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EVALUATION OF 2005 MISSOURI CRASH DATA REPORTED TO MCMIS CRASH FILE

DANIEL BLOWER
ANNE MATTESON

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Daniel Blower
Anne Matteson

The University of Michigan
Transportation Research Institute
Ann Arbor, MI 48109-2150
U.S.A.

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16. Abstract

This report is part of a series of reports 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. The earlier studies showed that reporting to the MCMIS Crash File was incomplete. This report examines the factors that are associated with reporting rates for the state of Missouri.

MCMIS Crash File records were matched to the Missouri Police Accident Report (PAR) file to determine the nature and extent of underreporting. Overall, it appears that Missouri is reporting 83.3 percent of crash involvements that should be reported to the Crash file.

Reporting rates vary by crash severity and vehicle type. Overall, about 94.6 percent of fatal involvements are reported, compared with 84.9 percent of injury, transported involvements, and 81.8 percent of towaway. Crashes involving large trucks such as tractor-semitrailers or doubles combinations were more likely to be reported than crashes involving single-unit trucks or buses. Crashes covered by the Missouri State Patrol were more likely to be reported than those covered by either county sheriffs or local police departments.

Missing data rates are low for most variables, although rates are elevated for body type, driver condition, roadway access, and roadway surface condition. Hazardous materials variables are also problematic. Inconsistencies for non-missing values between the two files may be explained by corrections applied in one file but not the other.

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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 selection criteria and crash severity threshold. FMCSA maintains the MCMIS file to support its mission to reduce crashes, injuries, and fatalities involving large trucks and buses. It is essential to assess the magnitude and characteristics of motor carrier crashes 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 a specific severity threshold.

The present report is part of a series of reports evaluating the completeness and accuracy of the data in the MCMIS Crash file. Previous reports on a number of states showed underreporting due in large part to problems police officers experience in interpreting and applying the reporting criteria. The problems were more severe in large jurisdictions and police departments. Each state also had problems specific to the nature of its system. Some states also had overreporting of cases, often due to technical problems with duplicate records. [See references 4 to 13] The states are responsible for identifying and reporting qualifying crash involvements. Accordingly, improved completeness and accuracy must ultimately reside with the individual states.

In this report, we focus on MCMIS Crash file reporting by the State of Missouri. In recent years, Missouri has reported from 4,300 to 5,900 involvements annually to the MCMIS Crash file. According to the 2002 Vehicle Inventory and Use Survey, in 2002, Missouri had almost 168,000 trucks registered, ranking 10th among the states and accounting for 3.1 percent of all truck registrations.[1] Missouri is the 18th largest state by population and generally falls ninth in terms of the number of annual truck and bus fatal involvements.

The method employed in this study is similar to previous studies.

1. The complete police accident report file (PAR file hereafter) from Missouri was obtained for the most recent year available, 2005. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the Missouri 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 Missouri.

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

4. Ineligible cases that were uploaded to the MCMIS file were examined to identify the extent and nature of overreporting.

Police accident report (PAR) data recorded in Missouri's statewide files as of May 24, 2006 were used in this analysis. The 2005 PAR file contains the computerized records of 321,124 vehicles involved in 175,120 crashes that occurred in Missouri.

2. Data Preparation

The Missouri PAR file and MCMIS Crash file each required some preparation before the Missouri records in the MCMIS Crash file could be matched to the Missouri PAR file. In the case of the MCMIS Crash file, the only processing necessary was to extract records reported from Missouri and to eliminate duplicate records. The Missouri PAR file required more extensive work to create a comprehensive vehicle-level file. The following sections describe the methods used to prepare each file and some of the problems uncovered.

2.1 MCMIS Crash Data File

The 2005 MCMIS Crash file as of August 21, 2006, was used to identify records submitted from Missouri. For calendar year 2005 there were 5,190 cases. An analysis file was constructed using all variables in the file.

The file was then examined for duplicate records (those involvements where more than one record was submitted for the same vehicle in the same crash; i.e., the report number and sequence number were identical). Only one pair of records was identified that appeared to be duplicates. However, upon further examination, most of the accident, vehicle, driver and carrier variables differed between the two. Thus, these cases were determined not to be duplicate records. In addition, records were examined for identical values for accident date, time, crash county, officer badge number, vehicle identification number, and driver date of birth, even though their case numbers were perhaps different. One would not expect all of these variables to be identical between two cases. Two such duplicate instances were found.

Further examination of the first pair revealed that all data except carrier-specific variables were the same. The second record's transaction_code had a value of "change," so it appears the second record was meant to be an update. In this case the first record was excluded. In the second pair all variables appeared to match between both members of the pair, except for number of injuries and processing dates. The member of the pair that appeared on the PAR file was kept, and the other member was excluded. After eliminating the two duplicate records identified above, the resulting MCMIS file contained 5,188 records.

2.2 Missouri Police Accident Report File

The Missouri PAR data for 2005 (dated May 24, 2006) was obtained from the state of Missouri. The data were contained in four text files, representing accident, vehicle, person, and VIN-specific information. The combined files contain records for 175,120 crashes involving 321,124 vehicles. Data for the PAR file are coded from the Missouri Uniform Accident Report completed by police officers.

The PAR file was first examined for duplicate records. A search for records with identical case numbers and vehicle numbers found no such instances. 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, case numbers (such as 50148417 and 5-148417, for example). Cases were also examined to determine if there were any records that contained identical time, place and vehicle/driver variables, even though their case numbers were perhaps different. Two cases would not be expected to be identical on all variables. To investigate this possibility, records were examined for duplicate occurrences based on the variables accident date, time, county, reporting officer's badge number, vehicle identification number (12-digit VIN), driver age and vehicle make. A total of 212 duplicate instances were found, representing 105 unique occurrences of the examined variables.

Duplicate pairs (or triplicates in some cases) were examined more closely for any patterns that might explain why they were occurring. These records were grouped into two categories: those where Accident Number differed, and those where Accident Number were identical. In the first group, where crash time, location, vehicle, and driver variables were the same, but Accident Number differed, one possible explanation is that a vehicle was involved in two accidents at the same place and virtually at the same time. Once crash events are stabilized, subsequent crashes are reported as new crashes. According to the PAR Manual, "Any subsequent contact after the situation stabilizes constitutes a separate accident." [p. 7] If a vehicle is reported as being in a second crash after the first one has stabilized, one would expect accident date, location, driver and vehicle information to be identical, but accident time to vary by a couple of minutes or longer. However, in the case of these records, accident hour and minute were identical, suggesting they are in fact duplicate records. Further examination of the records indicated that one record was meant to be an update, since a few of the variables differed between the two cases.

The second group of cases were identical on crash time, location, vehicle and driver variables, and also had identical Accident Numbers. In most instances vehicle number differed, suggesting the possibility that these could be two different vehicles in the same accident. However, with VIN recorded and identical among the two records, this is unlikely. In addition, in the majority of cases where driver age was recorded, it was also identical between the two records. These cases were also designated as duplicate records.

Thus, the pairs identified above were considered to be duplicates and one (or more) member(s) of each pair was excluded. Since there was no variable indicating a date the record was updated or processed, the second member of each pair was excluded, resulting in deletion of 107 records. The resulting PAR file has 321,017 records.

3. Matching Process

The next step involved matching records from the Missouri PAR file to corresponding records from the MCMIS file. After removing duplicates, there were 5,188 Missouri records from the MCMIS file available for matching, and 321,017 records from the Missouri PAR file. All records from the Missouri PAR data file were used in the match, even those that were not reportable to the MCMIS Crash file. This allows the identification of cases in the MCMIS Crash file that should not have been reported.

Matching records in the two files requires finding combinations of variables common to the two files that have a high probability of uniquely identifying accidents as well as specific vehicles

within an accident. Accident Number, which uniquely identifies a crash in the Missouri PAR data, and Report Number in the MCMIS Crash file, are obvious first choices. However, there appeared to be no correspondence between the two numbers. There was also no correspondence between the MCMIS-assigned Vehicle Crash ID variable and the PAR Accident Number. Other variables that were available for matching at the accident level included Crash Date, Crash Time (hour/minute), Crash County, and Reporting Officer Number. A variable designating "city" could not be used, as the PAR file contained a 4-digit Municipality code, but City Code on the MCMIS file was unrecorded for all cases.

Variables in the MCMIS file that could distinguish one vehicle from another within the same accident included Vehicle Sequence Number, Vehicle License Plate Number, Driver License Number, Vehicle Identification Number (VIN), and Driver Date of Birth. Vehicle License Plate Number and Driver License Number were not available on the PAR file. A 12-digit VIN is available in the PAR data (unrecorded in 7.2% of cases); VIN was unrecorded in 2.8% of MCMIS cases. Driver Age in the MCMIS file (derived from accident date and driver date of birth) was unrecorded 5.6% of the time, and Driver Age was unrecorded 13.4% of the time in the PAR file. Of the available variables identifying vehicles within the accident, Vehicle Sequence Number was the most reliable, as it was always recorded in both files.

