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EVALUATION OF 2009 VIRGINIA CRASH DATA REPORTED TO THE MCMIS CRASH FILE

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16. Abstract

This report is part of a series evaluating the data reported to the Motor Carrier Management Information System (MCMIS) Crash File undertaken by the Center for National Truck and Bus Statistics at the University of Michigan Transportation Research Institute. Earlier studies have shown that reporting to the MCMIS Crash File was generally incomplete. This report examines the factors that are associated with reporting rates for the State of Virginia.

MCMIS Crash File records were matched to the Virginia Crash file to determine the nature and extent of underreporting. Overall, it appears that Virginia is reporting 75.2 percent of crash involvements that should be reported to the MCMIS Crash file. Because police officers are instructed to code tractors with trailers as single unit trucks with three axles, reporting rates by truck configuration were not calculated, but the reporting rate for all trucks is 76.1 percent, and the reporting rate for buses is 67.4 percent. The reporting rate for fatal crashes is 84.1 percent, 77.3 percent for injured/transported crashes, and 73.0 percent for towed/disabled crashes.

The Virginia Police Crash Report form has a Commercial Motor Vehicle Section and it appears that the data recorded in this section plays a major role in determining what information gets uploaded to the MCMIS Crash file.

Missing data rates are low for most variables. Corresponding data elements in the MCMIS and Virginia Crash files were reasonably consistent for several variables examined.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
		AREA		
in^2	square inches	645.2	square millimeters	mm^2
ft^2	square feet	0.093	square meters	m^2
yd^2	square yard	0.836	square meters	m^2
ac	acres	0.405	hectares	ha
mi^2	square miles	2.59	square kilometers	km^2
		VOLUME		
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft^3	cubic feet	0.028	cubic meters	m^3
yd^3	cubic yards	0.765	cubic meters	m^3
	NOTE: volumes greater than 1000 L shall be shown in m^3			
		MASS		
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
		TEMPERATURE (exact degrees)		
^oF	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	^oC
		ILLUMINATION		
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	$candela/m^2$	cd/m^2
		FORCE and PRESSURE or STRESS		
lbf	poundforce	4.45	newtons	N
lbf/in^2	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

Symbol	When You Know	Multiply By	To Find	Symbol
		LENGTH		
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
		AREA		
mm^2	square millimeters	0.0016	square inches	in^2
m^2	square meters	10.764	square feet	ft^2
m^2	square meters	1.195	square yards	yd^2
ha	hectares	2.47	acres	ac
km^2	square kilometers	0.386	square miles	mi^2
		VOLUME		
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m^3	cubic meters	35.314	cubic feet	ft^3
m^3	cubic meters	1.307	cubic yards	yd^3
		MASS		
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
		TEMPERATURE (exact degrees)		
^oC	Celsius	1.8C+32	Fahrenheit	^oF
		ILLUMINATION		
lx	lux	0.0929	foot-candles	fc
cd/m^2	$candela/m^2$	0.2919	foot-Lamberts	fl
		FORCE and PRESSURE or STRESS		
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in^2

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380.
(Revised March 2003)

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1. Introduction

The Motor Carrier Management Information System (MCMIS) Crash file has been developed by the Federal Motor Carrier Safety Administration (FMCSA) to serve as a census file of trucks and buses involved in traffic crashes meeting a specified crash severity threshold. FMCSA maintains the MCMIS file to support its mission to reduce crashes, injuries, and fatalities involving large trucks and buses. Accurate and complete crash data are essential to assess the magnitude and characteristics of motor carrier crashes and to design effective safety measures to prevent such crashes. The usefulness of the MCMIS Crash file depends upon individual states transmitting a standard set of data items on all trucks and buses involved in traffic crashes that meet the crash file severity threshold.

The present report is part of a series of reports that evaluate the completeness and accuracy of the data in the MCMIS Crash file. Previous reports showed underreporting due in large part to problems in interpreting and applying the reporting criteria within the states' respective crash reporting systems. The problems often were more severe in large jurisdictions and police departments. Each state also had issues specific to the nature of its own system. [See references 1 to 39.] The states are responsible for identifying and reporting qualifying crash involvements. Accordingly, improved completeness and accuracy ultimately depends upon the efficiency and effectiveness of individual state systems.

In this report, we focus on MCMIS Crash file reporting by Virginia in 2009. Between 2004 and 2008, Virginia has reported from 2,310 to 5,330 involvements annually to the MCMIS Crash file. Virginia is the 12th largest state by population and in most years ranks about 18th among the states in terms of the number of annual truck and bus fatal involvements. In recent years the number of fatal truck and bus involvements in Virginia has decreased from 137 in 2005 to 91 in 2008.[40,41]

Police accident report (PAR) data recorded in Virginia's statewide files as of September 16, 2010 were used in this analysis. The 2009 PAR file contains the crash records for 223,050 vehicles. Of these vehicles, 10,765 were in 'non-reportable' crashes according to instructions in the police officer's manual for completing the Virginia Police Crash Report.[42] The manual instructs officers investigating a crash resulting in injury to or death of any person or total property damage to an apparent extent of $1,000 or more, to submit a crash report to the Department of Motor Vehicles (DMV). Crashes not meeting the severity criteria, or occurring on private property are not reportable to the DMV. The 10,765 non-reportable vehicles were not removed from the data file because a small number were reported to the MCMIS Crash file. Inclusion of these vehicles has negligible effect on results presented in this report and is discussed in greater detail in section 5.5.

The usual method for state evaluations consists of the following steps, which we attempted to pursue here:

1. The complete police accident report file (PAR file hereafter) from Virginia was obtained for the most recent year available, which was 2009. An algorithm was developed, using the data coded in the Virginia file, to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the Virginia PAR file—those that qualified for reporting to the Crash file as well as those that did not—were matched to the cases actually reported to the MCMIS Crash file from Virginia.

3. Cases that should have been reported, but were not, were compared with those that were reported to identify the sources of underreporting.

4. Cases that did not qualify but which were reported were examined to identify the extent and nature of overreporting.

2. Data Preparation

The Virginia PAR file and MCMIS Crash file each required processing before the Virginia records in the MCMIS Crash file could be matched to the Virginia PAR file. In the case of the MCMIS Crash file, the major tasks were to extract records reported from Virginia and to eliminate duplicate records. The Virginia PAR file was reformatted to create a comprehensive vehicle-level file from accident, vehicle, and person data.

The following sections describe the methods used to prepare each file and some of the problems uncovered.

2.1 MCMIS Crash Data File

The 2009 MCMIS Crash file as of May 31, 2010, was used to identify records submitted from Virginia. For calendar year 2009 there were 3,673 cases reported to the file from Virginia. An analysis file was constructed using all variables in the MCMIS file. This analysis file was examined for duplicate records (more than one record submitted for the same vehicle in the same crash; i.e., the report number and sequence number were identical). No such duplicates were found.

In addition, records were reviewed to find cases with identical values on accident number, accident date/time, county, street, vehicle identification number (VIN), and driver license number, even though their vehicle sequence numbers were different. The purpose is to find and eliminate cases where more than one record was submitted for the same vehicle and driver within a given accident. This can happen as records are corrected. No such duplicates were found. The resulting MCMIS file contains 3,673 unique records.

2.2 Virginia Police Accident Report File

The Virginia PAR data for 2009 was obtained from the state during September, 2010. The data were stored as an ACCESS database, representing Accident, Vehicle, and Person information. The files contained records for 116,742 traffic crashes involving 223,050 units. Data for the PAR

file are coded from the Commonwealth of Virginia Police Crash Report (FR300P, rev 7/07) completed by police officers and shown in Appendix A.

The PAR file was first examined for duplicate records (involvements where more than one record was submitted for the same vehicle in the same crash). A search for records with identical case numbers and vehicle numbers found no instances of duplicates. In addition, inspection of case numbers verified that they were recorded in a consistent format, so there was no reason to suspect duplicate records based on similar, but not identical, number formats (such as 1750936 and 175-936, for example).

Just as in the preparation of the MCMIS Crash file, cases also were examined to determine if there were any records that contained identical time, place, and vehicle/driver variables, regardless of vehicle number. Two crash records would not be expected to be identical on all variables. Records were examined for duplicate occurrences based on the fields for case number, accident date/time, jurisdiction, vehicle identification number (VIN), and driver date of birth. Based on the above algorithm, no duplicate pairs were found. The PAR file has 223,050 unique records.

