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EVALUATION OF 2008 VERMONT CRASH DATA REPORTED TO 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. 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 Vermont.

MCMIS Crash File records were matched to the Vermont crash file to determine the nature and extent of underreporting. It was necessary to focus just on crashes involving a fatality, A-injury or B-injury, because of problems identifying MCMIS reportable crashes in the Vermont crash file. It appears that Vermont reported 64.9 percent of these crash involvements in 2008.

Reporting rates were found to be related to crash severity, the configuration of the vehicle, and the type of enforcement agency that covered the crash. Over 71 percent of fatal crash involvements were reported, 54.5 percent of A-injury involvements, and 67.1 percent of B-injury involvements. More than 66 percent of reportable involvements of truck involvements were reported, but the reporting rate was 50.0 percent for buses.

Missing data rates are low for most variables. Corresponding data elements in the MCMIS and Vermont crash files were reasonably consistent, though all cases reported as truck with trailer in the MCMIS file were recorded as tractor-semitrailers in the Vermont crash file.

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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.
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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. The problems were more severe in large jurisdictions and police departments. Each state also had issues specific to the nature of its own system. Some states also were overreporting some cases, often due to technical problems with duplicate records. [See references 2 to 34.] 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 Vermont. In recent years, Vermont has reported from 147 to 412 involvements annually to the MCMIS Crash file. The trend has been toward dramatically increasing numbers of cases reported, with 147 reported in 2005, 268 in 2006, and 412 reported in 2007. Vermont is the 49th largest state by population and in most years ranks 47th in terms of the number of annual truck and bus fatal involvements. The number of fatal truck and bus involvements in Vermont has ranged from 15 in 2003 and 14 in 2004 to 4 in 2007 and 6 in 2008.

Police accident report (PAR) data recorded in Vermont's statewide files as of August, 2009, were used in this analysis. The 2008 PAR file contains the crash records for 27,122 units (primarily vehicles, but it also includes records for witnesses and pedestrians).

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 Vermont was obtained for the most recent year available, which was 2008. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the Vermont 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 Vermont.

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.

Evaluation of reporting from Vermont to the MCMIS Crash file was unusually uncertain and produced unexpected results. The number of records identified by the procedures used was high in relationship to the number of fatal involvements. The number of fatal involvements was verified independently with the Fatality Analysis Reporting System (FARS) file, which is a census of all fatal crash involvements in the U.S. But the number of crashes reportable as towaway was unusually large in relation to the number of fatal involvements, disproportionately large relative to what has been observed in other states. Also, the number of involvements in which an injured person was transported for treatment was much lower than the expected number. The information available in the computerized Vermont crash data was more limited than in many other states. This data limitation may explain the problems encountered in identifying crash involvements that meet the MCMIS reporting criteria.

Because of the data limitations and the consequent problem in identifying crash involvements that we could be confident truly meet the reporting criteria, it was not possible to do a full evaluation of how completely MCMIS crashes from Vermont are reported. However, it is possible to identify a subset of crashes that have a very high probability of meeting the reporting criteria, so the evaluation of reporting completeness is confined to those cases. The evaluation of the missing data rates and the consistency of the data reported was also performed.

The following sections describe the data preparation that was performed on the MCMIS and Vermont crashes files, the process of matching them to identify the records within the Vermont file that were reported to MCMIS, and the problem of identifying reportable crashes in the Vermont crash file data. A way around the problem of identifying the full set of reportable crashes is proposed, which simply selects a set of crash involvements that has a very high probability of being reportable. The evaluation of how completely Vermont reports to the MCMIS crash file is limited to this high-severity subset. Finally, results are presented regarding the quality of the data reported.

2. Data Preparation

The Vermont PAR file and MCMIS Crash file each required some preparation before the Vermont records in the MCMIS Crash file could be matched to the Vermont PAR file. In the case of the MCMIS Crash file, the only processing necessary was to extract records reported from Vermont and to eliminate duplicate records.