Four separate matches were performed using the available variables. In each match step, records in either file with duplicate values on all the match variables were excluded, along with records that were missing values on the match variables. The first match included the variables vehicle sequence number, crash month, day, hour, minute, crash county, officer number, VIN, and driver age. The second match step dropped driver age. The third match step matched on vehicle sequence number, crash month, day, hour, minute, crash county, officer number, and driver age (eliminating VIN). After reviewing the remaining non-matched cases, the fourth match used vehicle sequence number, crash month, day, hour, minute, crash county, and officer number (eliminating VIN and driver age). This process resulted in matching 99.8% of the MCMIS records to the PAR file.

See Table 1 for the variables used in each match step along with the number of records matched at each step.

Table 1 Steps in MCMIS/Missouri PAR File Match, 2005

Match step	Matching variables	Cases matched
Match 1	vehicle sequence number, crash month, day, hour, minute, crash county, officer number, VIN, driver age	4,795
Match 2	vehicle sequence number, crash month, day, hour, minute, crash county, officer number, VIN	151
Match 3	vehicle sequence number, crash month, day, hour, minute, crash county, officer number, driver age.	95
Match 4	vehicle sequence number, crash month, day, hour, minute, crash county, officer number	135
Total cases matched		5,176

Matched records were verified using other variables common to the MCMIS and PAR file as a final check to ensure the match was valid. The above procedure resulted in 5,176 matches, representing 99.8% of the 5,188 non-duplicate records reported to MCMIS. Figure 1 shows the flow of cases in the matching process.

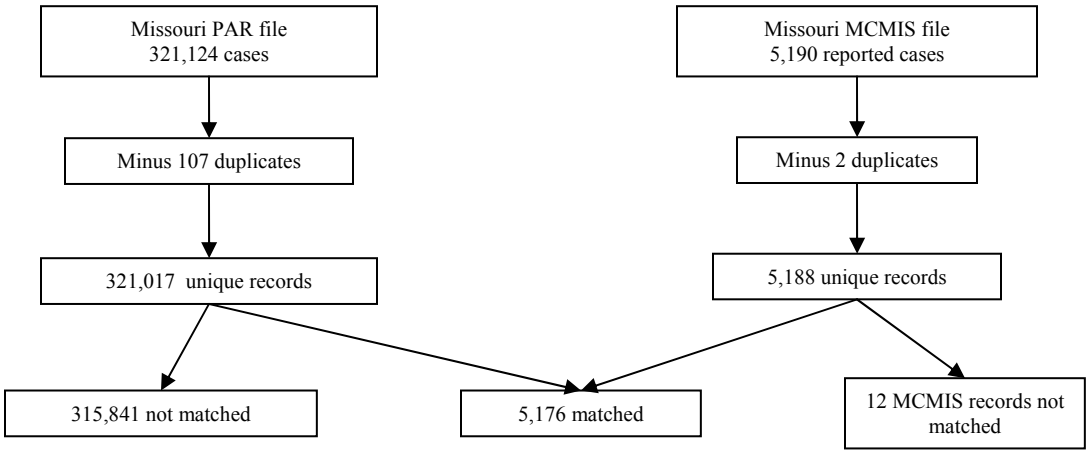


Figure 1 Case Flow in MCMIS/Missouri Crash File Match

Of the 5,176 matched cases, 68 are not reportable and 5,108 are reportable. The next section discusses the process of identifying cases that qualify for reporting to the MCMIS Crash file.

4. Identifying Reportable Cases

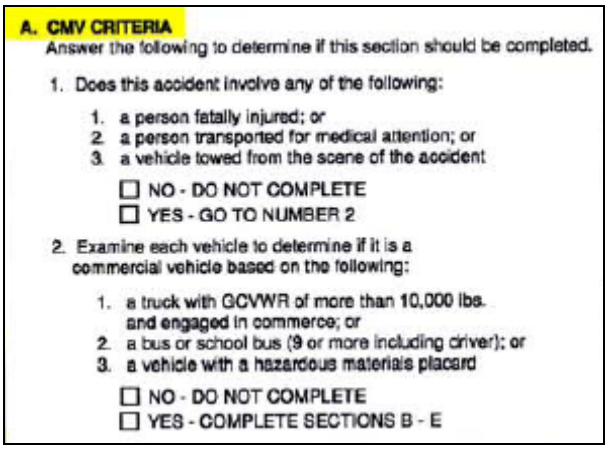
To evaluate the completeness of reporting to the crash file, it is necessary to identify records in the Missouri PAR file that qualified for reporting to the MCMIS Crash file. Reportable cases are identified using the variables available in the Missouri PAR file. The purpose of this process is to approximate as closely as possible the reporting threshold of the MCMIS file. The MCMIS criteria for a reportable crash involving a qualifying vehicle are shown in Table 2.

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.

The process of identifying reportable records, as set out in Table 2 above, is fairly straightforward in the Missouri PAR file, because Missouri crash data includes most of the variables and levels needed to identify reportable cases. In some cases, the information is not directly available, but reasonable substitutes can be developed and applied.

Missouri uses a set of questions in a box on the police accident report form to help the reporting officer identify reportable crash involvements and then to collect some of the data elements that are required. All the data elements that are required for the MCMIS Crash file are contained on the Missouri Uniform Accident Report form, either in the commercial motor vehicle box or elsewhere on the form. Missouri does not use a separate, supplemental form for the MCMIS Crash file data.


A. CMV CRITERIA
Answer the following to determine if this section should be completed.

1. Does this accident involve any of the following:
   1. a person fatally injured; or
   2. a person transported for medical attention; or
   3. a vehicle towed from the scene of the accident
   - ☐ NO - DO NOT COMPLETE
   - ☐ YES - GO TO NUMBER 2
2. Examine each vehicle to determine if it is a commercial vehicle based on the following:
   1. a truck with GCVWR of more than 10,000 lbs. and engaged in commerce; or
   2. a bus or school bus (9 or more including driver); or
   3. a vehicle with a hazardous materials placard
   - ☐ NO - DO NOT COMPLETE
   - ☐ YES - COMPLETE SECTIONS B - E

Figure 2 CMV Criteria from Missouri Uniform Accident Report

Figure 1 shows the two-part test applied by officers to determine if they need to complete the commercial vehicle section. The test is sufficiently accurate to identify reportable crash involvements. Note that the towaway criteria does not specify *disabling* damage, just that a vehicle was towed. Also, the criteria for a truck includes the phrase "engaged in commerce," and combines the two parts of the MCMIS criteria (truck with a GVWR over 10,000 pounds or a truck/trailer combination with a GCWR over 10,000 pounds) into "a truck with a GCVWR of more than 10,000 lbs." These variations should not materially affect an officer's ability to correctly identify reportable cases.

Reportable vehicles can be identified using the "vehicle body type" variable and two variables that indicate if a vehicle was transporting hazardous materials. The vehicle classification system used by Missouri includes codes that correspond almost exactly with the vehicle configuration variable in the MCMIS Crash file. (See Table 3.) MCMIS also has a category for truck/trailers (straight trucks pulling a trailer) which is not on the Missouri list, but the Missouri crash report includes a check box to record if a single-unit truck was pulling a trailer. Using this check box in combination with the vehicle body type codes allows all the truck and bus configurations in MCMIS to be identified precisely.

Table 3 Relevant Vehicle Body Type Codes on Missouri Uniform Accident Report

Small bus (9-15 with driver)
Bus (16 or more with driver)
School bus (less than 16 with driver)
School bus (16 or more with driver)
Single-unit Truck: 2 axles, 6 tires
Single-unit Truck: 3 or more axles
Truck Tractor With No Units
Truck Tractor With One Unit
Truck Tractor With Two Units
Truck Tractor With Three Units
Other Heavy Truck

Two variables record the presence of hazardous materials (hazmat), permitting light vehicles with hazardous materials to be identified. One of the variables records the type of material involved (gas, solid, liquid, or explosive) and the other indicates if a hazmat placard was displayed. The hazmat variables are found on the police report in the Commercial Motor Vehicle section, which has the instruction to only complete if the case qualifies for reporting, but in the computerized crash file supplied for this analysis, there was no missing data for either variable, indicating either that officers completed the variables for all cases or that missing data was padded with the

codes for “none” or “no placard.” In either case, the hazmat variables can be used to identify light vehicles that are reportable because they were transporting hazmat.

In fact, it was necessary to use both hazmat variables because there were some possible inconsistencies between them. Among the 321,124 vehicle records in the Missouri Crash file, there were three cases in which a vehicle was recorded as displaying a placard, but the variable that records the type of hazmat was coded as “none present.” And there were ten cases recorded as carrying one of the four types of hazardous material, but the hazmat placard variable was set to “no placard.” It is certainly possible that these cases are not inconsistent, and that in the first instance the placard was displayed in error and in the second instance the vehicle was operating illegally by not displaying a hazmat placard. In any case, both variables were used because the MCMIS Crash file instructions are to report all cases in which hazmat is transported, even if no placard is displayed, if involved in a crash of qualifying severity.

Accordingly, reportable vehicles were identified as all those assigned one of the body type codes tabulated in Table 3 and any other vehicle either displaying a placard or coded as carrying hazmat.