3. Matching Process

The next step involved matching records from the Virginia PAR file to corresponding records from the MCMIS file. There were 3,673 Virginia records from the MCMIS file available for matching, and 223,050 records from the Virginia PAR file. All records from the Virginia PAR data file were used in the match, even those that did not meet the requirements for reporting to the MCMIS Crash file. This allowed the identification of cases reported to the MCMIS Crash file that did not meet the reporting criteria.

Matching records in the two files is accomplished by using combinations of variables common to the two files that have a high probability of uniquely identifying accidents and specific vehicles within the accidents.

An obvious first choice is to match on the crash identifier, which uniquely identifies a crash. Although CrashId in the PAR data did not match MCMIS Report Number, the PAR Document Number matched a portion of the MCMIS number. Document Number in the PAR file is a 9-digit numeric field, and in the MCMIS Crash file, Report Number is stored as a 12-character alphanumeric value. The report number in the MCMIS Crash file is constructed as follows: The first two columns contain the state abbreviation (VA, in this case), followed by nine digits, and a tenth numeric or alpha value. Fortunately, the PAR document number, and digits 4-12 of the MCMIS report number appear to correspond, so this variable could be used in the match.

Other data items that are useful in matching at the crash level include Crash Date, Crash Time (stored in military time as hour/minute), Crash County, Crash City, Crash Street, and Reporting Officer's Identification number. The PAR file did not contain Crash Street or Officer ID. The PAR County variable contained a mixture of text names and numbers. There was also a Jurisdiction variable containing counties and cities. The MCMIS County code variable was also a mixture of counties and cities. Although the numbering scheme appeared to be different between the PAR and MCMIS files, there was a correspondence between the text county names,

so these variables could be used to match some of the cases. The PAR County variable was unrecorded in over 34% of PAR cases, but recorded in all of the MCMIS cases.

Variables in the MCMIS file that distinguish one vehicle from another within the same crash include vehicle license plate number, driver license number, VIN, driver date of birth, and driver last name. Of these, the PAR data file only contains VIN and Driver Date of Birth. The VIN was unrecorded in 3.1% of PAR cases, and in less than 1% of MCMIS cases. Driver Date of Birth was not present in 6.3% of PAR cases, but was missing in only 3.1% of MCMIS cases.

The match was performed in six steps, using the available variables. At each step, records in either file with duplicate values on all the match variables for the particular step were excluded, along with records with missing values for the match variables. The first match included the variables crash number, crash date (month, day), crash time (hour, minute), county, vehicle identification number (VIN), and driver date of birth. The second match step dropped driver date of birth, and matched on crash number, crash date, crash time, VIN, and county (based on PAR jurisdiction). After some experimentation, the third match step included crash number, crash date, crash time, and the last 6 digits of the VIN. The fourth match used crash number and truckbustype. The latter variable was created for matching purposes in the PAR and MCMIS datasets with code levels of Truck, Bus, and Other. The variables used in the final attempt at a computer-based match were VIN and driver birth year. The resulting matched records in steps 4 and 5 were each verified to ensure the PAR and MCMIS records corresponded.

An attempt was made to hand-match the remaining 44unmatched cases. In this process, we reviewed all cases in the PAR file in a crash on the specific crash date and hour of the record in the MCMIS file. Within the listing of potential matches, the variables VIN, Driver Date of Birth, and vehicle type were compared. Matching by this means resulted in eight additional matched cases.

This process resulted in matching 99.0 percent of the MCMIS records to the PAR file. Thirty-six MCMIS cases could not be matched. Some records could not be matched due to unrecorded values in the match variables (VIN and Driver Date of Birth). Perhaps some of these records were added to the MCMIS file as a result of attempting to apply corrections to the original records. Table 1 shows the variables used in each match step and the number of records matched at each step.

Table 1 Steps in MCMIS/Virginia PAR File Match, 2009

Step	Matching variables	Cases matched
Match 1	Crash number, crash date (month, day), crash time (hour, minute), county, vehicle identification number (VIN), and driver birthdate	1,522
Match 2	Crash number, crash date, crash time, jurisdiction, and VIN	426
Match 3	Crash number, crash date, crash time, VIN(last 6 digits)	1,515
Match 4	Crash number, truck/bus type	100
Match 5	VIN and driver birth year	66
Match 6	Hand-matched using all available variables	8
Total cases matched		3,637

The matches made were verified using other variables common to the MCMIS and PAR file as a final check to ensure each match was valid. The above procedure resulted in 3,637 matches, representing 99.0 percent of the 3,673 records reported to MCMIS.

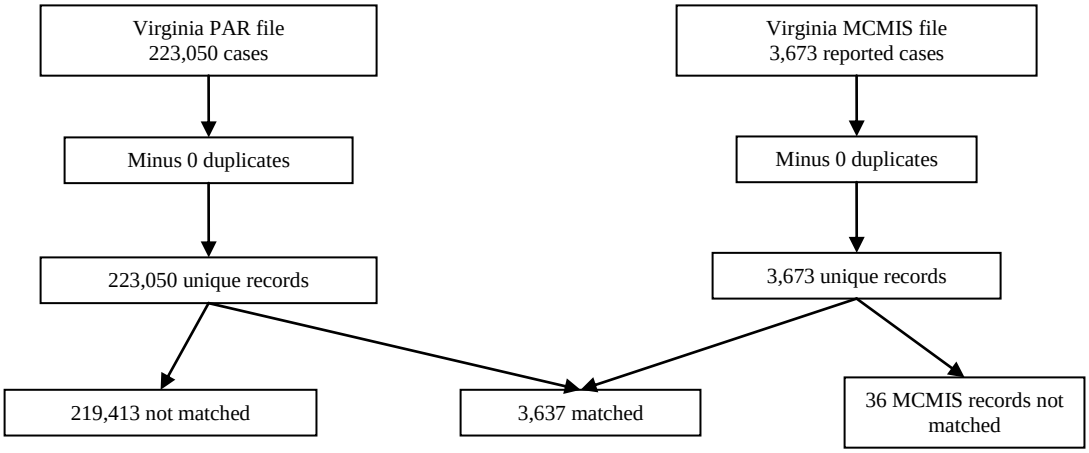

Figure 1 Case Flow in MCMIS/Virginia Crash File Match

Of the 3,637 matched cases, 2,915 apparently met the MCMIS reporting criteria (reportable), as well as could be determined using the data supplied, and 722 did not meet the MCMIS reporting criteria (not reportable). The method of identifying cases reportable to the MCMIS Crash file is discussed in the next section.

4. Identifying Reportable Cases

The next step in the evaluation of crash reporting is to identify records in the Virginia data that qualify for reporting to the MCMIS Crash file. Records are selected as reportable using the information available in the computerized crash files supplied by the State of Virginia. Records that are reportable to the MCMIS Crash file meet criteria specified by the FMCSA. The reporting criteria cover the type of vehicle and the severity of the crash. These criteria are discussed in more detail below, but the point here is that records transmitted to the MCMIS Crash file must be selected from among all the records in the state's crash data.

The method developed to identify reportable records is intended to be separate from any prior selection by the state being evaluated. This approach provides an independent method of evaluating the completeness of reporting. Accordingly, we use the information recorded by the officers on the crash report for all crashes.

Some states place some of the data elements intended for the MCMIS Crash file in a special section, with instructions to the reporting officer to complete that information only for vehicles and crashes that meet the MCMIS selection criteria. This is the case for Virginia which has a Commercial Motor Vehicle Section in the Police Crash Report (FR300P,rev 7/07) for vehicles meeting the following criteria:[Appendix A]

- A Truck or Truck Combination Rating Greater Than 10,000 lbs. (GVWR/GCWR), ***or***
- Any Motor Vehicle That Seats 9 or More People, Including the Driver, ***or***
- 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.

This definition approximates the MCMIS reporting criteria almost exactly. However, if the present evaluation of state reporting were limited only to records where those data elements had been filled out, it would obviously miss cases that had been missed by the state selection process. Accordingly, the method of identifying reportable cases used in this report attempts to be independent, and relies on variables that describe vehicles and crash severity to determine if they meet the MCMIS Crash file reporting criteria. This approach should provide the best opportunity to identify any cases that might have been overlooked.