The Vermont PAR file required more extensive work 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 2008 MCMIS Crash file as of June 9, 2009, was used to identify records submitted from Vermont. For calendar year 2008 there were 269 cases reported to the file from Vermont. An analysis file was constructed using all variables in the MCMIS file. The analysis file was then 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 examined for identical values on accident number, accident date/time, county, city, street, vehicle license number, and driver license number, even though their vehicle sequence numbers were different. The purpose is to identify cases with multiple records for the same vehicle and driver within a given accident. No such duplicates were found. The resulting MCMIS file contains 269 unique records.

2.2 Vermont Police Accident Report File

The Vermont PAR data for 2008 (as of August 2009) was obtained from the state. The data were stored as multiple text files, representing Accident, Vehicle, and Person information. The file contained records for 13,749 traffic crashes involving 27,122 units. Data for the PAR file are coded from the State of Vermont Uniform Crash Report completed by police officers.

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). Case numbers were recorded in an inconsistent format, so there was some reason to suspect duplicate records based on similar, but not identical, number formats. For example, some records contained alpha characters and dashes, and others did not. It appears that incident number is not pre-printed on the crash report, but assigned by the reporting agency. Instructions in the manual are “Enter the incident number your agency assigned to the crash.” The file was examined for duplicate records based on identical case number and vehicle number. No such instances were found.

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 accident date/time, crash county, city, vehicle registration number, and vehicle identification number (VIN). Based on the above algorithm, one pair of duplicate records was found. Examination of the records found that vehicle number differed between the records, but most other variables in the two records were identical. Since the major vehicle and driver variables were identical, these records were considered duplicates. The second record may have been mistakenly entered during the process of updating certain variables. Since it was not possible to tell which member was the correct one, the member with the fewest unrecorded variables was kept, and the other one deleted. After deleting one record the resulting PAR file has 27,121 unique records.

3. Matching Process

The next step involved matching records from the Vermont PAR file to corresponding records from the MCMIS file. There were 269 Vermont records from the MCMIS file available for

matching, and 27,121 records from the Vermont PAR file. All records from the Vermont 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. Crash Number, used to uniquely identify a crash in the Vermont PAR data, and Report Number in the MCMIS Crash file, are obvious first choices. Crash Number in the Vermont PAR file is a 14-digit alphanumeric field, while 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 (VT, in this case), followed by ten digits. Crash Number or incident number is assigned by each reporting agency (in some states, the crash reports have a pre-printed crash report number), and took a variety of different formats. There did not appear to be any relationship between the PAR and MCMIS report numbers, so this variable could not 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. Route Number in the Vermont data identifies the state route number of the road on which the crash occurred but it was unrecorded in over 26 percent of PAR cases. Moreover, the value was recorded in a different format from Crash Street in the MCMIS data. Reporting Officer's Badge Number was not available in the PAR data. Thus, these variables could not be used in the matching process, though Route was used in some cases to verify matches made by other means.

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. All of these variables were present in the PAR file, except for driver license number. Vehicle Registration Number was unrecorded approximately 16 percent of the time in the PAR data, but was complete in the MCMIS file. The driver-related variables were unrecorded in 20 to 24 percent of PAR cases. Both were always recorded in the MCMIS file. VIN was unrecorded in 16.4 percent of PAR cases, but was complete in the MCMIS file.

The match was performed in five steps, using the available variables. At each 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 crash date (month, day), crash time (hour, minute), county, city, vehicle license number, and driver date of birth. The second match step dropped city as well as vehicle license number and driver date of birth, and matched on crash date, crash time, county, VIN, and driver last name. After some experimentation, the third match step included crash date and driver last name. The variables used in the final attempt at a computer-based match were crash date and vehicle license plate number, resulting in only one matched case. An attempt was made to hand-match the remaining unmatched cases by reviewing all cases in the PAR file, and determining if any vehicle in a crash on the given crash date matched the MCMIS case. These hand-matches resulted in matching four additional cases in the fifth match. All matches made in steps two through five were also individually verified, based on additional variables.

In total, this process resulted in matching 97.4 percent of the MCMIS records to the PAR file. Seven cases could not be matched. Six of these cases may be duplicate records in the MCMIS file, as a somewhat similar MCMIS record had already been matched to a PAR record with a different crash number. Table 1 shows the variables used in each match step and the number of records matched at each step.

