHICLE
1. Not Ejected
2. Partially Ejected
3. Totally Ejected

SUMMONS ISSUED AS A RESULT OF CRASH
1. Yes
2. No
3. Pending

INJURY TYPE
1. Dead Before Report Made
2. Visible Signs of Injury, as Bleeding Wound or Distorted Member or Had to be Carried From Scene.
3. Other Visible Injury, as Bruises, Abrasions, Swelling, Limping, etc.
4. No Visible Injury, But Complaint of Pain, or Momentary Unconsciousness.
6. No Injury (driver only)

Investigating Officer	Badge/Code Number	Agency/Department Name and Code	Reviewing Officer	Report File Date

Sample

Officer Initials_____ Badge # _____

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

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Revised Report ○

CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	○ City of ○ Town of	Local Case Number

DRIVER INFORMATION

Veh | Veh

Driver's Action P1

1. No Improper Action
2. Exceeded Speed Limit
3. Exceeded Safe Speed But Not Speed Limit
4. Overtaking On Hill
5. Overtaking On Curve
6. Overtaking at Intersection
7. Improper Passing of School Bus
8. Cutting In
9. Other Improper Passing
10. Wrong Side of Road – Not Overtaking
11. Did Not Have Right-of-Way
12. Following Too Close
13. Fail to Signal or Improper Signal
14. Improper Turn – Wide Right Turn
15. Improper Turn – Cut Corner on Left Turn
16. Improper Turn From Wrong Lane
17. Other Improper Turn
18. Improper Backing
19. Improper Start From Parked Position
20. Disregarded Officer or Flagger
21. Disregarded Traffic Signal
22. Disregarded Stop or Yield Sign
23. Driver Distraction
24. Fail to Stop at Through Highway – No Sign
25. Drive Through Work Zone
26. Fail to Set Out Flares or Flags
27. Fail to Dim Headlights
28. Driving Without Lights
29. Improper Parking Location
30. Avoiding Pedestrian
31. Avoiding Other Vehicle
32. Avoiding Animal
33. Crowded Off Highway
34. Hit and Run
35. Car Ran Away – No Driver
36. Blinded by Headlights
37. Other
38. Avoiding Object in Roadway
39. Eluding Police
40. Fail to Maintain Proper Control
41. Improper Passing
42. Improper or Unsafe Lane Change
43. Over Correction

Condition of Driver Contributing to the Crash P2

1. No Defects
2. Eyesight Defective
3. Hearing Defective
4. Other Body Defects
5. Illness
6. Fatigued
7. Apparently Asleep
8. Other
9. Unknown

Veh | Veh

Driver Vision Obscured P3

1. Not Obscured
2. Rain, Snow, etc. on Windshield
3. Windshield Otherwise Obscured
4. Vision Obscured by Load on Vehicle
5. Trees, Crops, etc.
6. Building
7. Embankment
8. Sign or Signboard
9. Hillcrest
10. Parked Vehicle(s)
11. Moving Vehicle(s)
12. Sun or Headlight Glare
13. Other
14. Blind Spot
15. Smoke/Dust
16. Stopped Vehicle(s)

Type of Driver Distractions P4

1. Looking at Roadside Incident
2. Driver Fatigue
3. Looking at Scenery
4. Passenger(s)
5. Radio/CD, etc.
6. Cell Phone
7. Eyes Not on Road
8. Daydreaming
9. Eating/Drinking
10. Adjusting Vehicle Controls
11. Other
12. Navigation Device

Drinking P5

1. Had Not Been Drinking
2. Drinking – Obviously Drunk
3. Drinking – Ability Impaired
4. Drinking – Ability Not Impaired
5. Drinking – Not Known Whether Impaired
6. Unknown

Method of Alcohol Determination (by police) P6

1. Blood
2. Breath
3. Refused
4. No Test

Drug Use P7

1. Yes
2. No
3. Unknown

VEHICLE INFORMATION

Veh | Veh

Vehicle Maneuver V1

1. Going Straight Ahead
2. Making Right Turn
3. Making Left Turn
4. Making U-Turn
5. Slowing or Stopping
6. Merging Into Traffic Lane
7. Starting From Parked Position
8. Stopped in Traffic Lane
9. Ran Off Road – Right
10. Ran Off Road – Left
11. Parked
12. Backing
13. Passing
14. Changing Lanes
15. Other
16. Entering Street From Parking Lot