The MCMIS criteria for a reportable crash involving a qualifying vehicle are shown in Table 2. Reportable records must meet both the vehicle type and crash severity criteria. Identifying qualifying vehicles using the Virginia PAR data was accomplished using several variables in combination, and is described in Section 4.1. Identifying vehicles involved in crashes with fatalities, injuries transported for immediate medical attention, or those in crashes in which at least one vehicle was towed due to disabling damage was more straightforward and is described in Section 4.2. This is because variables are recorded in the Virginia Par file for capturing information related to injury, transportation to a medical facility, and disabling damage to the vehicle. The method used is intended to be conservative, in the sense that vehicles are only selected if variables in the Virginia Par file indicate that the criteria described in Table 2 below are satisfied.

Table 2 Vehicle and Crash Severity Threshold for MCMIS Crash File

Vehicle	Truck with GVWR over 10,000 or GCWR over 10,000, or Bus with seating for at least nine, including the driver, or Vehicle displaying a hazardous materials placard.
Accident	Fatality, or Injury transported to a medical facility for immediate medical attention, or Vehicle towed due to disabling damage.

4.1 Qualifying Vehicles

The first step is to identify vehicles in the Virginia Crash file that meet the MCMIS vehicle criteria shown in the upper portion of Table 2. Five variables were used in combination to identify qualifying vehicles. A hierarchy of variables was defined since some are more useful than others when identifying certain medium/heavy trucks and buses. The five variables and their level of importance in order are shown in the list below. The first four variables are recorded on the main form of the Virginia Police Crash Report and not in the Commercial Motor Vehicle Section. The hazmat placard variable is only recorded in the Commercial Motor Vehicle Section.[Appendix A]

1. Vehicle Identification Number (VIN)
2. Vehicle Body Type
3. Vehicle Make and Vehicle Model
4. Commercial Use
5. Hazmat Placard

The VIN is the primary variable used to identify whether a vehicle is a qualifying truck or bus because it is the most objective source of vehicle type information. David Hetzel of the National Institute for Safety Research (NISR) kindly decoded the VINs for all vehicles in the Virginia Crash file. VIN information is recorded except for approximately 3.5 percent of the 223,050 vehicles in the data file. In addition to the VIN, the Virginia PAR data includes a vehicle body type variable that has codes for identifying single-unit trucks with two axles, single unit trucks with three or more axles, truck tractors without trailers (bobtails), and a variety of buses.[See Page 2 of the Virginia Police Crash Report in Appendix A for the codes]

The vehicle make and vehicle model variables were used when the VIN indicated that a vehicle had GVWR less than 10,000 pounds, but the vehicle body type variable indicated that it was a medium/heavy truck. In that case, the vehicle make and model variables were used to confirm that the vehicle was a heavy truck. The vehicle make and model were also used when other variables were inconclusive regarding a vehicle's status, but the make and model identified it as a known truck or bus (eg, Kenworth, Peterbilt, Mack, International, Freightliner, and so on). The commercial use variable was used to confirm that pickups or vans with GVWR greater than 10,000 pounds (according to VIN decoding) were used for commercial use. The hazmat placard variable was used to identify vehicles displaying a hazardous materials placard that were not already identified as qualifying trucks or buses. The interested reader can see Appendix B for a full description of the algorithm used to select MCMIS qualifying vehicles.

Examination of the Police Officer's Instruction Manual for Completing the Police Crash Report indicates that officers are instructed to classify tractors with trailers as single unit trucks with three or more axles. This explains why there is no code on the crash report form for tractors with trailers. The following instruction appears in the manual for completing the Virginia Police Crash Report:[42, p.19]

If the vehicle is a tractor-trailer shade the oval adjacent to: **"Truck – Single Unit Truck (3 Axles or More)."**

Table 3 shows frequencies and percentages of relevant body type codes derived from the vehicle body type variable. Due to the relatively small number of trucks classified in the truck tractor/bobtail category, it appears that this category is reserved strictly for tractors without a trailer. In addition, due to the relatively large number of 4,208 single unit trucks with three or more axles, it appears that officers are in general following instructions and classifying tractors with trailers as single unit trucks.

Table 3 Relevant Body Type Codes Derived from the Vehicle Body Type Variable Only,Virginia PAR File, 2009

Vehicle body type	Count	Percent
Single unit truck (2 axles)	2,768	30.4
Single unit truck (3+ axles)	4,208	46.3
Truck tractor/ bobtail – no trailer	802	8.8
School bus	677	7.4
Transit/church bus	397	4.4
Commercial bus	240	2.6
Total	9,092	100.0

According to the method used in this report for identifying qualifying vehicles based on the strengths of five variables, Table 4 shows the distribution of qualifying vehicles classified as trucks, buses, and other vehicles displaying a hazardous materials placard. Medium or heavy trucks account for 87.2 percent of the vehicles, while 12.7 percent are buses. Another 0.1 percent are light vehicles with hazmat placards. Qualifying vehicles account for 8,134/223,050 = 3.6 percent of the vehicles in the 2009 Virginia PAR file. Note that it is not possible to present a classification of trucks and buses by body type (eg. tractors with trailers, single unit trucks) because tractors with trailers were classified as single unit trucks and there is no way to separate the tractors from that category.

Table 4 Vehicles Meeting MCMIS Vehicle Criteria Virginia PAR File, 2009

Vehicle Type	Count	Percent
Trucks	7,090	87.2
Buses	1,031	12.7
Non-trucks with Hazmat Placard	13	0.1
Total	8,134	100.0

Since identifying qualifying vehicles was accomplished using the algorithm described above, and in greater detail in Appendix B, the procedure was repeated two separate ways for comparative purposes. The first method uses only the VIN-decoded variable. The second method uses only the vehicle body type variable as recorded on the Virginia PAR form. Results are presented in Appendix C for the interested reader. The conclusion is that the VIN-decoded method identifies considerably fewer vehicles than the method based on the vehicle body type variable alone. The

method used in this study identifies a number intermediate between the other two. After extensive evaluation, we claim that the method used in this report is most accurate since it uses the five variables in combination, each one according to its specific strengths. Of the three methods shown in Appendix C, the one used in this report leads to the highest reporting rate of reportable involvements to the MCMIS Crash file.

4.2 Crash Severity

Having identified vehicles that qualify for reporting to the MCMIS Crash file, the next step is to identify crashes that meet the MCMIS crash severity criteria shown in the lower portion of Table 2. With respect to crash severity, qualifying crashes include those involving a fatality, an injured person transported for immediate medical attention, or a vehicle towed from the scene due to disabling damage. The Virginia data files include sufficient information for determining whether a crash meets the severity threshold for reporting to the MCMIS Crash file.

In the Virginia Person file an injury variable is recorded using a method similar to the common KABCN scale, where injuries are classified as Fatal (K), Incapacitating (A), Non-incapacitating, but evident (B), Possible (C), and No injury (N). On the Police Crash Report form there are two separate places for the officer to record injury type. One place is devoted to injury for drivers only. The second place is devoted to non-drivers.[See the exact injury codes on the Police Crash Report form, Appendix A, p.1 and p.6]

Determining whether an injured person was transported for immediate medical attention is also recorded in the Virginia Person file. There is an EMS Transport variable (Yes/No) indicating if the injured person was transported to a medical facility. As with the injury type variable, there are also two separate places for the officer to record whether an injured driver or non-driver was transported by emergency medical services personnel.

Using the injury and transported information in the Virginia Person file, an injured and transported variable was created at the crash level. In order to qualify as a MCMIS-reportable crash, the crash had to meet the strict MCMIS criteria. That is, the crash had to involve a fatality, or an injury transported for medical attention. This method likely leads to a conservative estimate of MCMIS qualifying crashes in the sense that some crashes involve injury in which the data indicate no persons were transported for medical care. Similarly, there are some crashes in which the data indicate there were no injuries, yet some persons were transported for medical care.

The last MCMIS criterion specifies “vehicles towed due to disabling damage.” On the Virginia Police Crash Report form there is space for the investigating officer to record whether a vehicle was towed from the scene **for any reason**, but this variable cannot be found in the supplied data file. However, there is a disabled variable recorded in the data file that appears to closely match the MCMIS criterion. According to the police officer’s manual for completing the form the instructions state:

> Shade the oval **“Disabled”** if the vehicle was disabled as a result of the crash and transported away from the scene by a tow truck or other vehicle. Disabled means the vehicle could not be driven from the scene.[42, p.12]

Table 5 shows the distribution of vehicle disabled as it is recorded at the vehicle level in the Virginia PAR file for all 223,050 vehicles. Approximately 25 percent of all vehicles in the crash file are coded as disabled. Other MCMIS evaluations tend to support an estimate of 30 percent for states that record information on the towed and disabled variables.[20,22,27,28,39] An analysis of the towed variable in the 2009 General Estimates System (GES) database shows that approximately 26 percent of vehicles are towed due to damage.[43]

Table 5 Distribution of Vehicle Disabled, Virginia PAR 2009

Vehicle disabled	Count	Percent
Yes	56,077	25.1
No	166,973	74.9
Total	223,050	100.0

There is a vehicle damage variable recorded in the Virginia PAR file that has levels describing whether the vehicle was totaled or on fire. If these vehicles are included in addition to those disabled, the percentage increases to about 29 percent. Since the definition of the disabled variable matches the MCMIS definition closely, totaled vehicles or those on fire are not included as towed and disabled. Using the definition of a disabled vehicle, a towed and disabled flag variable was created at the crash level to be used for estimating the number of qualifying vehicles satisfying this criterion.