Table 1 Steps in MCMIS/Vermont PAR File Match, 2008

Step	Matching variables	Cases matched
Match 1	Crash date (month, day), crash time (hour, minute), county, city, vehicle license number, and driver date of birth.	230
Match 2	Crash date, crash time, county, VIN, and driver last name.	19
Match 3	Crash date, driver last name	8
Match 4	Crash date, vehicle license plate number	1
Match 5	Hand-matched using all available variables	4
Total cases matched		262

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 262 matches, representing 97.4 percent of the 269 records reported to MCMIS.

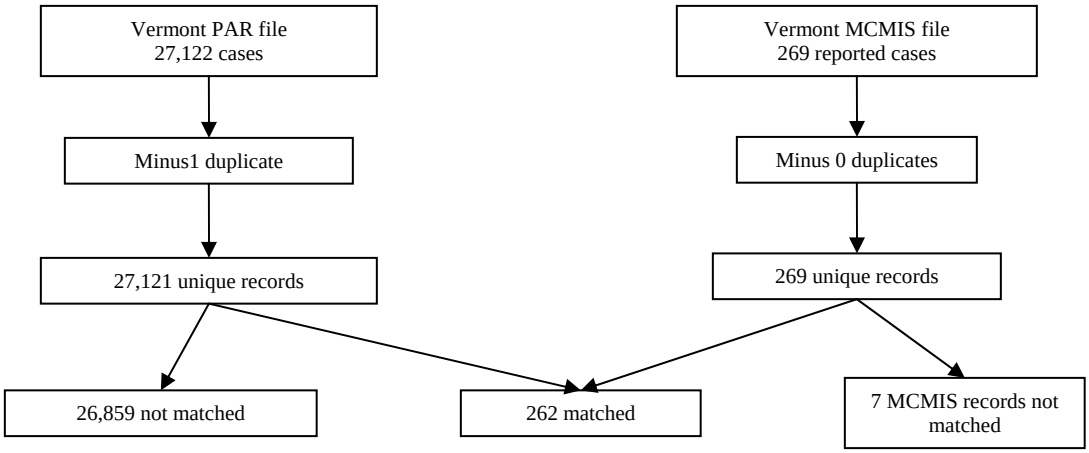

Figure 1 Case Flow in MCMIS/Vermont Crash File Match

Of the 262 matched cases, 248 apparently met the MCMIS reporting criteria (reportable), as well as that could be determined using the data supplied, and 14 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

4.1.1 Crash severity

The next step in the evaluation of crash reporting is to identify records in the Vermont data that qualified for reporting to the MCMIS Crash file. We note at the outset of this discussion that

identification of reportable records using the data available in the Vermont crash file was problematic, and the number of records identified by the usual methods is likely too high. There were critical issues with the information available to identify injured/transported and towed/disabled crashes, which are discussed below.

Records are selected as reportable using the information available in the computerized crash files that were sent by Vermont. 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 independent of any prior selection by the state being evaluated. This approach is necessary to determine 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 or crashes that meet the MCMIS selection criteria. This is the approach taken by Vermont. A section of the crash report is designated as "Large Truck/Bus (Commercial Motor Vehicle)" and contains fields used to identify the carrier and information about any hazardous cargo. 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. The method used for the vehicle and crash severity criteria are each discussed in turn.

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.

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 Vermont Person file includes information about the injury severity for each person involved in the crash. Vermont classifies injury using the common KABCO scale, where injuries are classified as fatal, incapacitating, nonincapacitating but evident, complaint of pain but not evident, and none. During the analysis, it was found that the Vermont Person file

includes records for a number of categories of persons that were not involved in the crash, including witnesses, vehicle owners, and the last known previous operator. Thus, it was necessary to filter these cases out in order to determine whether a crash involved an injury.

Determining whether an injured person was transported for immediate medical attention required using the Destination Hospital field. This field is recorded at the accident level; that is, the officer records the name of the medical facility where persons involved in the crash were transported. While Destination Hospital is recorded at the accident level (we assume this means that a person in the crash was transported to a hospital), the data are actually included in the vehicle file. It was assumed that this information could be used to identify crashes in which an injured person was transported for care. Specifically, if the accident involved an injured person, and a valid hospital code was entered in the hospital field, then the crash was considered to meet the injured/transported criteria.