Having identified qualifying vehicles, the next step is to identify crashes of sufficient severity to qualify for reporting to the MCMIS Crash file. Qualifying crashes include either a fatality, an injury transported for immediate medical attention, or a vehicle towed from the scene due to disabling damage. Fatal crashes are readily identified. Whether a crash included an injured person transported for medical attention can also be determined. The accident reporting form allows the officer to record if an injured person was transported to a medical facility by an EMS service or some other means. Using this information, it is possible to identify crashes with injured persons transported to a medical facility.

Identifying non-injury crashes in which a vehicle was towed due to disabling damage presents some difficulties. Whether a vehicle was towed is recorded for each vehicle, but there is no damage severity scale and so it cannot be determined if the vehicle was towed due to disabling damage or for some other reason. Instead, all that is recorded is whether the vehicle was towed or not. Thus, it is not possible to definitively determine the number of truck- or bus-involved crashes in which at least one vehicle was towed due to disabling damage.

Using the towed-vehicle variable to identify MCMIS-reportable crashes very likely overestimates the true number of reportable crashes, because not all towed vehicles are disabled. The General Estimates System (GES) file from NHTSA can be used to assess the size of this overestimation, because GES distinguishes vehicles towed due to disabling damage from those towed for other reasons. Using GES data for 2003-2005, it was determined that the number of truck-involved crashes in which a vehicle was towed for any reason is about 12 percent higher than the number of truck-involved crashes in which a vehicle was towed due to damage. Accordingly the true number of towaway crash involvements is probably lower than can be determined using the information in the Missouri crash file. However, since the full reporting criteria cannot be applied and since it is likely that the number of cases identified using the information available is within about 90 percent of the true number anyway, we used the vehicle-towed variable to identify towaway crashes. Table 4 shows the number of truck and bus crash involvements identified as reportable to the MCMIS Crash file from Missouri in 2005.

Table 4 Reportable Records in the Missouri Crash File, 2005

Crash severity	Reportable involvements
Fatal	186
Injury, transported for treatment	2,244
Towaway	3,702
Total	6,132

Table 4 shows that 6,132 cases in the 2005 Missouri Crash file were reportable to the MCMIS Crash file and Figure 1 shows that 5,176 were actually reported, of which 68 did not qualify for reporting. Of the 5,176 reported cases, 159 were coded as pickup trucks. According to the algorithm developed to identify reportable cases, pickups are not included as a reportable vehicle. However, in recent years, an increasing number of pickups are equipped with rear axles that increase their gross vehicle weight rating (GVWR) over 10,000 pounds, which qualifies them for reporting. In order to identify the set of pickups with a GVWR over 10,000 pounds, it is necessary to examine the Vehicle Identification Number (VIN) for each vehicle.

Examining the VINs of the 159 reported pickups showed that 76 of the vehicles had GVWRs greater than 10,000 pounds. All of these 76 qualify for reporting. The truck size criteria also includes combination vehicles with a gross combination weight rating (GCWR) over 10,000 pounds. Fifteen of the pickups had a GVWR in the range of 6,001 to 10,000 pounds (class 2) and also were pulling a trailer. It is reasonable to assume that with the trailers, these vehicles qualified as reportable. The remainder of the reported pickups did not qualify either by GVWR or by GCWR.

The experience of decoding the VINs to determine the actual GVWR of the vehicles raises the possibility that other trucks with a qualifying GVWR were classified as pickups or even types such as sport utility vehicle and vans, which would not be included in the selection algorithm. Developing a complete evaluation of all the vehicles in the crash file that were not classified as trucks was not feasible for this report. But it was possible to develop an estimate of the number of vehicles that were likely qualifying trucks but classified as some other vehicle type. Of the roughly 130,000 vehicles that were coded as something other than a truck or bus, about 1,000 were determined to be likely a truck (0.77 percent) by make and decoded GVWR.[1] (Note that it was determined only that they are likely trucks, not that they were involved in a reportable crash.) About 90 percent of these 1,000 vehicles were classified as pickups, so they are not necessarily classified incorrectly, since some pickups can have a GVWR of 10,001 pounds or more. Thus, it appears that using the vehicle body type variable to identify reportable vehicles would miss some cases, although the magnitude of the problem is relatively small. Accordingly, since it was not possible to do a complete evaluation of the VIN to confirm those vehicles as qualifying, they were not included in the process of identifying reportable crash involvements.

[1] David Hetzel of NISR, Inc., helpfully processed approximately 150,000 VINs through a VIN-decoding program he is developing. Les Pettis of UMTRI decoded the VINs of the 159 reported pickups, confirming 91 as trucks. The help of both is gratefully acknowledged.

5. Factors Associated with Reporting

The procedure described in the previous section identified 6,132 crash involvements as reportable to the MCMIS Crash file. The match process described in section 3 determined that 5,188 unique cases were reported to the MCMIS Crash file, of which 5,176 could be matched to the Missouri Crash file. And of the 5,176, 5,108 were determined to meet the MCMIS Crash file reporting criteria. Accordingly, of the 6,132 reportable crashes in 2005, Missouri reported 5,108, for an overall reporting rate of 83.3 percent. In this section, we will identify and discuss the factors that affected the chance that a qualifying crash would be submitted through the SafetyNet system and appear in the MCMIS Crash file.

Three general sets of factors were found to have an effect on the reporting of reportable crash involvements. The first is a set of factors related to the crash itself, which might help or hinder the officer in recognizing that a crash should be reported. In this category is the officer recognizing that qualifying vehicles are involved or that the crash is severe enough to meet the reporting threshold. It was also found that the state of registration of the vehicle and whether a driver possessed a CDL influenced reporting. The second type of factors relates to the pure administrative logistics of processing and uploading a crash record through the SafetyNet system. And finally, we examined the effect of who covered the crash in terms of reporting agency.

Table 5 shows the overall reporting rate and the reporting rate by the severity of the crash, aggregated by the three reportable crash severities. The overall rate of 83.3 percent represents an improvement from the previous rate for 2001 of 60.9 percent.[3] The table, however, shows variations in reporting rate by crash severity. Almost 95 percent of fatal crash involvements were reported, compared with 84.9 percent of involvements with a transported injury, and 81.8 percent of towaway involvements. Clearly, more severe crash involvements are more likely to be reported than less severe, and the differences are statistically significant. Although the rate for towaways is nearly the same as for the transported injury involvements, almost two-thirds of the unreported crashes are accounted for by towaway crashes.

Table 5 Reporting Rate by Crash Severity, Missouri 2005

Crash severity	Reportable	Reporting rate	Unreported	% of total unreported
Fatal	186	94.6	10	1.0
Injury, transported for treatment	2,244	84.9	339	33.1
Towaway	3,702	81.8	675	65.9
Total	6,132	83.3	1,024	100.0

Table 6 shows the reporting rates broken down by more detailed injury severity. Missouri, like other states, uses the KABC0 injury scale. Reportable involvements were classified by the most severe injury in the crash. As in Table 6, there is a linear relationship between reporting rates and the severity of the crash, in terms of deaths and injury. The most severe crashes are the most

likely to recognized by the reporting officer as reportable. Less severe crashes are less likely to be reported.

Table 6 Reporting Rate by Detailed Injury Severity, Missouri 2005

Crash severity	Reportable	Reporting rate	Unreported	% of total unreported
Fatal	186	94.6	10	1.0
Disabling injury (A)	544	91.0	49	4.8
Evident injury (B)	1,329	85.4	194	18.9
Probable injury (C)	1,013	79.5	208	20.3
Property damage	3,060	81.6	563	55.0
Total	6,132	83.3	1,024	100.0

The reporting rate also varied significantly by the type of vehicle involved, with truck involvements in qualifying crashes significantly more likely to be reported than bus or hazmat vehicles. Table 7 shows that the reporting rate for trucks was almost 85 percent, while buses were reported at a 71.1 percent rate and vehicles transporting hazmat only 16.7 percent. It should be noted that the hazmat vehicles in this table are vehicles that are not trucks, but which are being used to transport hazardous materials. This is an unusual use and only six such vehicles were found in the Missouri crash file. Note that though trucks were reported at the highest rate, they still accounted for almost 83 percent of the unreported cases, because most reportable vehicles are trucks. The 71.1 percent reporting rate for buses is also noteworthy. Though below the overall rate of 83.3 percent, it compares very favorably with the bus reporting rate of about 52 percent for 2001.[3]

Table 7 Reporting Rate by Vehicle Type, Missouri 2005

Vehicle Type	Reportable	Reporting rate	Unreported	% of total unreported
Truck	5,534	84.7	848	82.8
Bus	592	71.1	171	16.7
Transporting Hazardous Materials	6	16.7	5	0.5
Total	6,132	83.3	1,024	100.0

Table 8 shows the variation in reporting rate by detailed classification of vehicle body type. Crash involvements of the largest trucks were reported at the highest rate. Tractor-semitrailers, doubles, and triples were all reported at rates of 95 percent or higher. Similarly, single-unit trucks (SUT) with three or more axles were reported at a rate of 91.7 percent. Clearly, officers recognize that large trucks meet the MCMIS reporting criteria. In contrast, two-axle single unit trucks are reported at a 61.2 percent rate. These vehicles meet the reporting criteria, but are not as readily recognized as reportable by the officers.