Table 6 shows the numbers of qualifying vehicles that meet the threshold for a MCMIS reportable crash according to the MCMIS criteria. In total, it is estimated that 3,874 vehicles were reportable to the MCMIS Crash file. Of these, 88 were involved in fatal crashes and 1,791, or about 46.2 percent, were involved in crashes where at least one person was injured and transported for medical treatment. Based on the disabled variable described above, it is estimated that 1,995 or about 51.5 percent of reportable vehicles were involved in crashes where at least one vehicle was towed due to disabling damage.

Table 6 Reportable Records in the Virginia Crash File, 2009

Crash type	Count	Percent
Fatal	88	2.3
Injury transported for treatment	1,791	46.2
Vehicle towed due to damage	1,995	51.5
Total	3,874	100.0

5. Factors Associated with Reporting

The procedure described in the previous section identified 3,874 vehicles involved in crashes as reportable to the MCMIS Crash file. The match process described in Section 3 determined that 3,673 unique cases were reported to the MCMIS Crash file, of which 3,637 could be matched to the Virginia PAR data (Figure 1). Of the 3,637 cases that could be matched, 2,915 were determined to meet the MCMIS Crash file reporting criteria. Therefore, of the 3,874 reportable vehicles in 2009, Virginia reported 2,915, for an overall reporting rate of 75.2 percent. In this

section, some of the factors that affect the chance that a vehicle in a qualifying crash would be submitted through the SafetyNet system and appear in the MCMIS Crash file are identified. The results are presented in six subsections: overreporting, case processing, reporting criteria, commercial motor vehicle (CMV) section, Virginia non-reportable crashes, and truck/bus fire and explosion occurrence. Analysis of overreporting attempts to identify why cases were submitted that do not meet the MCMIS reporting criteria as defined by Table 2. Case processing deals with timing issues related to reporting such as crash month and time lag between crash date and uploading date to the MCMIS Crash file. Reporting criteria examines reporting by factors such as vehicle type and crash severity. The CMV section evaluates reporting by the CMV configuration variable coded from the CMV section of the crash report form. Virginia non-reportable crashes examines reporting by the crashes in the Virginia PAR file classified as 'non-reportable' according to Virginia's established crash severity threshold for filling out the crash report form. Finally, truck/bus fire occurrence examines reportable cases of crashes involving fire or explosion.

5.1 Overreporting

MCMIS evaluations tend to focus on underreporting because sources of underreporting tend to be more prevalent than overreporting. However, almost all states overreport cases to some degree. Overreporting results when cases are submitted to the MCMIS Crash file that do not meet the criteria for a reportable crash. Since 3,637 MCMIS cases could be matched to the Virginia PAR data, and 2,915 were determined to meet the reporting criteria, the difference, or 722 cases, were not reportable, and should not have been reported.

Table 7 shows a two-way classification of vehicle type and crash severity, and provides some explanation as to why these vehicles should not have been reported to the MCMIS Crash file. The majority of vehicles, 571+62+2=635, were qualifying vehicles, but were not involved in a crash serious enough to meet the crash severity threshold. There were also 1+28+29=58 vehicles in crashes in which the crash met the severity test, but the vehicle was not a qualifying truck, bus, or displaying a hazardous material placard. Finally, 29 vehicles were reported that meet neither the crash severity criteria nor the vehicle criteria since they are not trucks, buses, or hazmat placarded vehicles.

Table 7 Distribution of Non-reportable Vehicles in MCMIS Crash File, 2009

	Crash severity				
Vehicle type	Fatal	Transported injury	Towed/disabled	Other crash severity	Total
Truck	0	0	0	571	571
Bus	0	0	0	62	62
Non-truck with hazmat placard	0	0	0	2	2
Other vehicle not transporting hazmat	1	28	29	29	87
Total	1	28	29	664	722

Because the methods used in this report to identify MCMIS reportable vehicles are conservative, there is a chance that some of the 722 vehicles reported by Virginia claimed to be non-reportable

are in fact reportable. That is, to satisfy the injured and transported criterion, a qualifying vehicle had to be involved in a crash in which at least one person was injured and transported to a medical care facility as determined by the injury type and EMS transport variables recorded in the available Virginia PAR data. For example, there are records in the Virginia data in which a crash involved an incapacitating (A) injury, yet no person was transported to a medical care facility. Virginia may have reported such a crash, but the methodology used in this report would not identify that crash as reportable since the data indicate that no one in the crash was transported for medical attention.

The majority of the 722 vehicles in Table 7 that Virginia did report that are claimed to be non-reportable are 571 trucks that did not meet the MCMIS crash severity criteria. Table 8 shows the distribution of injury type by EMS transport at the person level for the 571 qualifying trucks. These 571 trucks were in crashes involving a total of 1,058 persons. Note that there are zero fatal outcomes since the methodology used in this report identifies any qualifying vehicle involving a fatality as reportable. Similarly, there are zero outcomes when there is some kind of injury (A,B,C) and EMS transport is 'Yes' since those involvements are also reportable. Since A and B injuries are serious injuries, the most questionable outcomes are those in which injury type is A or B, and EMS transport is coded as 'No' or 'Unknown' (shaded rows in Table 8). However, of the 1,058 persons, 10 +26=36 were coded with A or B injuries. The majority of the 1,058 persons were 886 coded with no injury. Examination of the 51 persons in which injury type and EMS transport are both unknown shows that 26 of these outcomes, or about half, are associated with Virginia 'non-reportable' crashes. These non-reportable vehicles were those involved in crashes that did not meet the crash severity criteria that require officers to fill out the Virginia Police Crash Report form. These criteria are not related to the MCMIS criteria for reporting to the MCMIS Crash file.[see section 5.5 for a discussion of Virginia non-reportable crashes]

Table 8 Person Level Distribution of Injury Type by EMS Transport (571 Trucks Identified in Table 7)

	EMS transport			
Injury type	Yes	No	Unknown	Total
Fatal (K)	0	0	0	0
Incapacitating (A)	0	9	1	10
Non-incapacitating (B)	0	25	1	26
Possible (C)	0	78	4	82
None evident (O)	5	792	89	886
Unknown	1	2	51	54
Total	6	906	146	1,058

For the towed and disabled criterion, only the vehicle disabled variable was used to identify vehicles involved in crashes in which at least one vehicle was towed due to disabling damage and is described in detail in section 4.2.

5.2 Case Processing

Delays in transmitting cases may partially account for the incompleteness of the MCMIS Crash file. The time lag in extracting and submitting reports to the file might explain some portion of

the unreported cases. All reportable crash involvements for a calendar year are required to be transmitted to the MCMIS Crash file within 90 days of the date of the crash. The 2009 MCMIS Crash file as of May 31, 2010 was used to identify records submitted from Virginia, so all 2009 cases should have been reported by that date.

Table 9 shows reporting rates according to month of the crash. The lowest reporting rate was 69.8 in August and the 97 unreported cases represent 10.1 percent of the total. The highest reporting rate was 82.6 percent in March. Since the overall reporting rate is 75.2 percent, there does not appear to be great variation in rates according to crash month. There are 42 reportable cases in which crash month is unknown (not recorded in the Virginia Data file) and the reporting rate is 52.4 percent, but the percentage of missing data is small. These 42 cases are 'non-reportable' vehicles and are discussed in greater detail in section 5.5.