Skidding Tire/Mark V2

1. Before Application of Brakes
2. After Application of Brakes
3. Before and After Application of Brakes
4. No Visible Skid Mark/Tire Mark

Vehicle Body Type V3

1. Passenger car
2. Truck – Pick-up/Passenger Truck
3. Van
4. Truck – Single Unit Truck (2-Axles)
7. Motor Home, Recreational Vehicle
8. Special Vehicle – Oversized Vehicle/Earthmover/Road Equipment
9. Bicycle
10. Moped
11. Motorcycle
12. Emergency Vehicle (Regardless of Vehicle Type)
13. Bus – School Bus
14. Bus – City Transit Bus/Privately Owned Church Bus
15. Bus – Commercial Bus
16. Other (Scooter, Go-cart, Hearse, Bookmobile, Golf Cart, etc.
18. Special Vehicle – Farm Machinery
19. Special Vehicle – ATV
21. Special Vehicle – Low-Speed Vehicle
22. Truck – Sport Utility Vehicle (SUV)
23. Truck – Single Unit Truck (3 Axles or More)
25. Truck – Truck Tractor (Bobtail-No Trailer)

Veh | Veh

Vehicle Damage V4

1. Unknown
2. No damage
3. Overturned
4. Motor
5. Undercarriage
6. Totaled
7. Fire
8. Other

Vehicle Condition V5

1. No Defects
2. Lights Defective
3. Brakes Defective
4. Steering Defective
5. Puncture/Blowout
6. Worn or Slick Tires
7. Motor Trouble
8. Chains In Use
9. Other
10. Vehicle Altered
11. Mirrors Defective
12. Power Train Defective
13. Suspension Defective
14. Windows/Windshield Defective
15. Wipers Defective
16. Wheels Defective
17. Exhaust System

Special Function Motor Vehicle V6

1. No Special Function
2. Taxi
3. School Bus (Public or Private)
4. Transit Bus
5. Intercity Bus
6. Charter Bus
7. Other Bus
8. Military
9. Police
10. Ambulance
11. Fire Truck
12. Tow Truck
13. Maintenance
14. Unknown

EMV in service V7

1. Yes
2. No

Truck Cover V8

1. Yes
2. No

Sample

Officer Initials_____ Badge # _____

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Police Crash Report

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CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	○ City of ○ Town of	Local Case Number

CRASH INFORMATION

Location of First Harmful Event In Relation to Roadway C1

○ 1. On Roadway
○ 2. Shoulder
○ 3. Median
○ 4. Roadside
○ 5. Gore
○ 6. Separator
○ 7. In Parking Lane or Zone
○ 8. Off Roadway, Location Unknown
○ 9. Outside Right-of-Way

Weather Condition C2

○ 1. No Adverse Condition (Clear/Cloudy)
○ 3. Fog
○ 4. Mist
○ 5. Rain
○ 6. Snow
○ 7. Sleet/Hail
○ 8. Smoke/Dust
○ 9. Other
○ 10. Blowing Sand, Soil, Dirt, or Snow
○ 11. Severe Crosswinds

Light Conditions C3

○ 1. Dawn
○ 2. Daylight
○ 3. Dusk
○ 4. Darkness –Road Lighted
○ 5. Darkness –Road Not Lighted
○ 6. Darkness –Unknown Road Lighting
○ 7. Unknown

Traffic Control Device C4

○ 1. Yes – Working
○ 2. Yes – Working and Obscured
○ 3. Yes – Not Working
○ 4. Yes – Not Working and Obscured
○ 5. Yes – Missing
○ 6. No Traffic Control Device Present