Buses were reported at a lower rate than trucks, and they also show the same differences by the size of the vehicle. Almost 90 percent of large school buses (16 or more passengers) were reported, and almost 80 percent of other large bus types. But only 69.0 percent of small buses (9-15 passenger including the driver) were reported, and no small school buses were reported. Again, reporting officers are more likely to recognize large vehicles as meeting the MCMIS reporting criteria.

Table 8 Reporting Rate by Detailed Vehicle Body Type, Missouri 2005

Vehicle body type	Reportable	Reporting rate	Unreported	% of total unreported
Passenger Car	1	0.0	1	0.1
Sport Utility Vehicle	1	0.0	1	0.1
Small bus (9-15 w/driver)	116	69.0	36	3.5
Bus (16+ w/driver)	201	79.1	42	4.1
School bus (<16 w/driver)	70	0.0	70	6.8
School bus (16+ w/driver)	205	88.8	23	2.2
Other transport device	1	0.0	1	0.1
Pickup	94	97.9	2	0.2
SUT, 2 axles, 6 tires	1,477	61.2	573	56.0
SUT, 3+ axles	630	91.7	52	5.1
Truck-tractor, no trailer	113	89.4	12	1.2
Truck-tractor w/one unit	2,906	94.8	152	14.8
Truck-tractor w/two units	115	95.7	5	0.5
Truck-tractor w/three units	5	100.0	0	0.0
Other heavy truck	197	72.6	54	5.3
Total	6,132	83.3	1,024	100.0

The high reporting rate for reportable pickups is probably anomalous. In section 4 above (identifying reportable cases), it was noted that some pickups meet the GVWR criterion, but also that this can only be determined by decoding the VIN. We decoded the VIN and determined that a number of pickups that were reported to the MCMIS Crash file met the GVWR criterion. But we were unable to fully evaluate the VINs of vehicles not reported to the file to make a final determination on all of the other vehicles that were not classified as trucks or buses. It was noted that about 1,000 vehicles, most of which were classified as pickups, probably met the GVWR criterion. A full evaluation of these vehicles might result in a lower reporting rate for pickups. The high rate reported in Table 8 is based mainly on the 159 pickups that were reported to the MCMIS file.

Whether a case is recognized as reportable may also be influenced by the state the vehicle is based in, as reflected by the vehicle license state. Reporting officers may more easily recognize an out-of-state vehicle as meeting the criteria for reporting, because some may be under the

impression that since the data are reported to the Federal government, only vehicles in interstate commerce are included. Table 9 shows reporting rates by the license state of the vehicle. If this were true, one would expect that reporting rates would be higher for vehicles with license plates from outside of Missouri that in-state vehicles. Reporting rates are relatively high for Missouri-licensed vehicles and but even higher for vehicles licensed in other states and provinces. Almost 80 percent of the reportable involvements of Missouri-licensed vehicles were reported, compared with almost 90 percent of out-of-state trucks and buses. This difference is both statistically and practically significant. However, it appears that the difference shown in Table 9 is primarily an artifact of the low rate at which two axle SUTs are reported, as will be discussed next.

Table 9 Reporting Rate by Vehicle License State, Missouri 2005

Vehicle license state	Reportable	Reporting rate	Unreported	% of total unreported
Missouri	3,406	78.5	731	71.4
Other state or province	2,726	89.3	293	28.6
Total	6,132	83.3	1,024	100.0

It was hypothesized that the different reporting rates for in-state or out-of-state might reflect different reporting rates for larger and small vehicles. If the out-of-state licensed vehicles are primarily big tractor-semitrailers and more of the in-state vehicles are medium duty trucks, then the difference by license state may just reflect the fact, as shown in Table 8, that big trucks are more likely to be reported than smaller ones. To test this possibility, we examined reporting rates by vehicle body type and license state. The results are tabulated in Table 10. They show that reporting rates for each vehicle type are very similar, whether the vehicle is licensed in Missouri or not. The rates for tractor-semitrailers, doubles and triples are virtually identical. For smaller reportable trucks, such as two axle/six tire SUTs, reporting rates for in-state licensed vehicles are actually slightly higher than out-of-state, 62.3 percent to 57.3 percent. There are wider variations for buses, but the numbers of vehicles in those categories are not large enough to materially affect overall reporting rates. But the lower overall reporting rate for in-state vehicles is driven by the fact that the number of two axle/six tire SUTs is very large (about 25 percent of all cases) and reported at a substantially lower rate than larger trucks. So it appears that the vehicle license state does not play a substantial role in reporting rates and that vehicle size is a much more critical issue.

Table 10 Reporting Rate by Vehicle Body Type and Vehicle License State, Missouri 2005

	Vehicle licensed in Missouri		Vehicle licensed in Other State/Province		All Vehicles	
Vehicle body type	Reporting rate	Reportable cases	Reporting rate	Reportable cases	Overall rate	Total reportable
Passenger Car	n/a	0	0.0	1	0.0	1
Sport Utility Vehicle	0.0	1	n/a	0	0.0	1
Small bus (9-15 w/driver)	66.7	102	85.7	14	69.0	116
Bus (16+ w/driver)	80.0	145	76.8	56	79.1	201

	Vehicle licensed in Missouri		Vehicle licensed in Other State/Province		All Vehicles	
Vehicle body type	Reporting rate	Reportable cases	Reporting rate	Reportable cases	Overall rate	Total reportable
School bus (<16 w/driver)	0.0	65	0.0	5	0.0	70
School bus (16+ w/driver)	88.9	199	83.3	6	88.8	205
Other transport device	n/a	0	0.0	1	0.0	1
Pick-up	97.3	74	100.0	20	97.9	94
SUT, 2 axles, 6 tires	62.3	1,154	57.3	323	61.2	1,477
SUT, 3+ axles	91.8	501	91.5	129	91.7	630
Truck-tractor, no trailer	89.8	49	89.1	64	89.4	113
Truck-tractor w/one unit	94.3	946	95.0	1,960	94.8	2,906
Truck-tractor w/two units	93.8	16	96.0	99	95.7	115
Truck-tractor w/three units	100.0	2	100.0	3	100.0	5
Other heavy truck	72.4	152	73.3	45	72.6	197
Total	78.5	3,406	89.3	2,726	83.3	6,132

Driver license type may also serve as a cue to the reporting officer that a case may be reportable. A commercial driver's license (CDL) is required for a truck or combination with a gross vehicle weight rating over 26,000 pounds. CDLs are not required for all reportable MCMIS vehicles of course, since the GVWR threshold for a reportable vehicle is 10,001 or more pounds. Accordingly, a truck legally requiring only an operator's license could qualify for reporting, but of course light, non-qualifying vehicles also only require an operator's license. Table 11 shows that reporting rates for vehicles whose drivers possessed a CDL were substantially higher than where the driver had an operator's license only. Over 90 percent of the reportable involvements of drivers who had a CDL were reported, compared with 63.6 percent of reportable involvements where the driver had only an operator's license. This difference is not entirely a reflection of the fact that CDL drivers generally drive larger trucks, which has previously been shown to be associated with higher rates of reporting. Only about 51 percent of reportable involvements of two-axle SUTs were reported when the driver had only an operator's license. However, 76.6 percent of reportable two-axle SUTs were reported if the driver possessed a CDL, even if not required to drive the particular vehicle. Apparently, the possession of a CDL is associated with high rates of reporting, independent of the size of the vehicle involved in the crash.

Table 11 Reporting Rate by Driver License Type, Missouri 2005

Driver license type	Reportable	Reporting rate	Unreported	% of total unreported
No driver	177	72.3	49	4.8
Operator	1,337	63.6	487	47.6
CDL	4,371	90.4	418	40.8
Permit	3	100.0	0	0.0
Unlicensed	32	56.3	14	1.4
Unknown	212	73.6	56	5.5
Total	6,132	83.3	1,024	100.0

Delays in processing records for upload through SafetyNet to the MCMIS Crash file may also play a role in reporting rates. States are allowed 90 days from the crash to report crash records. The August 21, 2006, version of the MCMIS Crash file was used for this evaluation, so all reportable records should have been reported by the August 21 close date of the MCMIS file. However, Figure 3 suggests that possibly not all the November and December records had been processed. Note, however, that the figure also shows a comparably low reporting rate in February. It is not clear if the rates for February, November, and December are all related to the same process or if the February rate was a one-time anomaly and the November/December rates are due to delays in record-processing. However, the tight, markedly-higher rates for the other months suggest that a relatively high rate of reporting is achievable.