Table 9 Reporting Rate by Accident Month in Virginia Crash File, 2009

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	277	70.4	82	8.6
February	246	72.8	67	7.0
March	317	82.6	55	5.7
April	304	78.0	67	7.0
May	308	76.3	73	7.6
June	357	75.9	86	9.0
July	310	73.2	83	8.7
August	321	69.8	97	10.1
September	332	71.7	94	9.8
October	355	76.3	84	8.8
November	307	78.8	65	6.8
December	398	78.4	86	9.0
Unknown	42	52.4	20	2.1
Total	3,874	75.2	959	100.0

Figure 2 shows the median latency in case submission by month, where latency is the number of days between crash date and the date the case was uploaded to the MCMIS Crash file, minus the 90-day grace period. Therefore, a positive number for a month gives the median number of days cases were submitted after the 90-day grace period. Negative numbers give the median number of days that cases were submitted within the 90-day grace period for a month. Figure 2 is based on the 2,915 matched and reportable cases submitted by Virginia. As shown by the horizontal line, over the entire 12 months, cases were submitted approximately 41 days prior to the end of the grace period. All points in the plot are negative, indicating that in general, cases were submitted within the grace period. However, in July, cases tended to be submitted close to the end of the grace period. There is also some evidence that in June and August, cases were submitted about one month prior to the end of the grace period.

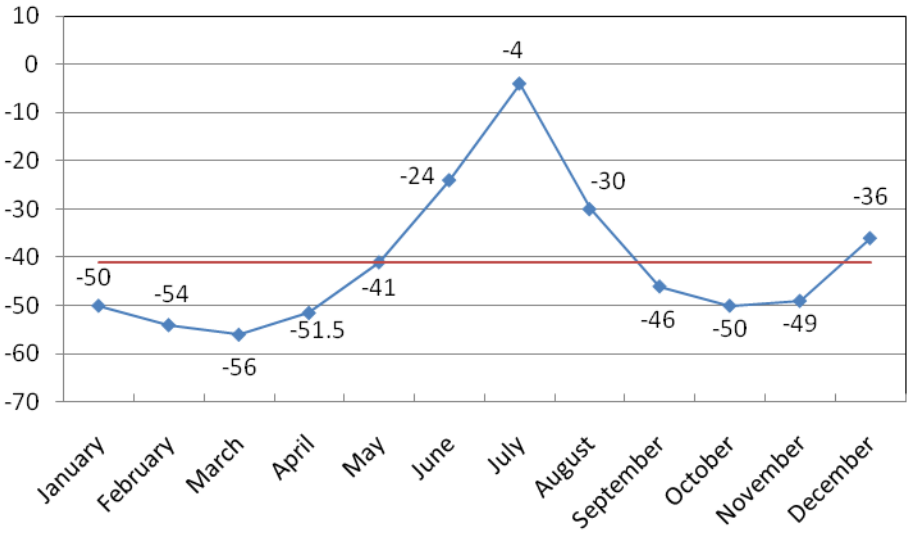

Figure 2 Median Latency (in Days, Minus 90) in Reporting to the MCMIS Crash File, Virginia Matched and Reportable Cases, 2009

Figure 3 is an empirical cumulative distribution plot that shows the percentage of cases submitted to the MCMIS Crash file by the number of days after the crash. A vertical line at 90 days shows that about 80 percent of the cases were uploaded to the MCMIS Crash file within the 90-day grace period. The median time between crash occurrence and record upload was 49 days. Two-thirds were submitted within 64 days, and 95 percent were submitted within 186 days.

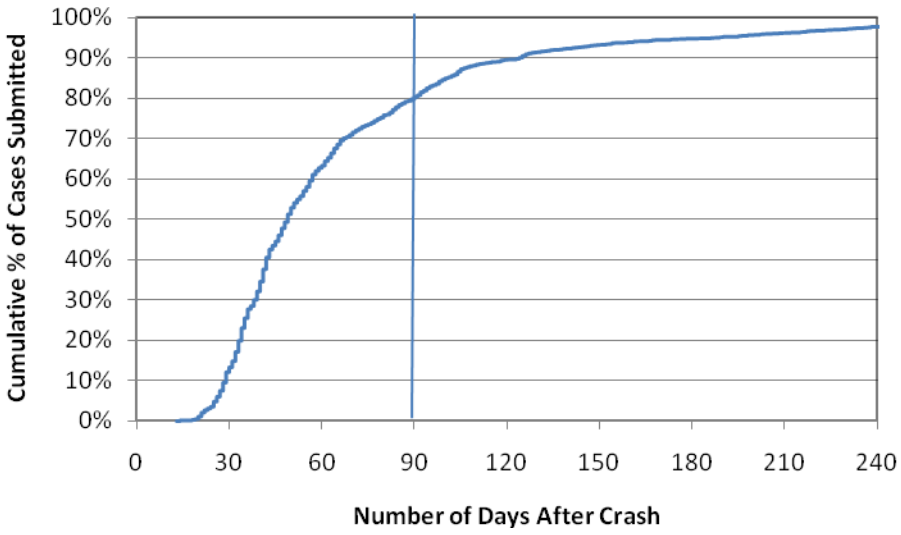

Figure 3 Cumulative Percentage of Cases Submitted to MCMIS Crash File by Number of Days After the Crash

5.3 Reporting Criteria

In this subsection, reporting is investigated according to variables in the Virginia PAR file related to the reporting criteria for a MCMIS-reportable crash, as outlined in Table 2. Previous studies have consistently shown that trucks are more likely to be reported than buses and that fatal crashes are more likely to be reported than injury involvements. Since the criteria revolve around attributes associated with the vehicle type and crash severity, calculating reporting rates for these two variables is a logical starting point for assessing where improvements can be gained.

Table 10 shows reporting rates by vehicle type. The reporting rate for trucks is close to the overall rate since trucks represent the majority of reportable cases. There is a declining trend in reporting rates for buses and light vehicles with a hazmat placard. In total, there were 347 buses that were reportable to MCMIS, and 67.4 percent of these buses were reported. Finally, only 3 of the 9 reportable non-trucks with a hazmat placard were reported resulting in a reporting rate of one-third.

Table 10 Reporting Rate by Vehicle Type, Virginia 2009

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck	3,518	76.1	840	87.6
Bus	347	67.4	113	11.8
Non-truck with hazmat placard	9	33.3	6	0.6
Total	3,874	75.2	959	100.0

Table 11 shows reporting rates by crash severity. Reporting rates tend to decrease as the severity of the crash decreases and this is the case in Virginia. The reporting rate for fatal involvements is 84.1 percent, but these crashes represent only 1.5 percent of the total unreported cases. The reporting rate is 77.3 percent for the injured and transported category which represents approximately 42.4 percent of the total unreported cases. Finally, the reporting rate for crashes meeting the towed and disabled threshold is 73.0 percent. The overall reporting rate of 75.2 percent is intermediate between the injured/transported and towed/disabled rates since the majority of reportable cases are in those two categories.

Table 11 Reporting Rate by Crash Severity, Virginia 2009

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	88	84.1	14	1.5
Injured/Transported	1,791	77.3	407	42.4
Towed/Disabled	1,995	73.0	538	56.1
Total	3,874	75.2	959	100.0

Table 12 shows reporting rates to the MCMIS Crash file by maximum injury severity in the crash. The fatal involvement results are identical to those shown in Table 11. Note the general declining trend in reporting rates as injury severity decreases. In addition, the percentage of total unreported cases generally increases as injury severity decreases. Crashes involving no injury account for 45.8 percent of the unreported cases.

Table 12 Reporting Rate by Detailed Injury Severity, Virginia 2009

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	88	84.1	14	1.5
Incapacitating	656	80.5	128	13.3
Non-incapacitating	409	77.0	94	9.8
Possible	1,043	73.5	276	28.8
None evident	1,666	73.6	439	45.8
Unknown	12	33.3	8	0.8
Total	3,874	75.2	959	100.0

5.4 Commercial Motor Vehicle Section

The Virginia Police Crash Report form has a Commercial Motor Vehicle (CMV) Section.[Appendix A, p.5] In that section the MCMIS reporting criteria are described and the reporting officer is instructed to fill out that portion of the report only if the vehicle meets the MCMIS reporting requirements. Except for hazmat placard information, this report does not use data recorded from the CMV Section to identify vehicles reportable to the MCMIS Crash file, but rather the data recorded on the main Police Crash Report form as outlined and described in Section 4. As described in Section 4, the method of identifying reportable cases used in this report attempts to be independent, and relies on variables that describe vehicles and crash severity to determine if they meet the MCMIS Crash file reporting criteria. This approach should provide the best opportunity to identify any cases that might have been overlooked.