Applying this method to identify crashes in which an injured person was transported produced percentages that seem too low. Only about 82 percent of crashes in which someone suffered incapacitating injuries included a hospital coded, indicating that someone was transported for medical attention. And only 50.0 percent of crashes for which a non-capacitating injury was recorded also had someone transported for medical treatment. These percentages seem low in comparison with what has been observed in other states. When we compared these results with results from the NASS GES file for 2008, the proportions transported in Vermont were significantly lower than the national experience. In the GES file, which is a nationally representative survey of all police reported crashes, over 95 percent of crashes in which the maximum injury severity was an incapacitating injury had someone transported for treatment. The proportions for non-incapacitating were 75.1 percent and 52.2 percent respectively. Each of these proportions is substantially higher than what is derived from the Vermont crash file (Table 3). The unusually low percentages from Vermont suggests that the hospital information may be under-recorded, that is, that the correct information is not entered onto the crash report in a substantial number of cases. Since the destination hospital data is the only indication that a person was transported, there is no way to cross-check the data.

Table 3 Proportion of Transported Nonfatal Injuries Crashes Involving MCMIS-Reportable Vehicles

Crash severity	Vermont 2008	GES 2008
Incapacitating	81.8	95.8
Non-incapacitating	50.0	75.1
Possible	22.9	52.2
All severities	48.2	66.5

The Vermont PAR data also includes information needed to identify crashes in which a vehicle was towed from the scene. This information is equally problematic. Whether the vehicle was towed is captured in a text field with the name of the tow operator. There is no variable that captures damage severity to the vehicles, which could be used to cross-check the towed by information, only one that indicates the point of contact. And there is no variable that captures directly whether the vehicle was towed or not. The only indication that a vehicle was towed is the text string that identifies who towed the vehicle. This field (towed_by) is blank in 70.7

percent of vehicle records. In most of the remaining records, there is a string that appears to be the name of a tow company, but there are also some ambiguous entries, such as personal names. Do the names indicate that the person towed the vehicle away, or that he drove it away? Other entries seem to indicate the vehicle was not towed, such as "drive away," "Driven By Operator," "Driver," though some are ambiguous also, such as "Left at residence" and "Driver Made Arrangements." Does that mean the driver arranged to have the vehicle towed? Or that the driver arranged for the vehicle to be driven away? In the absence of information about vehicle damage severity, there is no supporting evidence to judge. Unfortunately the towed by information does not unambiguously indicate whether the vehicle was towed or not, and in the absence of vehicle damage information, it is impossible to tell if the vehicle was disabled. The manual states that the tow information is important, particularly when the crash involves a commercial vehicle.

We reviewed all of the strings that were entered into the towed-by field and developed an algorithm that ignored all cases in which the text seemed to indicate the vehicle was not towed. Nevertheless, when we used the remaining "towed by" information to identify crashes in which a vehicle was towed, the result was that a relatively high proportion of crashes were identified as crashes in which at least one vehicle was towed. Table 4 shows that, overall, 43.1 percent of crashes in which a MCMIS-reportable vehicle was involved resulted in at least one towed vehicle, when the towed by information is used. This is substantially higher than the 26.5 percent proportion determined from the GES crash file, again for MCMIS-reportable vehicles. While GES shows a somewhat higher rate for incapacitating crashes, the rate is lower for crashes in which the most severe injury was non-incapacitating or possible. Note that almost three-quarters of crashes in the Vermont data in which the most severe injury was a possible injury, included indication that a vehicle was towed in the towed-by field, compared to only 54.4 percent in the national data. Over 35 percent of no-injury crashes apparently involved a towed vehicle, compared to only 16.9 percent—less than half—in the GES crash file for 2008.

Table 4 Proportion of Crashes with Towed/Disabled Vehicles
Crashes Involving MCMIS-Reportable Vehicles

Most severe injury in crash	Vermont 2008	GES 2008
Fatal	100.0	91.2
Incapacitating	77.3	89.0
Non-incapacitating	85.4	78.0
Possible	74.3	54.4
No Injury	35.4	16.9
Unknown	25.0	77.9
Not recorded	45.8	40.4
Total	43.1	26.5

These results suggest that using the only information available in the Vermont crash file to identify qualifying nonfatal crashes results in an underestimate of injury/transported crashes and an overestimate of towed/disabled crashes.