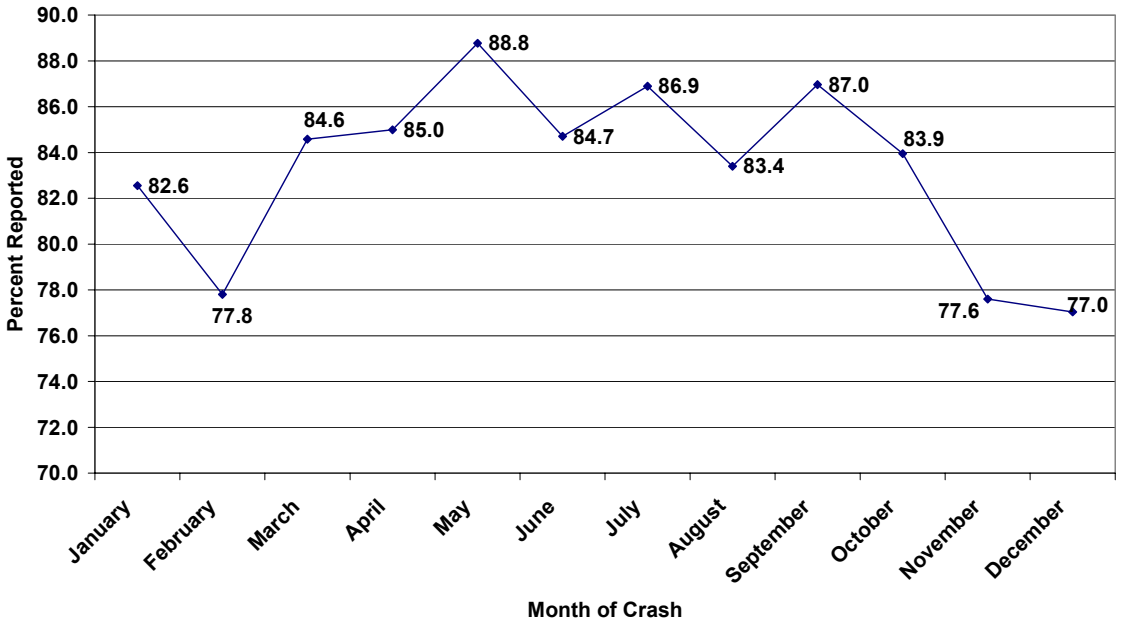


Figure 3 Reporting Rate by Month of Crash, Missouri 2005

Reporting rates can also vary by the responsible agency type. Different types of enforcement organizations—such as the Highway Patrol, county Sheriffs, and municipal police departments—can have different levels of training and different ranges of responsibilities. The Missouri Highway Patrol had the highest reporting rate, with 91.3 percent of reportable crashes covered actually reported to the MCMIS Crash file. Rates for police departments were somewhat lower. The city police departments in both Kansas City and St. Louis achieved rates of 75.7 and 73.8 percent respectively, lower than the rate for all cases of 83.3 percent. The reporting rate for St. Louis County Police Department was somewhat lower, at 68.4 percent. Crashes covered by County Sheriffs were reported at a 73.8 percent rate, though they totaled only 178 of the 6,132 reportable cases.

Table 12 Reporting Rate by Responsible Agency, Missouri 2005

Agency	Reportable	Reporting rate	Unreported	% of total unreported
Missouri Highway Patrol	2,892	91.3	253	24.7
St. Louis Co Police Dept.	177	68.4	56	5.5
Kansas City Police Dept.	560	75.7	136	13.3
St. Louis City Police Dept.	477	73.8	125	12.2
Other Police Dept.	1,885	77.9	417	40.7
County Sheriff	141	73.8	37	3.6
Total	6,132	83.3	1,024	100.0

Reporting rates also vary by county of crash, and by the number of reportable crashes, which reflects the density of enforcement work. St. Louis County had the highest number of reportable crash involvements, occurring at a rate of over two per day. Table 13 shows the top ten counties in Missouri, ranked in terms of the number of reportable crashes. The top ten together accounted for 54.0 percent of MCMIS-reportable crash involvements in Missouri in 2005, while the remaining 104 counties accounted for 46.0 percent. Taken together, the top ten counties reported 79.4 percent of reportable crashes, which is relatively close to the overall rate of 83.3 percent. However, because of the sheer size of the top ten counties, they account for two-thirds of the unreported cases. And reportable crashes in the remaining 104 counties were reported at an 87.9 percent rate.

Table 13 Reporting Rate by County of Crash, Missouri 2005

County	Reportable	Reporting rate	Unreported	% of total unreported
Saint Louis	776	78.7	165	16.1
Jackson	743	77.8	165	16.1
Saint Louis City	477	73.8	125	12.2
Saint Charles	271	83.8	44	4.3
Greene	250	77.2	57	5.6
Jefferson	195	81.5	36	3.5
Clay	190	79.5	39	3.8
Boone	157	86.0	22	2.1
Franklin	139	89.2	15	1.5
Jasper	111	87.4	14	1.4
Top Ten Counties	3,309	79.4	682	66.6
All Other Counties	2,481	87.9	342	33.4

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 are important to 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 Missouri Crash file and in the MCMIS Crash file. Inconsistencies can indicate errors in translating information recorded on the crash report to the values in the MCMIS Crash file.

Table 14 shows missing data rates for selected, important variables in the MCMIS Crash file. Missing data rates are generally quite 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. Missing data rates for some other variables are higher. Variables relating to driver licensing are missing for 5.3 to 5.5 percent of cases. Road access is missing for all cases, as is citation issued and driver condition. Trafficway type are missing for 17.4 percent of cases. Weather is not recorded in 28 percent of cases. Vehicle Identification Number (VIN) is missing in only 2.8 percent, and missing data rates for vehicle license state and vehicle license number are similarly low.

Table 14 Missing Data Rates for Selected MCMIS Crash File Variables, Missouri 2005

Variable	Percent unrecorded	Variable	Percent unrecorded
Report number	0.0	Fatal injuries	0.0
Accident year	0.0	Non-fatal Injuries	0.0

Variable	Percent unrecorded	Variable	Percent unrecorded
Accident month	0.0	Interstate	0.0
Accident day	0.0	Light	0.0
Accident hour	0.0	Event one	0.0
Accident minute	0.0	Event two	0.0
County	0.0	Event three	0.9
Body type	0.1	Event four	3.2
Configuration	0.0	Number of vehicles	0.0
GVWR class	17.0	Officer badge number	0.0
DOT number*	10.5	Road access	100.0
Carrier state	0.0	Road surface	0.0
Citation issued	100.0	Road trafficway	17.4
Driver condition	100.0	Towaway	0.0
Driver date of birth	5.5	Truck or bus	0.0
Driver license number	5.3	Vehicle license number	2.4
Driver license state	5.3	Vehicle license state	2.3
Driver license class	100.0	VIN	2.8
Driver license valid	0.0	Weather	28.0

* Counting cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	0.3
Percentages of hazmat placarded vehicles only:	
Hazardous cargo release	0.0
Hazardous materials class (1-digit)	34.0
Hazardous materials class (4-digit)	15.1
Hazardous materials name	56.5

The second section of the table shows missing data rates for the hazardous materials (hazmat) variables. Hazmat placard was unrecorded in only 0.3 percent of cases. However, rates for the variables describing the hazardous material (where present) were higher. The percentages only pertain to cases in which it was coded that the vehicle displayed a hazmat placard. The 1-digit hazmat class code was missing in 34.0 percent of these cases, the four digit class code was missing in 15.1 percent of cases, and the hazmat name was missing in 56.5 percent of cases. It should also be noted that the one-digit and 4-digit codes were entered in some cases even though the vehicle was not coded as displaying a hazmat placard. This is possible, of course, but it would be a violation of the hazmat regulations. But it should be noted that while 53 cases were

coded as displaying a placard, there were 49 cases coded no placard but with a valid 1-digit hazmat class coded and 57 cases with a valid 4-digit hazmat code. It is likely that some fraction of these cases are genuinely inconsistent (hazmat placard is coded incorrectly or the hazmat class codes should have been blank), rather than indicative of a violation of hazmat regulations.

We also compared the values of variables in the MCMIS Crash file with the value of comparable variables in the Missouri 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. Missouri has adopted in many instances the same code levels for certain variables as are used in the MCMIS Crash file. This is a real advantage in simplifying the problem of ensuring consistency between the record of a case in the state crash file and the record of the case as it appears in MCMIS. By using the same values, no translating is necessary before uploading to Safetynet. This eliminates one possible source of error.

Overall, the consistency between the two files is good. We compared the values for vehicle configuration, number of fatally injured persons, light condition, roadway surface condition, weather, number of vehicles, hazardous materials release, the sequence of events variables, and vehicle license state. For most of the variables considered, the values in the state file matched the values in the MCMIS file. The exceptions are discussed below.

Table 15 shows the comparison of vehicle configuration between the MCMIS file and the Missouri Crash file. Subtotals are shown for small buses, large buses, and trucks. The percentages shown are for each subtotal group. Overall the comparison is good, though there are some notable inconsistencies. Among the 100 records coded small bus in the MCMIS file, 27 are coded as a larger bus type. There were 322 records coded as a larger bus in the MCMIS file, and 7 (2.2 percent) were coded as a small bus, and one as a truck-tractor with one trailer. The truck codes are substantially consistent, with one large exception. No cases were coded as a tractor-semitrailer in the MCMIS Crash file, though there were 2,753 in the Missouri Crash file.