Table 13 shows reporting rates by the commercial vehicle configuration variable that appears in the CMV Section of the crash form. For trucks and buses, the reporting rates are not far from 100 percent. Only for passenger cars displaying a hazmat placard is the rate lower than the rest, but only 7 reportable cases were found for that category. Close agreement between reportable cases identified using the method in this report and the commercial vehicle configuration vehicle suggests that Virginia at least partially uses the CMV Section when determining which vehicles should be uploaded for submission to the MCMIS Crash file.

The methods used in this report, however, also identify 882 reportable vehicles for which information was not provided for the commercial vehicle configuration variable. These vehicles were not reported to the MCMIS Crash file, and the reporting rate for the not provided category is 2.9 percent. These cases represent 92 percent of the unreported vehicles. The method used in this report for identifying vehicles reportable to the MCMIS Crash file was intended to be conservative. That is, using variables recorded from the main portion of the crash report form,

vehicles were only selected if they met the reporting criteria outlined in Table 2 in the strictest sense.

Table 13 Reporting Rates by Commercial Vehicle Configuration, Virginia 2009

Commercial vehicle configuration	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Not provided	908	2.9	882	92.0
Passenger car (hazmat placard only)	7	71.4	2	0.2
Light truck (hazmat placard only)	6	100.0	0	0.0
Bus (9-15, including driver)	43	97.7	1	0.1
Bus (16+, including driver)	261	97.7	6	0.6
Single unit truck (2 axles, 6 tires)	417	96.9	13	1.4
Single unit truck (3+ axles)	403	98.5	6	0.6
Truck trailer	299	96.7	10	1.0
Truck tractor	59	98.3	1	0.1
Tractor/semi	1,314	97.5	33	3.4
Tractor/doubles	47	95.7	2	0.2
Other truck >10K lbs	109	97.2	3	0.3
Not applicable	1	100.0	0	0.0
Total	3,874	75.2	959	100.0

5.5 Virginia Non-Reportable Crashes

Of the 223,050 vehicles in the Virginia PAR file, 10,765 were in 'non-reportable' crashes according to instructions in the police officer's manual for completing the Virginia Police Crash Report.[42] The definition of 'non-reportable' in this sense is related to motor vehicle laws of Virginia that require officers to submit a police crash report to the Virginia Department of Motor Vehicles, and not to the definition of a vehicle in a crash reportable to the MCMIS Crash file described in Table 2. An excerpt from the instruction manual describing a reportable crash follows.

> Every law-enforcement officer who in the course of duty investigates a motor vehicle accident resulting in injury to or death of any person or total property damage to an apparent extent of $1,000 or more, either at the time of and at the scene of the accident or thereafter and elsewhere, by interviewing participants or witnesses shall, within twenty-four hours after completing the investigation, forward a written report of the accident to the Department.[42, p.3]

Crashes meeting the severity criteria occurring on public property are reportable. Crashes occurring on private property, even though they may meet the severity criteria, are not reportable. Because some vehicles flagged as non-reportable were uploaded to the MCMIS Crash file, we did not delete them from this analysis. Table 13 shows reporting rates based on whether a crash was considered reportable or not. Overall, 42 vehicles flagged as 'non-reportable' were identified as reportable to the MCMIS Crash file. Of these, 22 were reported for a reporting rate of 52.4 percent. The other 20 vehicles were not reported. Inspection of crash severity status shows that all 42 vehicles qualified for reporting to the MCMIS Crash file due to

the towed and disabled criteria. The 42 vehicles are the same as those shown in Table 9 in which crash month is unknown.

Table 14 Reporting Rates by Reportable Status, Virginia 2009

Virginia reportable	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Yes	3,832	75.5	939	97.9
No	42	52.4	20	2.1
Total	3,874	75.2	959	100.0

5.6 Fire Occurrence

State evaluations typically include a short section showing reporting rates in relation to the occurrence of a vehicle fire. Fire occurrence is captured at the vehicle level on the Virginia Police Crash Report form. There were 7 reportable trucks with fire coded, and no buses. Six of the seven trucks were reported, for a reporting rate of 85.7 percent.

Table 15 Reporting of Crash Involvements with Fire Occurrence, Virginia 2009

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck	7	85.7	1	100.0
Bus	0	NA	0	0.0
Total	7	85.7	1	100.0

6. Data Quality of Reported Cases

In this section, we consider the quality of data reported to the MCMIS Crash file. Two aspects of data quality are examined. The first is the amount of missing data. Missing data rates affect the usefulness of a data file because records with missing data cannot contribute to an analysis. The second aspect of data quality considered here is the consistency of coding between records as they appear in the Virginia Crash file and in the MCMIS Crash file. Inconsistencies may indicate problems in translating information recorded on the crash report to the values in the MCMIS Crash file. All 3,637 matched cases reported to the MCMIS crash file from Virginia for 2009 are used, since the purpose of the analysis is to examine the quality of the data as reported.

Table 16 shows missing data rates for selected, important variables in the MCMIS Crash file. Missing data rates are generally low, with a handful of exceptions. On most fundamental, structural variables, such as date, time, number of fatalities and number of injuries, missing data rates are either zero or extremely low. For some of the driver-related variables data are missing for about 3 percent of the cases. Three of the four event variables are missing large percentages of data, though this is not necessarily an indication of a problem, since most crashes consist of a single impact. The only variable with a significantly high rate of missing data is road access, where the information is not present for 99.9 percent of the cases.

Table 16 Missing Data Rates for Selected MCMIS Crash File Variables, Virginia 2009

Variable	Percent unrecorded	Variable	Percent unrecorded
Report number	0.0	Fatal injuries	0.0
Accident year	0.0	Non-fatal injuries	0.0
Accident month	0.0	Interstate	0.0
Accident day	0.0	Light	0.0
Accident hour	0.0	Event one	0.7
Accident minute	0.0	Event two	40.7
County	0.0	Event three	50.7
Body type	0.1	Event four	62.2
Configuration	0.0	Number of vehicles	0.0
GVWR class	0.0	Road access	99.9
DOT number *	0.3	Road surface	0.0
Carrier state	0.0	Road trafficway	0.1
Citation issued	0.2	Towaway	0.0
Driver date of birth	3.1	Truck or bus	0.0
Driver license number	3.0	Vehicle license number	0.0
Driver license state	3.1	Vehicle license state	0.0
Driver license class	3.3	VIN	0.1
Driver license valid	0.2	Weather	0.0

* Based on cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	8.1
Percentages of hazmat placarded vehicles only:	
Hazardous cargo release	0.9
Hazardous materials class (1-digit)	0.0
Hazardous materials class (4-digit)	0.0
Hazardous materials name	0.0

The second section of the table shows missing data rates for the hazardous materials (hazmat) variables. Whether the vehicle displayed a hazmat placard was unrecorded for 8.1 percent of the vehicles. The other missing data rates shown are limited to the 108 in Virginia where the vehicle displayed a hazmat placard, indicating it was carrying hazmat. For the cargo release variable only 0.9 percent is unrecorded, and for the other variables, none of the data are missing.

Selected variables in the MCMIS Crash file were also compared to variables in the Virginia Crash file. The purpose of this comparison is to identify any errors in translating variables from the values in the state crash file to the values required for Safetynet. Virginia has adopted in many instances the same code levels for certain variables that are used in the MCMIS Crash file.

Table 17 shows a comparison between the light condition variable in the MCMIS Crash file and the Virginia PAR file for the 3,637 vehicles that were matched in the two files. Obvious inconsistencies between the variables are shaded. Agreement is generally very good since the total percentage of disagreement is about 1.5 percent.

Table 17 Comparison of Light Condition in MCMIS and Virginia Crash Files, 2009

Light condition			
MCMIS Crash file	Virginia Crash file	Cases	Percent
Daylight	Unknown	40	1.1
	Daylight	2,523	69.4
	Darkness Rd not lit	1	<0.1
Dark not lighted	Unknown	8	0.2
	Daylight	1	<0.1
	Darkness Rd not lit	643	17.7
Dark lighted	Unknown	4	0.1
	Darkness Rd lit	223	6.1
Dark Unk lighting	Darkness Unk Rd Ltg	5	0.1
Dawn	Unknown	1	<0.1
	Dawn	134	3.7
Dusk	Daylight	1	<0.1
	Dusk	52	1.4
Other	Unknown	1	0.0
Total		3,637	100.0

Another variable that is recorded in both the MCMIS and Virginia Crash files is the road surface condition. Table 18 shows a comparison of this variable between the two files. Agreement for this variable is also very good with the total disagreement estimated at 1.5 percent.