This finding is further reinforced by comparing the distribution of fatal, injured/transported, and towed/disabled involvements in Vermont with the results from other states and from the national experience as represented by GES. Table 5 shows the MCMIS crash severity distributions in

several states and GES, in comparison with the distribution in Vermont using the hospital and towed-by fields. The distribution in Vermont differs markedly from the other states and from GES. The proportion of crashes classified as injured/transported in Vermont is less than half that in the other states, while the proportion of towed/disabled is 20 to over 30 percentage points higher.

Table 5 Comparison of Distribution of MCMIS Reportable Crash Severity in Vermont, Selected States, and GES

Reportable cases	Tenn-essee 2004	Missouri 2005	Ohio 2005	Louis-siana 2005	South Dakota 2005	Okla-homa 2007	GES 2008	Vermont
Fatal	2.6	3.0	2.3	3.3	4.2	3.2	2.1	1.8
Injured/trans	36.2	36.6	44.1	44.8	33.1	36.5	40.6	15.9
Towed/disabled	61.3	60.4	53.6	51.8	62.7	60.4	57.4	82.4

Furthermore, when we developed the full selection algorithm using the variables, the result identified 397 crash involvements as meeting the MCMIS crash file selection criteria. Again, this number seems significantly out of proportion to the number of fatal crash involvements in Vermont. UMTRI has independently developed a method of estimating the number of nonfatal crash involvements that should be reported from a state, given the number of fatal involvements.[35] Fatal crash involvements are typically known with a very high degree of certainty, simply because they are so serious. In the case of Vermont in 2008, the UMTRI prediction method predicts that the 7 fatal truck and bus involvements in the Vermont crash file for 2008 implies that 197 nonfatal crash involvements would have also occurred, with a 90% prediction interval ranging from 90 to 432.

While the 397 estimated above falls within the prediction interval, it is very high relative to the number of fatal involvements. Taken in combination with the fact that the proportions of injury/transported and towed/disabled have been shown to be substantially different from the national experience, leads us to question the accuracy of a selection algorithm using the unvalidated destination hospital and towed-by fields. Therefore we conclude that an evaluation of reporting completeness using the hospital and towed-by fields to identify reportable cases would significantly overestimate the number of reportable cases. This would not be useful because it would be based on a set of cases that were likely misidentified.

Accordingly, we decided to focus on a subset of crashes that can be identified reliably and have a high probability of being reportable. Injury severity, particularly more serious injuries, are likely to be reported reliably. Analysis of the 2008 GES crash file shows that 99.1 percent of crashes involving A-injuries, and 91.9 percent of crashes involving B-injuries meet the MCMIS reporting criteria. These crash involvements qualify as reportable either because an injured person was transported for medical attention or because a vehicle was towed due to disabling damage. Focusing on crashes involving K (fatal), A (incapacitating), or B (nonincapacitating but evident) injuries takes advantage of the fact that crashes with a serious injury also are highly likely to include vehicles damaged enough to require towing. Thus, selecting crash involvements with K, A, or B injuries identifies a subset in which 94.7 percent or more qualify for reporting to the MCMIS Crash file. We can be confident that they are reportable, even without looking at the hospital or towed-by fields.

It should be clearly understood that the KAB subset is only a portion of the true number of reportable cases. From Table 5, we would estimate that they account for only 40 to 50 percent of the full number of reportable cases. But at least, the subset provides the opportunity to evaluate usefully crash reporting.

For simplicity's sake, the subset of crashes evaluated here will be referred to as serious crashes in this report. It should be kept in mind that the evaluation of reporting rates is limited to this subset.

4.1.2 MCMIS reportable vehicles

Having identified crashes by crash severity, the next step is to identify vehicles that qualify for reporting to the MCMIS Crash file. A Unit Type field in the crash file classifies vehicles among 24 distinct types. It appears this variable is added in post-crash case processing by the state, since it is not part of the paper crash report. Unit Type was recorded for all cases in the PAR file.