Traffic Control Type C5

○ 1. No Traffic Control
○ 2. Officer or Flagger
○ 3. Traffic Signal
○ 4. Stop Sign
○ 5. Slow or Warning Sign
○ 6. Traffic Lanes Marked
○ 7. No Passing Lines
○ 8. Yield Sign
○ 9. One Way Road or Street
○ 10. Railroad Crossing With Markings and Signs
○ 11. Railroad Crossing With Signals
○ 12. Railroad Crossing With Gate and Signals
○ 13. Other
○ 14. Pedestrian Crosswalk
○ 15. Reduced Speed – School Zone
○ 16. Reduced Speed – Work Zone
○ 17. Highway Safety Corridor

Roadway Alignment C6

○ 1. Straight – Level
○ 2. Curve – Level
○ 3. Grade – Straight
○ 4. Grade – Curve
○ 5. Hillcrest – Straight
○ 6. Hillcrest – Curve
○ 7. Dip – Straight
○ 8. Dip – Curve
○ 9. Other
○ 10. On/Off Ramp

Roadway Surface Condition C7

○ 1. Dry
○ 2. Wet
○ 3. Snowy
○ 4. Icy
○ 5. Muddy
○ 6. Oil/Other Fluids
○ 7. Other
○ 8. Natural Debris
○ 9. Water (Standing, Moving)
○ 10. Slush
○ 11. Sand, Dirt, Gravel

Roadway Surface Type C8

○ 1. Concrete
○ 2. Blacktop, Asphalt, Bituminous
○ 3. Brick or Block
○ 4. Slag, Gravel, Stone
○ 5. Dirt
○ 6. Other

Roadway Description C9

○ 1. Two-Way, Not Divided
○ 2. Two-Way, Divided, Unprotected Median
○ 3. Two-Way, Divided, Positive Median Barrier
○ 4. One-Way, Not Divided
○ 5. Unknown

Roadway Defects C10

○ 1. No Defects
○ 2. Holes, Ruts, Bumps
○ 3. Soft or Low Shoulder
○ 4. Under Repair
○ 5. Loose Material
○ 6. Restricted Width
○ 7. Slick Pavement
○ 8. Roadway Obstructed
○ 9. Other
○ 10. Edge Pavement Drop Off

Relation to Roadway C11

Interchange Area:

○ 1. Main-Line Roadway
○ 2. Acceleration/Deceleration Lanes
○ 3. Gore Area (Between Ramp and Highway Edgelines)
○ 4. Collector/Distributor Road
○ 5. On Entrance/Exit Ramp
○ 6. Intersection at end of Ramp
○ 7. Other location not listed above within an interchange area (median, shoulder and roadside)

Intersection Area:

○ 8. Non-Intersection
○ 9. Within Intersection
○ 10. Intersection-Related - Within 150'
○ 11. Intersection-Related - Outside 150'

Other Location:

○ 12. Crossover Related
○ 13. Driveway, Alley-Access - Related
○ 14. Railway Grade Crossing
○ 15. Other Crossing (Crossings for Bikes, School, etc.)

Intersection Type C12

○ 1. Not at Intersection
○ 2. Two Approaches
○ 3. Three Approaches
○ 4. Four Approaches
○ 5. Five-Point, or more
○ 6. Roundabout

Work Zone C13

○ 1. Yes
○ 2. No

Work Zone Workers Present C14

○ 1. With Law Enforcement
○ 2. With No Law Enforcement
○ 3. No Workers Present

Work Zone Location C15

○ 1. Advance Warning Area
○ 2. Transition Area
○ 3. Activity Area
○ 4. Termination Area

Work Zone Type C16

○ 1. Lane Closure
○ 2. Lane Shift/Crossover
○ 3. Work on Shoulder or Median
○ 4. Intermittent or Moving Work
○ 5. Other

School Zone C17

○ 1. Yes
○ 2. Yes - With School Activity
○ 3. No

Type of Collision C18

○ 1. Rear End
○ 2. Angle
○ 3. Head On
○ 4. Sideswipe – Same Direction
○ 5. Sideswipe – Opposite Direction
○ 6. Fixed Object in Road
○ 7. Train
○ 8. Non-Collision
○ 9. Fixed Object – Off Road
○ 10. Deer
○ 11. Other Animal
○ 12. Pedestrian
○ 13. Bicyclist
○ 14. Motorcyclist
○ 15. Backed Into
○ 16. Other