Table 18 Comparison of Road Surface Condition in MCMIS and Virginia Crash Files, 2009

Road surface condition			
MCMIS Crash file	Virginia Crash file	Cases	Percent
Dry	Unknown	39	1.1
	Dry	2,685	73.8
Wet	Unknown	11	0.3
	Dry	1	0.0
	Wet	696	19.1
Water	Water	7	0.2
Snow	Unknown	3	0.1
	Snowy	87	2.4
Slush	Slush	14	0.4
Ice	Icy	84	2.3
Sand,mud,dirt,oil	Oil/other fluids	4	0.1
	Sand,dirt,gravel	3	0.1
Other	Other	3	0.1
Total		3,637	100.0

Although not shown, the MCMIS vehicle configuration variable and the Virginia Commercial Motor Vehicle (CMV) configuration variable agree very closely for the same 3,637 vehicles. The Virginia CMV configuration variable is the one coded based on the CMV section of the police crash report, not the vehicle body type variable that appears on the main part of the form. Therefore, the coded vehicle types for the two variables are very similar. It appears that the data coded in the CMV section of the crash report plays a major role in determining what information gets uploaded to the MCMIS Crash file.

7. Summary and Discussion

This report is an evaluation of reporting to the MCMIS Crash file by the state of Virginia in 2009. Records were matched between the Virginia PAR file and the MCMIS Crash file using variables common to both files with low percentages of missing data. There were 223,050 unique PAR records available for matching with 3,673 unique records in the MCMIS Crash file. No duplicate records were found in either of the files. In total, 3,637, or 99.0 percent of the MCMIS records were matched (Figure 1).

The next step in the evaluation process focused on identifying reportable vehicles using the Virginia PAR file according to the MCMIS vehicle and crash severity criteria. Overall, 8,134 vehicles were identified as qualifying trucks, buses, or vehicles displaying a hazardous materials placard (Table 4). The method used to identify qualifying vehicles was based on a combination of five variables shown in the order listed below:

1. Vehicle Identification Number (VIN)
2. Vehicle Body Type
3. Vehicle Make and Vehicle Model
4. Commercial Use
5. Hazmat Placard

The VIN was used as the primary variable to identify whether a vehicle was a qualifying truck or bus because it is the most objective source of vehicle type information. The vehicle body type variable as recorded on the Virginia PAR form was used to supplement the VIN. The vehicle make and vehicle model variables were used when the VIN indicated that a vehicle had GVWR less than 10,000 pounds, but the vehicle body type variable indicated that it was a medium/heavy truck. In that case, the vehicle make and model variables were used to confirm that the vehicle was a heavy truck. The commercial use variable was used to confirm that medium/heavy pickups or large vans were used for commercial purposes. The algorithm used for identifying qualifying vehicles was employed in a way that attempted to take advantage of the strengths of each variable. A full discussion of the method used to identify qualifying vehicles is given in Section 4.1 and Appendix B. Appendix C shows a comparison of methods for identifying qualifying vehicles using the VIN alone, the vehicle body type as recorded on the PAR alone, and the method based on five variables described in this study.

Examination of the Police Officer's Instruction Manual for Completing the Police Crash Report indicates that officers are instructed to classify tractors with trailers as single unit trucks with three or more axles. This explains why there is no code on the main crash report form for tractors

with trailers. In the Commercial Motor Vehicle (CMV) Section of the form there is a CMV configuration variable that has codes for identifying the various truck and bus configurations similar to those recorded in the MCMIS file. To a large extent, it appears that this section is used by Virginia for reporting to MCMIS. However, if the present evaluation of state reporting were limited only to records in the CMV section where those data elements had been filled out, it would obviously miss cases that had been overlooked by the state selection process. Accordingly, the method of identifying reportable cases used in this report attempts to be independent, and relies on variables recorded on the main part of the form that describe vehicles and crash severity to determine if they meet the MCMIS Crash file reporting criteria.

After identifying qualifying vehicles, it is necessary to determine which of these vehicles meet the crash severity criteria for reporting to MCMIS. Virginia classifies injury using a method similar to the common KABCN scale, where injuries are classified as Fatal (K), Incapacitating (A), Non-incapacitating, but evident (B), Possible (C), and No injury. Determining whether an injured person was transported for immediate medical attention is also recorded in the Virginia Crash file. There is an EMS Transport variable indicating whether an injured person was transported to a care facility. A crash was thus determined to meet the MCMIS injury severity criteria if crash severity was Fatal, or if crash severity was A, B, or C injury, and EMS Transport was 'yes'. This is likely a conservative estimate in the sense that the recorded data must explicitly indicate that a vehicle was in a crash involving an injury, and at least one person in the crash was transported to a medical care facility.

The last MCMIS criterion specifies "vehicles towed due to disabling damage." The definition of the disabled variable coded in the Virginia PAR data matches the MCMIS criterion very closely and is stated below.

> Shade the oval **"Disabled"** if the vehicle was disabled as a result of the crash and transported away from the scene by a tow truck or other vehicle. Disabled means the vehicle could not be driven from the scene.[42, p.12]

Any qualifying vehicle involved in a crash satisfying the above definition was considered towed and disabled. The frequency distribution of this variable is consistent with the towed variable in the 2009 General Estimates System, [43] and with towed and disabled variables derived in other MCMIS evaluations. [20,22,27,28,39]

In total, it is estimated that 3,874 vehicles were reportable to the MCMIS Crash file. Of these, 88 were involved in fatal crashes and 1,791, or about 46.2 percent, were involved in crashes where at least one person was injured and transported for medical treatment. Based on the disabled variable, it is estimated that 1,995 or about 51.5 percent of reportable vehicles were involved in crashes where at least one vehicle was towed due to disabling damage.

Of the 3,874 reportable vehicles in 2009, Virginia reported 2,915, for an overall reporting rate of 75.2 percent. An additional 722 vehicles were reported, but did not meet the vehicle and crash severity criteria for reporting, and should not have been reported. These overreported vehicles are largely qualifying trucks that did not meet the crash severity criteria (Table 7).

Specific variables were examined to identify sources of underreporting. Reporting rates were calculated and presented in four groups. The four groups are case processing, reporting criteria,

non-reportable vehicles, and fire/explosion. Case processing considers timing issues, reporting criteria deals with vehicle and crash severity issues, non-reportable vehicles briefly discusses the inclusion of vehicles in this study not meeting a property damage dollar amount threshold, and fire/explosion considers fire or explosions in reportable vehicles.

With respect to timing issues related to reporting, reporting rates were fairly consistent over the twelve months in 2009. The highest rate was 82.6 percent in March and the lowest rate was 69.8 percent in August. For the remaining months, the reporting rates were fairly close to the overall reporting rate of 75.2 percent. On a monthly basis, Virginia appears to upload cases well within the 90-day grace period, except for July in which cases are uploaded close to the end of the grace period. Overall, approximately 80 percent of cases are uploaded within the 90-day grace period (Figure 3).

Overall, the reporting rate for trucks is 76.1 percent which is close to the overall rate since trucks represent the majority of reportable vehicles. The reporting rate for buses is 67.4 percent. Results for trucks by vehicle body style are not presented in this report since the VIN was used as the primary variable to identify qualifying vehicles. In addition, tractors with trailers are coded as single unit trucks with three axles, making it difficult to determine how many of the qualifying vehicles are single unit trucks or tractor trailer combinations.

With respect to crash severity, the reporting rate for fatal crashes is 84.1 percent. The rate declines to 77.3 percent for injured and transported crashes, and 73.0 percent for towed and disabled crashes. Based on the KABCN scale, rates also decline slightly as severity declines. For A-injuries and B-injuries the reporting rates are 80.5 percent and 77.0 percent, respectively, while the rate for C-injuries is 73.5 percent.

The Virginia PAR data includes a variable that defines ‘non-reportable’ vehicles. These are vehicles involved in crashes not meeting a severity threshold in terms of a property damage dollar amount. The definition of a non-reportable vehicle in this sense is not related to the definition of a vehicle reportable to the MCMIS Crash file used in this report. In the Virginia PAR file, there are 10,765 non-reportable vehicles. Because some vehicles flagged as non-reportable were uploaded to the MCMIS Crash file, we did not delete them from this analysis. Overall, 42 vehicles flagged as ‘non-reportable’ were identified as reportable to the MCMIS Crash file. Of these, 22 were reported and 20 were not.