Table 15 Comparison of Vehicle Configuration in MCMIS and Missouri Crash Files

Vehicle configuration		Cases	Percent
MCMIS Crash file	Missouri Crash file		
Light truck (only if HM placard)	Pickup	1	100.0
Bus (seats 9-15, including driver)	Small bus (9-15 w/driver)	73	73.0
Bus (seats 9-15, including driver)	Bus (16+ w/driver)	11	11.0
Bus (seats 9-15, including driver)	School bus (16+ w/driver)	16	16.0
Small bus subtotal		100	100.0
Bus (seats >15, including driver)	Small bus (9-15 w/driver)	7	2.2
Bus (seats >15, including driver)	Bus (16+ w/driver)	148	46.0
Bus (seats >15, including driver)	School bus (16+ w/driver)	166	51.6
Bus (seats >15, including driver)	Truck-tractor w/one unit	1	0.3
Large bus subtotal		322	100.0

Vehicle configuration		Cases	Percent
MCMIS Crash file	Missouri Crash file		
SUT, 2-axle, 6-tire	SUT, 2 axles, 6 tires	903	19.0
SUT, 3+ axles	SUT, 3+ axles	578	12.2
Truck trailer	Truck-tractor with 1 unit	2,753	57.9
Truck tractor (bobtail)	Truck-tractor-no units	101	2.1
Tractor/double	Truck-tractor with 2 units	110	2.3
Tractor/triple	Truck-tractor with 3 units	5	0.1
Unk. heavy truck, >10,000 lbs. GVWR	Pickup	159	3.3
Unk. heavy truck, >10,000 lbs. GVWR	SUT, 2 axles, 6 tires	1	0.0
Unk. heavy truck, >10,000 lbs. GVWR	Other heavy truck	143	3.0
Truck subtotal		4,753	100.0
Total, All vehicles		5,176	

It appears that the truck-tractor with one unit (tractor-semitrailer) configuration in the Missouri file is incorrectly mapped to the "truck trailer" code in the MCMIS file. A truck trailer is defined as a straight truck pulling a trailer, not a tractor pulling a trailer. This appears to be a simple programming error that is readily remedied.

A similar mapping problem also appears in the light condition variable. Most of the code levels match precisely. However, all 816 cases coded as "dark, no street lights" in the Missouri crash file are coded "dark, unknown roadway lighting" in MCMIS. These cases should be coded, "dark, not lighted."

Comparison of weather codes in the MCMIS and Missouri files sheds light on the rate of missing data for the variable noted in Table 14. Missouri captures weather condition in two variables, so that the weather at the time of the crash can be more fully described, while the MCMIS Crash file only allows one weather condition to be captured. In most cases, the first Missouri weather variable is mapped to the MCMIS Crash file weather variable. But all cases in which the first Missouri weather variable is coded "cloudy" are coded "unknown" in the MCMIS file. These cases account for almost all of the missing data in the MCMIS Crash file weather variable. There is typically valid information in the second weather variable that could be used to fill out the data in the MCMIS variable, rather than leaving it unknown. There are some other inconsistencies, where the first variable does not have a value that directly maps to the MCMIS weather variable, and the information in the second weather variable is ignored. As in the case of the configuration variable, a relatively straightforward programming fix would eliminate this problem.

7. Summary and Discussion

Missouri improved its reporting to the MCMIS Crash file substantially between 2001 and 2005. The evaluation of the 2001 reporting showed that about 60.9 percent of reportable crash involvements were reported; that rate increased to 83.3 percent of the cases for 2005. Moreover,

since crashes with a vehicle towed due to disabling damage cannot be distinguished from crashes with a vehicle towed for any reason, the true reporting rates may be somewhat higher than estimated here. Just as important, the problem of duplicate records reported to MCMIS was virtually eliminated. In 2001, almost 1,200 duplicate records were found in the MCMIS Crash file, amounting to 19.8 percent of all the records submitted. However, only two duplicate records were found in the 2005 MCMIS Crash data reported from Missouri. Reporting rates improved in every area, as indicated in Table 16.

Table 16 Comparison of MCMIS Reporting by Missouri, 2001 and 2005

	Year	
Evaluation item	2001	2005
Number of duplicate records	1,161	2
Percentage of duplicates	19.8%	0.03%
Reporting rates		
Overall	60.9%	83.3%
Fatal involvements	76.8%	94.6%
Injury, transported	63.7%	84.9%
Towaway	58.8%	81.8%
Truck	62.1%	84.7%
Bus	48.5%	71.1%

Missouri does not seem to be overreporting cases to the MCMIS file, i.e. reporting cases that do not meet the reporting criteria. Only 68 cases were reported that did not appear to be reportable. All were pickup trucks that did not meet the vehicle threshold. There may be some overreporting of towaway crashes, but since the Missouri crash data does not distinguish between vehicles towed due to damage or for some other reason, we cannot judge the extent of overreporting in that regard.

Although reporting has improved substantially from 2001, the finding of the previous evaluation that reporting rates are associated with the reporting criteria is still valid. This is true for both the vehicle type and the crash severity criteria. The most serious crashes are the most likely to be reported. Almost 95 percent of reportable fatal involvements were correctly reported—only 10 of 186 were missed—while 84.9 percent of crashes with a transported injury were reported, and 81.8 percent of reportable towaway involvements. Similarly, crashes involving large trucks and buses were more likely to be reported than smaller, but still qualifying vehicles. Between 95 and 100 percent of reportable crashes of tractor combinations were reported, while only 62.3 percent of two-axle SUTs were reported. In the evaluation of the 2001 data it was noted that 53.1 percent of SUTs were reported, so while the rate has increased substantially, this truck type is still a problem and accounts for 56.0 percent of all unreported cases.

The bus reporting rate, while substantially improved, still is lower than for trucks, and is strongly affected by the lower reporting rate for smaller buses. Almost 90 percent (88.8 percent) of large

school buses were reported, while no small (<16 passenger) school buses were reported and only 69.0 percent of other small buses.

Reporting rates also are associated with the type of policing agency that covered the crash and with the size of the area in which the crash occurred. The State Highway Patrol has the highest reporting rate, 91.3 percent, but still is responsible for about one-quarter of unreported cases. Local police departments report about 76.3 percent of reportable crashes, and county sheriffs about 73.8 percent. In addition, the biggest counties in terms of number of reportable crashes, tended to lag in terms of reporting rates.

Taken together, these findings strongly support the idea that reporting crashes is primarily dependent on the officer in the field recognizing a reportable crash and correctly completing the needed information. It is likely that increased attention, supervision, and experience with identifying reportable crashes contributed to the substantial improvement in reporting. Whether this improvement can be sustained to achieve substantially full reporting remains to be seen. It is possible that an alternative approach, which relieves officers of the burden of recognizing crashes that meet the reporting thresholds, may also be a viable means of achieving substantially complete reporting.

In terms of data quality, many of the problems were related to errors in translating values as recorded on the Missouri Crash Report to the values of the variables in the MCMIS Crash file. These problems likely can be permanently fixed by straightforward programming changes. It also appears that some variables required for the MCMIS file are not being collected, such whether a citation was issued and roadway access class. To correct these problems, either the crash report would have to be changed or the information linked in from another source.

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12 Matteson, A., and Blower, D., *Evaluation of Illinois Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. July 2005. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

13 Blower, D., and Matteson, A., *Evaluation of Washington Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. June 2006. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

Appendix A: Missouri Uniform Accident Report

MISSOURI UNIFORM ACCIDENT REPORT PAGE _____ OF _____

SPACE USED FOR BARCODE	**1 - AGENCY NAME AND ORI**					
LEFT THE SCENE ☐ YES ☐ NO	CLEARED ☐ YES ☐ NO	ACCIDENT CLASSIFICATION	PROPERTY DAMAGE ONLY ☐	NUMBER INJURED	NUMBER KILLED	REPORT / CASE / INCIDENT NUMBER
NUMBER OF VEHICLES INVOLVED	ACCIDENT DATE	ACCIDENT TIME (MIL.)	TIME NOTIFIED (MIL.)	TIME ARRIVED (MIL.)	INVESTIGATION DATE	

2 - LOCATION

COUNTY	MUNICIPALITY	BEAT / ZONE	TRP / DIST / PCT	INVESTIGATED AT SCENE ☐ YES ☐ NO	
ON	DISTANCE FROM _____ FEET ___.___ MILES	LOCATION ☐ AFTER ☐ BEFORE ☐ AT	INTERSECTING STREET OR ROADWAY		
ROADWAY DIRECTION	SPEED LIMIT	SPEED LIMIT	GEO - CODE	GPS LONGITUDE _____ LATITUDE	

ROAD MAINTAINED BY ☐ 1. STATE ☐ 2. COUNTY ☐ 3. MUNICIPAL ☐ 4. PRIVATE PROPERTY ☐ 5. OTHER

3 - DAMAGE TO PROPERTY OTHER THAN VEHICLES ☐ NONE

GIVE OWNER'S NAME AND ADDRESS, DESCRIPTION OF PROPERTY, AND DAMAGE.
☐ MoDOT

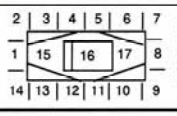
DRIVER 1

4. DRIVER'S FULL NAME (LAST, FIRST, MI)		ADDRESS (STREET, CITY, STATE, ZIP)		
DRIVER LICENSE NUMBER / ID NUMBER	STATE	TYPE OF LICENSE ☐ 1. OPERATOR CLASS ____ ☐ 2. CDL CLASS ____ ☐ 3. PERMIT ☐ 4. UNLICENSED ☐ 5. MC ONLY		MC ENDORSEMENT ☐ YES ☐ NO ☐ NA
PROOF OF INSURANCE ☐ YES ☐ NO ☐ NOT REQUIRED	INSURANCE COMPANY	☐ DRIVER ☐ VEHICLE	POLICY NUMBER ☐ NA	