Some of the vehicle types in the Unit Type variable are somewhat ambiguous as to whether they identify qualifying vehicles. These types include Pickup Truck, Panel Truck, Van, and Buses where the Vehicle Configuration variable from the Commercial Vehicle section was left unrecorded. Some of these vehicles may actually have GVWRs greater than 10,000 pounds. Decoding the VIN can show whether the vehicle meets the GVWR standard, or qualifies as a bus. An examination of 1,530 such vehicles with VINs found 125 vehicles that met the GVWR standard or were valid buses. These vehicles were added to the set of MCMIS-qualifying vehicles. Table 6 shows the code levels of the Unit Type variable that meet the vehicle criteria.

Table 6 Relevant Unit Type Codes in Vermont PAR file

Trucks
Logging truck
Van (where GVWR>10,000 lbs.)
Other truck (where GVWR>10,000 lbs.)
Panel truck (where GVWR>10,000 lbs.)
Pickup truck (where GVWR>10,000 lbs.)
SUT
Tractor/twin trailers
Tractor/trailer
Truck/tractor (bobtail)
Unknown (heavy truck)
Buses
Bus (where vehicle configuration or VIN identified as a bus)
Van (identified as a bus)
Other (identified as a bus)
Pickup truck (identified as a bus)

In addition to these vehicle types, any vehicle, regardless of size, displaying a hazardous materials placard, also meets the MCMIS vehicle type definition. Vermont's crash form includes fields in the commercial vehicle section pertaining to whether a vehicle was placarded for transporting hazmat, the hazmat class number (1-digit) and the 4-digit hazmat number. In

addition, the Vehicle Configuration variable in that section includes a code for "any 4-tire vehicle with Placard." These variables were used to identify vehicles transporting hazmat.

In total, there were 111 vehicles identified as eligible trucks and buses in crashes with a K, A-, or B- injury in the Vermont PAR data. Table 7 shows the distribution by vehicle type. Medium or heavy trucks accounted for 91 percent of the vehicles, while 9.0 percent are buses. No light vehicles with hazmat placards were involved in the serious crashes used for the evaluation.

Table 7 Vehicles Meeting MCMIS Accident and Vehicle Criteria, Vermont PAR File, 2008

Vehicle type	N	%
Truck	101	91.0
Bus	10	9.0
Other, transporting hazmat	0	0.0
Total	111	100.0

Implementing the eligible vehicle and crash severity filters identified a total of 111 cases in the Vermont crash data in 2008. There were 111 qualifying vehicles—either a truck or bus—involved in a crash that included either a fatality, an incapacitating injury (A), or a non-incapacitating but evident injury (B). As noted above, this number likely underestimates somewhat the true number of reportable records. These 111 records, which are highly likely to be reportable (98 percent or more), will be the subject of the evaluation of factors affecting reporting.

Table 8 Focused Set of Reportable Records in Vermont Crash File, 2008

	Most serious injury in crash			
MCMIS Vehicle type	Fatal	A-injury	B-injury	Total
Truck	7	20	74	101
Bus	0	2	8	10
Hazmat placard	0	0	0	0
Total	7	22	82	111

5. Factors Associated with Reporting

The process described in section 4 identified 111 records in the 2008Vermont crash file as meeting the MCMIS Crash file reporting criteria. This is a subset of the true number of reportable cases, because, as explained in section 4, we were not confident that we could identify reliably all the cases that met the MCMIS reporting criteria. Thus, we focus on the reporting of the 111 records that we have high confidence met the MCMIS reporting criteria. Of these records, 72, or 64.9 percent, were actually reported to the MCMIS Crash file. This section provides a discussion of factors that apparently affected the successful identification and reporting of records to the MCMIS Crash file.

5.1 Overreporting

The state evaluations typically include a section on overreporting of cases, that is, a discussion of the number of cases reported the MCMIS Crash file that did not qualify for reporting. However,

given the uncertainties in identifying reportable cases from Vermont, it is not possible to identify records that should not have been reported. They may exist, but the information to support the classification is not available.

5.2 Case Processing

Delays in transmitting cases may partially account for the incompleteness of the MCMIS Crash file. Reporting rates are generally higher in earlier months and lower in later months. Table 9 shows reporting rates according to month of the crash. Reporting rates for the serious crashes considered in this report were all over 75 percent from January through April, compared with the overall rate of 64.9 percent. Rates were particularly low in three months: 16.7 percent for crashes in August, 37.5 percent in May and 40.0 percent in June.