Missing data rates in the MCMIS Crash file were also examined for key variables. Except for the road access variable, percentages of missing data are less than 5 percent. Three of the subsequent event variables are missing high percentages of data, but this is most likely not a problem since often the first event is all that is recorded. Selected variables that are recorded in both the Virginia PAR file and MCMIS Crash file, such as light condition and road surface condition, were also compared and tended to show general good agreement between the two files.

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Appendix A Virginia Traffic Accident Reports

Revised Report

Commonwealth of Virginia • Department of Motor Vehicles
Police Crash Report

0 7 0 7 A

FR300P (Rev 7/07)

Page ______ of ______

CRASH

GPS Lat. | GPS Long.

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

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

(The right half of the form repeats the VEHICLE #, DRIVER, VEHICLE and PASSENGER sections for a second vehicle.)

Sample

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

Officer Initials_____ Badge #_____

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

0 7 0 7 B

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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

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)

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

Officer Initials_____ Badge # _____

Commonwealth of Virginia • Department of Motor Vehicles

Police Crash Report

0 7 0 7 C

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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

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

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

CRASH DIAGRAM

VEHICLE #

Fill In Impact Area(s).
Initial Impact.

12, 11, 1, 10, 2, 9, 13, 3, 8, 4, 7, 5, 6

Veh Dir of Travel–N/S/E/W

VEHICLE #

Fill In Impact Area(s).
Initial Impact.

12, 11, 1, 10, 2, 9, 13, 3, 8, 4, 7, 5, 6

Veh Dir of Travel–N/S/E/W

VEHICLE #

Fill In Impact Area(s).
Initial Impact.

12, 11, 1, 10, 2, 9, 13, 3, 8, 4, 7, 5, 6

Veh Dir of Travel–N/S/E/W

VEHICLE #

Fill In Impact Area(s).
Initial Impact.

12, 11, 1, 10, 2, 9, 13, 3, 8, 4, 7, 5, 6

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 # _____

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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
◯ 0–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 (Y) (N)	HM Cargo Released (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

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◯ 13. Intermodel Container Chassis
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License Class P8

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

Commercial Endorsement P9

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◯ P–Passenger Vehicle
◯ N–Tank Vehicle
◯ H–Required To Be Placarded for Hazardous Materials
◯ X–Combined Tank/HAZMAT
◯ 0–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 (Y) (N)	HM Cargo Released (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
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◯ 3. Not in Commerce-Government (Trucks and Buses)
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Officer Initials________ Badge #_________

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

PEDESTRIAN

Name of Injured (Last, First, Middle)

Address (Street and Number)

City | State | ZIP

Driver's License # | State

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

Ped # Ped #

Pedestrian Actions P10

N/A N/A

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

N/A N/A

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

N/A N/A

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

N/A N/A

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

Pedestrian Drug Use P14

N/A N/A

1. Yes
2. No
3. Unknown

Pedestrian Wear Reflective Clothing P15

N/A N/A

1. Yes
2. No

Use sections below for additional passengers.

VEHICLE

PASSENGER *(only if injured or killed)*

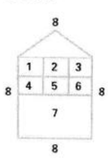
Name of Injured (Last, First, Middle)					EMS Transport	Date of Death
					Ⓨ Ⓝ	MM DD YY
Position In/On Vehicle	**Safety Equip Used**	**Airbag**	**Ejected**	**Injury Type**	**Birthdate**	**Gender**
					MM DD YYYY	Ⓜ Ⓕ
Name of Injured (Last, First, Middle)					**EMS Transport**	**Date of Death**
					Ⓨ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

VEHICLE

PASSENGER *(only if injured or killed)*

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

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.

Appendix B Algorithm for Selecting Qualifying Vehicles Using the Virginia 2009 PAR Data

The following table shows the method used for identifying trucks and buses that satisfy the vehicle criteria outlined in Table 2. For example, if the VIN indicates that a vehicle is a single unit truck (SUT) and the vehicle body type is not a bus, the vehicle is classified as a qualifying truck. Any vehicle coded as a motor home or emergency vehicle by either the VIN or the vehicle body type variable was excluded from consideration as a qualifying vehicle. The commercial use variable was used to confirm that pickups or vans were used for commercial use.

The vehicle make and vehicle model variables were used when the VIN indicated that a vehicle had GVWR less than 10,000 pounds, but the vehicle body type variable indicated that it was a medium/heavy truck. In that case, the vehicle make and model variables were used to confirm that the vehicle was a heavy truck. As shown by the bottom row of the table, the vehicle make and model were also used when other variables were inconclusive regarding a vehicle's status, but the make and model identified a vehicle as a known truck or bus (eg, Kenworth, Peterbilt, Mack, International, and so on).

VIN	Vehicle Body Type	Vehicle Make and Model	Commercial Use	Classification
SUT	not bus			Truck
GVWR<10,000 lbs	SUT 3+ axles	Heavy Truck		Truck
Medium/ Heavy Pickup >10,000 lbs			Yes	Truck
Step, Walk-in Van	not bus			Truck
Truck Tractor with / without Trailers				Truck
Unknown or Trailer	Truck Tractor/ Bobtail			Truck
Bus				Bus
SUT, Large Van, Unknown	Bus			Bus
Large Van			Yes	Truck
GVWR<10,000 lbs	Truck Tractor/ Bobtail	Heavy Truck		Truck
		Heavy Truck or Bus		Truck or Bus

Appendix C Comparison of VIN-Decoded, PAR Vehicle Type, and Commercial Vehicle Type Identification of MCMIS Qualifying Vehicles

To identify qualifying vehicles, this report uses five variables in combination as described in Section 4.1 and Appendix B. Two of the primary variables are the VIN-decoded vehicle type and the vehicle body type as recorded on the Virginia Police Crash Report Form. A cross-classification of these two variables appears below. As shown by entries on the main diagonal, the variables tend to agree; however, there are considerable differences, as shown by the shaded cells in the table.

The vehicle body type variable classifies more vehicles as trucks and buses than does the VIN decoded variable. The biggest difference is that there are 3,221 vehicles classified as trucks by the vehicle body type variable that are not identified by the VIN decoded variable. In addition, there are 1,208 vehicles classified as trucks by the VIN decoded variable that are not identified by the vehicle body type variable. Furthermore, there are 596 vehicles classified as buses by the vehicle body type variable that are not identified by VIN decoding.

		Vehicle Body Type Recorded on PAR				
		Truck	Bus	Hazmat	Other	Total
VIN Decoded Vehicle Type	Truck	4,476	58	2	1,208	5,744
	Bus	52	660	0	127	839
	Hazmat	29	0	13	0	42
	Other	3,221	596	0	212,608	216,425
	Total	7,778	1,314	15	213,943	223,050

The table below summarizes information about identified vehicles by showing total qualifying vehicles using the VIN-decoded vehicle type variable, the vehicle body type variable as recorded on the Virginia Police Crash Report Form (PAR), and the methodology used in this report (Study) based on a combination of five variables. The total number of identified vehicles using the method in this report is intermediate between the VIN-decoded method and the PAR method. After extensive evaluation of the three methods, the Study method is most accurate since it relies on the VIN method when the VIN is believed to be accurate, the PAR method when the vehicle body type variable is most reliable, and in addition, the make and model of the vehicle when there is doubt concerning the VIN or the PAR methods.

	VIN	PAR	Study
Truck	5,744	7,778	7,090
Bus	839	1,314	1,031
Hazmat	42	15	13
Total	6,625	9,107	8,134

As a further check on any differences due to the definition of qualifying vehicles, the injured/transported and towed/disabled criteria were applied in order to arrive at reporting rates based on the three methods. The following table shows number of vehicles reportable to the MCMIS Crash file. We claim that the VIN method produces a number that is too small, the PAR method produces a number that is too large, and the Study method, which is intermediate, reflects the most accurate number of reportable vehicles to the MCMIS Crash file. Note that Figure 1 in the main body of this report shows that 3,637 vehicles reported to the MCMIS Crash file were matched to the Virginia PAR file. Estimates of underreporting and overreporting are discussed in this report.

Crash type	VIN	PAR	Study
Fatal	72	87	88
Injury transported for treatment	1,545	1,944	1,791
Vehicle towed due to damage	1,714	2,225	1,995
Total	3,331	4,256	3,874

Finally, the table below shows reporting rates calculated according to the three methods. There is about a 9 percent difference between the Study method and the PAR method. The Study method produces a rate of 75.2 percent, the highest of the three.

Reporting	VIN	PAR	Study
Reported	2,365	2,834	2,915
Reportable	3,331	4,256	3,874
Rate	71.0	66.6	75.2