VEHICLE 1

YEAR	MAKE	MODEL	COLOR	
LIC. PLATE NO.	STATE / YEAR	VIN		TOTAL NO. OF OCCUPANTS
VEHICLE OWNER NAME (LAST, FIRST, MI) / COMMERCIAL CARRIER	ADDRESS (STREET, CITY, STATE, ZIP)	☐ SAME AS DRIVER		

VEHICLE DAMAGE (Circle all damaged areas) ☐ NONE



18 - Undercarriage
19 - Windshield
20 - Burned
21 - Towed Unit
22 - Cargo

INITIAL IMPACT NO. ☐ NA

TOWED FROM SCENE ☐ YES ☐ NO

TOW CO. INFORMATION

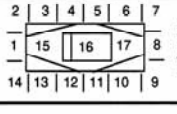
DRIVER 2

5. DRIVER'S FULL NAME (LAST, FIRST, MI)		ADDRESS (STREET, CITY, STATE, ZIP)		
DRIVERS LICENSE NUMBER / ID NUMBER	STATE	TYPE OF LICENSE ☐ 1. OPERATOR CLASS ____ ☐ 2. CDL CLASS ____ ☐ 3. PERMIT ☐ 4. UNLICENSED ☐ 5. MC ONLY		MC ENDORSEMENT ☐ YES ☐ NO ☐ NA
PROOF OF INSURANCE ☐ YES ☐ NO ☐ NOT REQUIRED	INSURANCE COMPANY	☐ DRIVER ☐ VEHICLE	POLICY NUMBER ☐ NA	

VEHICLE 2

YEAR	MAKE	MODEL	COLOR	
LIC. PLATE NO.	STATE / YEAR	VIN		TOTAL NO. OF OCCUPANTS
VEHICLE OWNER NAME (LAST, FIRST, MI) / COMMERCIAL CARRIER	ADDRESS (STREET, CITY, STATE, ZIP)	☐ SAME AS DRIVER		

VEHICLE DAMAGE (Circle all damaged areas) ☐ NONE



18 - Undercarriage
19 - Windshield
20 - Burned
21 - Towed Unit
22 - Cargo

INITIAL IMPACT NO. ☐ NA

TOWED FROM SCENE ☐ YES ☐ NO

TOW CO. INFORMATION

6 - WITNESS ☐ NONE IDENTIFIED

NAME OF WITNESS	ADDRESS (STREET, CITY, STATE, ZIP)	TELEPHONE NO.

DISTRIBUTION: **COPY** - AGENCY FILE; **ORIGINAL** - MISSOURI STATE HIGHWAY PATROL - TRAFFIC DIVISION - P.O. BOX 568 - JEFFERSON CITY, MO 65102 SHP-2P 01/02

REPORT #_____ PAGE _____ OF_____

7. COLLISION DIAGRAM	Direction Prior to Impact (circle one)																Est. Speed - Fatals Only			
	V1	N	E	S	W	V2	N	E	S	W	V3	N	E	S	W	V4	N	E	S	W	V1	V2	V3	V4

INDICATE NORTH

INDICATE ROAD NAMES

REQUIRED UNLESS DELAYED REPORT

DIAGRAM NOT TO SCALE

8. EVIDENTIARY PHOTOS TAKEN

☐ YES ☐ NO BY WHOM AVAILABLE FROM

RECONSTRUCTION - Includes Narrative, Diagram, & Photo(s)

☐ YES ☐ NO BY WHOM

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9 - CODES

SEAT LOCATION

FR SR TR
FC SC TC
FL SL TL

XX - Not Known
P - Pedestrian
B - Bicycle
M - Motorcycle
OE - Occupant - Enclosed Load Area
OU - Occupant - Unenclosed Load Area
CP - Commercial Passenger
SV - Other (Explain in Remarks)

INJURY
1. Fatal
2. Disabling
3. Evident - Not Disabling
4. Probable - Not Apparent
5. None Apparent
6. Unknown

TRANSPORTED (Medical Treatment)
1. No
2. EMS
3. Other
4. Unknown

EJECTION
1. NA
2. No
3. Partially
4. Totally
5. Unknown

AIR BAG FRONT
1. None / NA
2. Deployed
3. Not Deployed

AIR BAG SIDE
1. None / NA
2. Deployed
3. Not Deployed

SAFETY DEVICES
1. None
2. Not Used
3. Shoulder Belt Only
4. Lap Belt Only
5. Shoulder and Lap Belt
6. Child Restraint
7. Helmet Used
8. Helmet Not Used
9. Use Unknown

10 - DRIVERS

NAME / ADDRESS	DATE OF BIRTH MM-DD-YYYY	SEX	VEH. NO.	SEAT LOC.	INJ.	TRANS-PORT	EJEC-TION	AIR BAG F	AIR BAG S	SAF DEV	TELEPHONE NO.
☐ NA DRIVER 1 - SAME ADDRESS AS ABOVE			1								
☐ NA DRIVER 2 - SAME ADDRESS AS ABOVE			2								

11 - OTHER OCCUPANTS & PEDESTRIANS (SAD = SAME AS DRIVER)

☐ SAD											
☐ SAD											
☐ SAD											
☐ SAD											
☐ SAD											
☐ SAD											

12. VEHICLE BODY TYPES AUTOMOBILES / SPECIAL VEHICLES

V1 V2

- ☐ ☐ 1. Passenger Car
- ☐ ☐ 2. Station Wagon
- ☐ ☐ 3. Sport Utility Vehicle
- ☐ ☐ 4. Limousine (6-15 for hire)
- ☐ ☐ 5. Van (8 or less with driver)
- ☐ ☐ 6. Small Bus (9-15 with driver)
- ☐ ☐ 7. Bus (16 or more with driver)
- ☐ ☐ 8. School Bus (less than 16 with driver)
- ☐ ☐ 9. School Bus (16 or more with driver)
- ☐ ☐ 10. Motorcycle — ☐ ☐ 2 Wh. / ☐ ☐ 3 Wh. / ☐ ☐ 4 Wh. / ☐ ☐ 5 Wh. or More / ☐ ☐ Unknown
- ☐ ☐ 11. ATV
- ☐ ☐ 12. Motorized Bicycle
- ☐ ☐ 13. Pedalcycle
- ☐ ☐ 14. Motor Home / Camper
- ☐ ☐ 15. Farm Implements
- ☐ ☐ 16. Construction Equipment
- ☐ ☐ 17. Other Transport Device
- ☐ ☐ 18. Unknown
- ☐ ☐ 19. Pick-up
- ☐ ☐ 20. Single-unit Truck: 2 axles, 6 tires
- ☐ ☐ 21. Single-unit Truck: 3 or more axles
- ☐ ☐ A. Vehicle Pulling Another Unit(s) 1-21 only
- ☐ ☐ 22. Truck Tractor With No Units
- ☐ ☐ 23. Truck Tractor With One Unit
- ☐ ☐ 24. Truck Tractor With Two Units
- ☐ ☐ 25. Truck Tractor With Three Units
- ☐ ☐ 26. Other Heavy Truck

GCVW Rating (not licensed weight) 19-26 only
- ☐ ☐ Less than or equal to 10,000 lbs.
- ☐ ☐ 10,001 - 26,000 lbs.
- ☐ ☐ Greater than 26,000 lbs.

13. EMERGENCY VEHICLE INVOLVEMENT

V1 V2 ☐ NA

- ☐ ☐ 1. Police
- ☐ ☐ 2. Fire
- ☐ ☐ 3. Ambulance
- ☐ ☐ 4. Other (must check "A")
- ☐ ☐ A. Emergency Vehicle on Emergency Run

14. HAZARDOUS MATERIALS ☐ NA

V1 V2

- ☐ ☐ Placard Displayed
- ☐ ☐ 1. Gases in Bulk
- ☐ ☐ 2. Solids in Bulk
- ☐ ☐ 3. Liquids in Bullk
- ☐ ☐ 4. Explosives
- ☐ ☐ 5. None
- ☐ ☐ A. Hazardous Materials' Cargo Released / Spilled

15. ACCIDENT TYPE

- ☐ 1. On Roadway
- ☐ 2. Off Roadway

COLLISION INVOLVING
- ☐ 1. Animal
- ☐ 2. Pedalcycle
- ☐ 3. Fixed Object
- ☐ 4. Other Object
- ☐ 5. Pedestrian
- ☐ 6. Train
- ☐ 7. MV in Transport
- ☐ 8. MV on Other Roadway
- ☐ 9. Parked MV

NON-COLLISION
- ☐ 10. Overturning
- ☐ 11. Other Non-Collision

TWO VEHICLE COLLISION
- ☐ 60. Head On
- ☐ 61. Rear End
- ☐ 62. Sideswipe - Meeting
- ☐ 63. Sideswipe - Passing
- ☐ 64. Angle
- ☐ 65. Backed Into
- ☐ 67. Other