Sample

Officer Initials_____ Badge # _____

Commonwealth of Virginia • Department of Motor Vehicles

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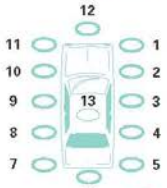
CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	○ City of ○ Town of	Local Case Number

CRASH DIAGRAM

VEHICLE

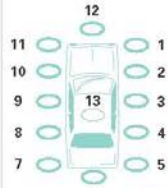
Fill In Impact Area(s). Initial Impact. ☐



Veh Dir of Travel–N/S/E/W ○

VEHICLE

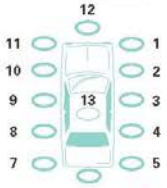
Fill In Impact Area(s). Initial Impact. ☐



Veh Dir of Travel–N/S/E/W ○

VEHICLE

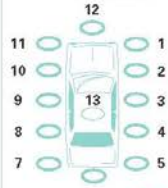
Fill In Impact Area(s). Initial Impact. ☐



Veh Dir of Travel–N/S/E/W ○

VEHICLE

Fill In Impact Area(s). Initial Impact. ☐



Veh Dir of Travel–N/S/E/W ○

Indicate North by Arrow ○

Sample

DAMAGE TO PROPERTY OTHER THAN VEHICLES

Approx. Repair Cost	Object Struck (Tree, Fence, etc.)	Property Owners Name (Last, First, Middle)	Address (Street and Number)	VDOT Property ○ Yes ○ No

CRASH DESCRIPTION

CRASH EVENTS

Vehicle #	First Event	Second Event	Third Event	Fourth Event	Most Harmful Event

Vehicle #	First Event	Second Event	Third Event	Fourth Event	Most Harmful Event

Vehicle #	First Event	Second Event	Third Event	Fourth Event	Most Harmful Event

Vehicle #	First Event	Second Event	Third Event	Fourth Event	Most Harmful Event

First Harmful Event of Entire Crash that Results in First Injury or Damage.

COLLISION WITH FIXED OBJECT

1. Bank Or Ledge
2. Trees
3. Utility Pole
4. Fence Or Post
5. Guard Rail
6. Parked Vehicle
7. Tunnel, Bridge, Underpass, Culvert, etc.
8. Sign, Traffic Signal
9. Impact Cushioning Device
10. Other
11. Jersey Wall
12. Building/Structure
13. Curb
14. Ditch
15. Other Fixed Object
16. Other Traffic Barrier
17. Traffic Sign Support
18. Mailbox

COLLISION WITH PERSON, MOTOR VEHICLE OR NON-FIXED OBJECT

19. Pedestrian
20. Motor Vehicle In Transport
21. Train
22. Bicycle
23. Animal
24. Work Zone Maintenance Equipment
25. Other Movable Object
26. Unknown Movable Object
27. Other

NON-COLLISION

28. Ran Off Road
29. Jack Knife
30. Overturn (Rollover)
31. Downhill Runaway
32. Cargo Loss or Shift
33. Explosion or Fire
34. Separation of Units
35. Cross Median
36. Cross Centerline
37. Equipment Failure (Tire, etc)
38. Immersion
39. Fell/Jumped From Vehicle
40. Thrown or Falling Object
41. Non-Collision Unknown
42. Other Non-Collision

Officer Initials_____ Badge # _____

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

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CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	○ City of ○ Town of	Local Case Number

COMMERCIAL MOTOR VEHICLE SECTION

This form is being completed because the vehicle is:

○ A Truck or Truck Combination Rating Greater Than 10,000 lbs. (GVWR/GCWR)

○ Any Motor Vehicle That Seats 9 or More People, Including the Driver

○ A Vehicle of Any Type with a Hazardous Materials Placard Regardless of Weight

AND The crash resulted in:

A fatality: any person(s) killed in or outside of any vehicle (truck, bus, car, etc.) involved in the crash or who dies within 30 days of the crash as a result of an injury sustained in the crash

OR

An injury: any person(s) injured as a result of the crash who immediately receives medical treatment away from the crash scene

OR

A tow-away: any motor vehicle (truck, bus, car, etc.) disabled as a result of the crash and transported away from the scene by a tow truck or other vehicle