Table 9 Reporting Rate by Accident Month in Vermont Crash File, 2008

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	13	76.9	3	7.7
February	13	76.9	3	7.7
March	14	78.6	3	7.7
April	9	77.8	2	5.1
May	8	37.5	5	12.8
June	5	40.0	3	7.7
July	10	70.0	3	7.7
August	6	16.7	5	12.8
September	7	85.7	1	2.6
October	10	50.0	5	12.8
November	6	66.7	2	5.1
December	10	60.0	4	10.3
Total	111	64.9	39	100.0

5.3 Reporting Criteria

This section presents the results of examining reporting rates by the factors—crash severity and vehicle type—that are used to determine if a specific crash involvement is reportable. In the current evaluation, crash severity is restricted to K, A-, and B-injury crashes because these are the ones we can be sure are reportable. This analysis is intended to help identify characteristics of the vehicle or crash that are more likely to trigger the process that results in a reported case.

Table 10 shows reporting rates, the number of unreported cases, and the proportion of unreported cases for each level of the MCMIS crash severity criteria. Traffic crashes that resulted in a fatality were reported at the highest rate, with 71.4 percent of such crash involvements reported. The two less-severe levels of crash severity were reported at lower rates. Almost 95 percent of the unreported involvements did not include a fatality. B-injury crashes were actually reported at a somewhat higher rate than A-injury crashes. Note that the reporting rates are lower for less serious crashes. That is, lower severity crashes are less likely to be recognized as meeting the

requirements of the MCMIS Crash file. The differences, however, are small, given the number of cases.

Table 10 Reporting Rate by MCMIS Crash Severity, Vermont 2008

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	7	71.4	2	5.1
Incapacitating (A)	22	54.5	10	25.6
Non-incapacitating (B)	82	67.1	27	69.2
Total	111	64.9	39	100.0

The second component of the MCMIS Crash file criteria is the vehicle type. As described above, trucks, buses, and other vehicles transporting sufficient amounts of hazmat to require a placard all meet the reporting requirements. There were no light vehicles transporting hazmat among the serious crashes evaluated in this report, so only reporting rates for trucks and buses are considered here. Table 11 shows the rates for the different general types of vehicles. The reporting rate for trucks was 66.3 percent, close to the overall rate of 64.9 percent, which is expected since trucks account for 101 of the 111 total reportable vehicles. The reporting rate for buses is 50.0 percent, somewhat lower than the rate for trucks. This difference is not statistically significant, because of the small number of cases, but it is consistent with the pattern observed in other states of bus involvements reported at a lower rate than truck.

Table 11 Reporting Rate by MCMIS Vehicle Class, Vermont 2008

MCMIS vehicle class	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck	101	66.3	34	87.2
Bus	10	50.0	5	12.8
Total	111	64.9	39	100.0

Table 12 provides more detail about the effect of vehicle configuration on reporting rates, showing rates by each level of the unit type field in Vermont. The highest reporting rates are for the biggest vehicles. The rates are highest for single unit trucks, tractor/trailers, and truck/tractors. Large trucks are more reliably recognized as meeting the reporting requirements, while smaller trucks, which also qualify, are more often overlooked. Qualifying pickups, whose VINs show that they meet the 10,000 GVWR threshold, are reported at only a 10.5 percent rate. These vehicles account for 43.6 percent of unreported cases.

Table 12 Reporting Rate by Police-Reported Vehicle Configuration, Vermont 2008

Unit type	Reportable cases	Reporting rate	Unreported	% of total unreported
Pickup truck (GVWR>10,000 lbs)	19	10.5	17	43.6
Logging truck	1	0.0	1	2.6
Single unit truck	33	78.8	7	17.9
Tractor/trailer	44	81.8	8	20.5
Truck/tractor (bobtail)	1	100.0	0	0.0
Other	3	33.3	2	5.1
Unknown heavy truck	1	100.0	0	0.0
Bus	9	55.6	4	10.3
Total	111	64.9	39	100.0

Reporting rates, which are a measure of how reliably reportable records are recognized as meeting the MCMIS reporting criteria, vary by both the type of vehicle and by the severity of the crash. The effects do not seem to be additive—bus rates are low for both crash severities and for trucks, the pattern largely follows that for crash severity by itself. (See Table 13.)