16. TRAFFIC CONDITIONS

V1 V2

- ☐ ☐ 1. Normal
- ☐ ☐ 2. Accident Ahead
- ☐ ☐ 3. Congestion Ahead

17. VEHICLE ACTION / SEQUENCE OF EVENTS

1. Going Straight
2. Overtaking
3. Making Right Turn
4. Right Turn on Red
5. Making Left Turn
6. Making U Turn
7. Skidding / Sliding
8. Slowing / Stopping
9. Start in Traffic
10. Start From Parked
11. Backing
12. Stopped in Traffic
13. Parked
14. Changing Lanes
15. Avoiding
16. Crossover Median
17. Crossover Centerline
18. Crossing Road
19. Airborne
20. Ran Off Road - Right
21. Ran Off Road - Left
22. Overturn / Rollover
23. Fire / Explosion
24. Immersion
25. Jackknife
26. Cargo Loss / Shift
27. Equipment Failure
28. Separation of Units
29. Returned to Road
30. Collision Inv. Pedestrian
31. Collision Inv. Pedalcycle
32. Collision Inv. Train
33. Collision Inv. Animal (enter code - explain)
34. Collision Inv. MV in Transport
35. Collision Inv. Parked Motor Vehicle
36. Collision Inv. Fixed Object (enter code - explain)
37. Collision Inv. Other Object (explain)
38. Other - Non Collision

V1 ☐ Unknown

_____/_____/_____/_____/_____/_____/_____

33. Animal Code _____

36. Fixed Object Code _____/_____/_____

V2 ☐ Unknown

_____/_____/_____/_____/_____/_____/_____

33. Animal Code _____

36. Fixed Object Code _____/_____/_____

Animal, Fixed Object, and Inattention Codes explained in narrative.

REPORT #_____ PAGE _____ OF_____

18. PROBABLE CONTRIBUTING CIRCUMSTANCES

V1 V2

- ☐ ☐ 1. Vehicle Defects (explain)
- ☐ ☐ 2. Traffic Control Inoperable or Missing
- ☐ ☐ 3. Improperly Stopped on Roadway
- ☐ ☐ 4. Speed - Exceeded Limit
- ☐ ☐ 5. Too Fast for Conditions
- ☐ ☐ 6. Improper Passing
- ☐ ☐ 7. Violation Signal / Sign
- ☐ ☐ 8. Wrong Side (not passing)
- ☐ ☐ 9. Following Too Close
- ☐ ☐ 10. Improper Signal
- ☐ ☐ 11. Improper Backing
- ☐ ☐ 12. Improper Turn
- ☐ ☐ 13. Improper Lane Usage / Change
- ☐ ☐ 14. Wrong Way (One-Way)
- ☐ ☐ 15. Improper Start From Park

P1 P2

- ☐ ☐ ☐ ☐ 16. Improperly Parked
- ☐ ☐ ☐ ☐ 17. Failed to Yield
- ☐ ☐ ☐ ☐ 18. Alcohol
- ☐ ☐ ☐ ☐ 19. Drugs
- ☐ ☐ ☐ ☐ 20. Physical Impairment (explain)
- ☐ ☐ ☐ ☐ 21. Inattention (explain)

P1 _____ P2 _____ V1 _____ V2 _____

- ☐ ☐ ☐ ☐ 22. None

19. PEDESTRIAN INVOLVEMENT

P1 P2 ☐ NA

- ☐ ☐ 1. At Intersection
- ☐ ☐ 2. Not At Intersection

CROSSING ROAD

- ☐ ☐ 3. With Signal
- ☐ ☐ 4. Against Signal
- ☐ ☐ 5. No Signal
- ☐ ☐ 6. Diagonally
- ☐ ☐ 7. Within Crosswalk
- ☐ ☐ 8. Within Marked Crosswalk
- ☐ ☐ 9. Behind / In Front of Parked Car
- ☐ ☐ 10. With Traffic
- ☐ ☐ 11. Against Traffic
- ☐ ☐ 12. Getting On / Off Vehicle
- ☐ ☐ 13. Standing / Lying / Sitting on Road
- ☐ ☐ 14. Pushing / Working on Vehicle
- ☐ ☐ 15. Other Working
- ☐ ☐ 16. Playing on Road
- ☐ ☐ 17. Off Roadway

20. VISION OBSCURED

V1 V2

- ☐ ☐ 1. Windshield
- ☐ ☐ 2. Load on Vehicle
- ☐ ☐ 3. Trees / Brush
- ☐ ☐ 4. Building
- ☐ ☐ 5. Embankment
- ☐ ☐ 6. Signboards
- ☐ ☐ 7. Hillcrest
- ☐ ☐ 8. Parked Cars
- ☐ ☐ 9. Moving Cars
- ☐ ☐ 10. Glare
- ☐ ☐ 11. Other (explain)
- ☐ ☐ 12. Not Obscured

21. TRAFFIC CONTROL

V1 V2

- ☐ ☐ 1. Construction Zone
- ☐ ☐ 2. Other Work Zone
- ☐ ☐ 3. School Zone
- ☐ ☐ 4. Stop Sign
- ☐ ☐ 5. Electric Signal
- ☐ ☐ 6. RR Signal / Gate
- ☐ ☐ 7. Yield Sign
- ☐ ☐ 8. Officer / Flagman
- ☐ ☐ 9. No Passing Zone
- ☐ ☐ 10. Turn Restricted
- ☐ ☐ 11. Signal on School Bus
- ☐ ☐ 12. None

22. ROAD CHARACTER

ALIGNMENT

- ☐ 1. Straight
- ☐ 2. Curve

PROFILE

- ☐ 1. Level
- ☐ 2. Grade
- ☐ 3. Hillcrest

23. LIGHT CONDITION

- ☐ 1. Daylight
- ☐ 2. Dark with Street Lights On
- ☐ 3. Dark with Street Lights Off
- ☐ 4. Dark - No Street Lights
- ☐ 5. Indeterminate (explain)

24. WEATHER CONDITION

- ☐ 1. Clear
- ☐ 2. Cloudy
- ☐ 3. Rain
- ☐ 4. Snow
- ☐ 5. Sleet
- ☐ 6. Freezing (temp.)
- ☐ 7. Fog / Mist
- ☐ 8. Indeterminate (explain)

25. ROAD CONDITION

- ☐ 1. Dry
- ☐ 2. Wet
- ☐ 3. Snow
- ☐ 4. Ice
- ☐ 5. Slush
- ☐ 6. Mud
- ☐ 7. Standing Water
- ☐ 8. Moving Water
- ☐ 9. Other (explain)

26. ROAD SURFACE

- ☐ 1. Concrete
- ☐ 2. Asphalt
- ☐ 3. Brick
- ☐ 4. Gravel
- ☐ 5. Dirt / Sand
- ☐ 6. Multi-Surface

27 - COMMERCIAL MOTOR VEHICLE (Complete for each commercial vehicle involved.)

A. CMV CRITERIA

Answer the following to determine if this section should be completed.

1. Does this accident involve any of the following:
   1. a person fatally injured; or
   2. a person transported for medical attention; or
   3. a vehicle towed from the scene of the accident
   - ☐ NO - DO NOT COMPLETE
   - ☐ YES - GO TO NUMBER 2
2. Examine each vehicle to determine if it is a commercial vehicle based on the following:
   1. a truck with GCVWR of more than 10,000 lbs. and engaged in commerce; or
   2. a bus or school bus (9 or more including driver); or
   3. a vehicle with a hazardous materials placard
   - ☐ NO - DO NOT COMPLETE
   - ☐ YES - COMPLETE SECTIONS B - E

B. CARRIER ID NUMBER

V1 ICC NO. MC _____ USDOT NO. _____

V2 ICC NO. MC _____ USDOT NO. _____

C. HAZARDOUS MATERIAL PLACARD NUMBER ☐ NA

V1 4-Digit Placard Number from Diamond / Box _____ Number From Bottom of Diamond _____

V2 4-Digit Placard Number from Diamond / Box _____ Number From Bottom of Diamond _____

D. TRAFFICWAY

- ☐ 1. Two-Way; Not Divided
- ☐ 2. Two-Way; Divided; Unprotected Median
- ☐ 3. Two-Way; Divided; Positive Median Barrier
- ☐ 4. One-Way; Not Divided

E. CARGO BODY TYPE

V1 V2

- ☐ ☐ 1. Enclosed Box
- ☐ ☐ 2. Cargo Tank
- ☐ ☐ 3. Flatbed
- ☐ ☐ 4. Dump
- ☐ ☐ 5. Concrete Mixer
- ☐ ☐ 6. Auto Transporter
- ☐ ☐ 7. Garbage / Refuse
- ☐ ☐ 8. Grain, Chip, Gravel
- ☐ ☐ 9. Pole Trailer
- ☐ ☐ 10. Other

28 - NARRATIVE / STATEMENTS (If additional room is necessary, attach a separate sheet.)

29. REPORTING OFFICER SIGNATURE	DSN / BADGE NO.	BEAT / ZONE	TROOP / DIST / PCT

REVIEWING OFFICER 1 SIGNATURE	DSN / BADGE NO.	REVIEWING OFFICER 2 SIGNATURE	DSN / BADGE NO.