VEHICLE

Vehicle Configuration V10

○ 1. Passenger Car (Only if Vehicle Has Hazardous Materials Placard)
○ 2. Light Truck (Only if Vehicle Has Hazardous Materials Placard)
○ 3. Bus (Seats 9-15 People, Including Driver)
○ 4. Bus (Seats for 16 People or More, Including Driver)
○ 5. Single Unit Truck (2 Axles, 6 Tires)
○ 6. Single Unit Truck (3 or More Axles)
○ 7. Truck Trailer(s) [Single-Unit Truck Pulling Trailer(s)]
○ 8. Truck Tractor (Bobtail)
○ 9. Tractor/Semi-trailer (One Trailer)
○ 10. Tractor/Doubles (Two Trailers)
○ 11. Other Truck Greater Than 10,000 lbs. (Not Listed Above)

Cargo Body Type V11

○ 1. Bus (Seats 9-15 People, Including Driver)
○ 2. Bus (Seats For 16 People or More, Including Driver)
○ 3. Van/Enclosed Box
○ 4. Cargo Tank
○ 5. Flatbed
○ 6. Dump
○ 7. Concrete Mixer
○ 8. Auto Transporter
○ 9. Garbage/Refuse
○ 10. Grain/Chips/Gravel
○ 11. Pole-Trailer
○ 12. Vehicle Towing Another Motor Vehicle
○ 13. Intermodel Container Chassis
○ 14. Logging
○ 15. Other Cargo Body (Not Listed Above)
○ 16. Not Applicable/ No Cargo Body

License Class P8

○ Class A
○ Class B
○ Class C
○ Class DRL (regular drivers license)
○ Class M

Commercial Endorsement P9

○ T–Double Trailer
○ P–Passenger Vehicle
○ N–Tank Vehicle
○ H–Required To Be Placarded for Hazardous Materials
○ X–Combined Tank/HAZMAT
○ O–Other

GVWR/ GCWR V12

○ 1. 10,000 lbs. or Less
○ 2. 10,001–26,000 lbs.
○ 3. Greater Than 26,000 lbs.

Hazardous Material

Hazardous Material Placard: ○ Y ○ N

HM 4–Digit	HM Placard Name	HM Class	HM Cargo Present	HM Cargo Released
			○ Y ○ N	○ Y ○ N

Carrier Identification

Commercial Motor Carrier Name	Address (P.O. Box if No Street Address)		
Carrier's ID Number / US DOT#	State (Intrastate Only)	City	State / Zip

Commercial/Non-Commercial V13

○ 1. Interstate Carrier
○ 2. Intrastate Carrier
○ 3. Not in Commerce-Government (Trucks and Buses)
○ 4. Not in Commerce-Other Truck (Over 10,000 lbs.)

VEHICLE

Vehicle Configuration V10

○ 1. Passenger Car (Only if Vehicle Has Hazardous Materials Placard)
○ 2. Light Truck (Only if Vehicle Has Hazardous Materials Placard)
○ 3. Bus (Seats 9-15 People, Including Driver)
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License Class P8

○ Class A
○ Class B
○ Class C
○ Class DRL (regular drivers license)
○ Class M

Commercial Endorsement P9

○ T–Double Trailer
○ P–Passenger Vehicle
○ N–Tank Vehicle
○ H–Required To Be Placarded for Hazardous Materials
○ X–Combined Tank/HAZMAT
○ O–Other

GVWR/ GCWR V12

○ 1. 10,000 lbs. or Less
○ 2. 10,001–26,000 lbs.
○ 3. Greater Than 26,000 lbs.

Hazardous Material

Hazardous Material Placard: ○ Y ○ N

HM 4–Digit	HM Placard Name	HM Class	HM Cargo Present	HM Cargo Released
			○ Y ○ N	○ Y ○ N

Carrier Identification

Commercial Motor Carrier Name	Address (P.O. Box if No Street Address)		
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Commercial/Non-Commercial V13

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Sample

Officer Initials_____ Badge # _____

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

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CRASH

Crash Date MM DD YYYY	MILITARY Time (24 hr clock)	County of Crash	○ City of ○ Town of	Local Case Number

PEDESTRIAN

Name of Injured (Last, First, Middle)

Address (Street and Number)

City	State	ZIP

Driver's License #	State

Gender (M) (F)	EMS Transport (Y) (N)	Injury Type	Birthdate MM DD YYYY	Date of Death MM DD YYYY

PEDESTRIAN

Name of Injured (Last, First, Middle)

Address (Street and Number)

City	State	ZIP

Driver's License #	State

Gender (M) (F)	EMS Transport (Y) (N)	Injury Type	Birthdate MM DD YYYY	Date of Death MM DD YYYY

Ped # Ped #

Pedestrian Actions P10

- 1. Crossing At Intersection With Signal
- 2. Crossing At Intersection Against Signal
- 3. Crossing At Intersection No Signal
- 4. Crossing At Intersection Diagonally
- 5. Crossing Not At Intersection – Rural
- 6. Crossing Not At Intersection – Urban
- 7. Coming From Behind Parked Cars
- 8. Getting Off Or On School Bus
- 9. Playing In Roadway
- 10. Getting Off Or On Another Vehicle
- 11. Hitching On Vehicle
- 12. Walking In Roadway With Traffic – Sidewalks Available
- 13. Walking In Roadway With Traffic – Sidewalks Not Available
- 14. Walking In Roadway Against Traffic – Sidewalks Available
- 15. Walking In Roadway Against Traffic – Side Walks Not Available
- 16. Working In Roadway
- 17. Standing In Roadway
- 18. Lying In Roadway
- 19. Not In Roadway
- 20. Other

Pedestrian Drinking P11

- 1. Had Not Been Drinking
- 2. Drinking-Obviously Drunk
- 3. Drinking-Ability Impaired
- 4. Drinking-Ability Not Impaired
- 5. Drinking-Not Known Whether Impaired

Condition of Pedestrian Contributing to the Crash P12

- 1. No Defects
- 2. Eyesight Defective
- 3. Hearing Defective
- 4. Other Body Defects
- 5. Illness
- 6. Fatigued
- 7. Apparently Asleep
- 8. Other

Method of Alcohol Determination by Police P13

- 1. Blood
- 2. Breath
- 3. Refused
- 4. No Test

Pedestrian Drug Use P14

- 1. Yes
- 2. No
- 3. Unknown

Pedestrian Wear Reflective Clothing P15

- 1. Yes
- 2. No

Use sections below for additional passengers.

VEHICLE

PASSENGER *(only if injured or killed)*

Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

VEHICLE

PASSENGER *(only if injured or killed)*

Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

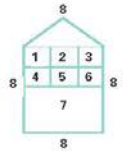
Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

Name of Injured (Last, First, Middle)	EMS Transport (Y) (N)	Date of Death MM DD YY

Position In/On Vehicle	Safety Equip Used	Airbag	Ejected	Injury Type	Birthdate MM DD YYYY	Gender (M) (F)

Codes



POSITION IN/ON VEHICLE
1. Driver
2-6. Passengers
7. Cargo Area
8. Riding/Hanging On Outside
9-98. All Other Passengers

SAFETY EQUIPMENT USED
1. Lap Belt Only
2. Shoulder Belt Only
3. Lap and Shoulder Belt
4. Child Restraint
5. Helmet
6. Other
7. Booster Seat
8. No Restraint Used
9. Not Applicable

AIRBAG
1. Deployed – Front
2. Not Deployed
3. Unavailable/Not Applicable
4. Keyed Off
5. Unknown
6. Deployed – Side
7. Deployed – Other (Knee, Air Belt, etc.)
8. Deployed – Combination

EJECTED FROM VEHICLE
1. Not Ejected
2. Partially Ejected
3. Totally Ejected

SUMMONS ISSUED AS A RESULT OF CRASH
1. Yes
2. No
3. Pending

INJURY TYPE
1. Dead Before Report Made
2. Visible Signs of Injury, as Bleeding Wound or Distorted Member or Had to be Carried From Scene.
3. Other Visible Injury, as Bruises, Abrasions, Swelling, Limping, etc.
4. No Visible Injury, But Complaint of Pain, or Momentary Unconsciousness.

Sample

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