Table 13 Reporting Rate by Crash Severity and Vehicle Type, Vermont 2008

Crash Severity	Truck	Bus	Total
Fatal	71.4	n/a	71.4
A-injury	55.0	50.0	54.5
B-injury	68.9	50.0	67.1
Total	66.3	50.0	64.9

5.4 Variables from the CMV Supplement

Vermont collects the additional data required for the MCMIS crash file in a special section of the crash report. The reporting officer is instructed to complete the form for any vehicle that meets the MCMIS reporting requirements. Those reporting requirements are accurately given.

Reporting rates vary significantly by how many of the CMV variables are completed. Cases in which most of the fields were filled in were reported at a high rate, much higher than the overall rate. Where many or most of the fields were filled out, 80.0 and 87.5 percent of reportable cases were reported. When only a few of the fields were filled in, less than 30 percent were reported. Most tellingly, none of the 21 records from the set of serious crash involvements considered here that had none of the CMV fields completed were reported to the MCMIS crash file. It appears that completing some portion of the CMV supplemental area is a necessary condition for reporting to the MCMIS crash file, but not sufficient. The more fields that are filled in, the more likely the record is to be reported.

Table 14 Reporting Rates by CMV Variables Recorded, Vermont 2008

CMV variables	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
None recorded	21	0.0	21	53.8
Few recorded	7	28.6	5	12.8
Many recorded	35	80.0	7	17.9
Most recorded	48	87.5	6	15.4
Total	111	64.9	39	100.0

5.5 License state

This comparison uses license state as a surrogate (imperfect of course) for involvement in interstate commerce, to see if vehicles clearly involved in interstate commerce are more or less likely to be reported to the national crash file, maintained by regulator of trucks and buses involved in interstate commerce. Vehicles with out-of-state licenses were somewhat more likely to be reported than in-state licensed vehicles, 75.6 percent to 58.5 percent. The in-state licensed vehicles accounted for almost 70 percent of un-reported cases, so this is an area that could contribute to a substantial improvement in the overall reporting rate.

Table 15 Reporting Rate by License State
Vermont 2008

License state	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
In-state	65	58.5	27	69.2
Out-state	45	75.6	11	28.2
Unrecorded	1	0.0	1	2.6
Total	111	64.9	39	100.0

5.6 Reporting Agency[1]

In addition to the reporting criteria, reporting rates may reflect differences in the type of enforcement agency that investigated the crash. The level and frequency of training or the intensity of supervision may also vary. Such differences can serve as a guide for directing resources to areas that would produce the greatest improvement. This section examines reporting rates by agency.

Reporting rates vary significantly by the type of investigating agency (Table 16). There are three primary levels of investigating agencies identified in the Vermont crash file: State police, county sheriff, and city police. Crashes covered by the State police have the highest reporting rate, at 74.0 percent. The State police also cover about 70 percent of reportable crash involvements, so

[1] This section typically also examines rates by crash location, to determine if population density or urbanization affect reporting rates. The number of cases in the focused evaluation for this report is too few to provide meaningful results.

despite their relatively high rate, the underreporting of crash involvements covered by state police accounts for about half of all the unreported crash involvements. The reporting rate for county sheriffs is 25.0 percent and for city police at 46.7 percent. It is likely the differences in training and enforcement duties account for the marked differences in reporting rates among the agencies.

Table 16 Reporting Rate by Investigating Agency, Vermont 2008

Investigating agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
State police	77	74.0	20	51.3
County Sheriff	4	25.0	3	7.7
City Police	30	46.7	16	41.0
Total	111	64.9	39	100.0

5.7 Fire Occurrence

State evaluations typically include a short section showing reporting rates in relation to the occurrence of a vehicle fire in the crash. However, there were no such cases in the Vermont 2008 serious crashes used in the evaluation.

6. Data Quality and Reporting Latency of Reported Cases

In this section, we consider the quality of data reported to the MCMIS crash file, as well as reporting latency (elapsed time from crash occurrence to when the crash was reported). 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 state crash file and in the MCMIS Crash file. Inconsistencies can indicate problems in translating information recorded on the crash report to the values in the MCMIS Crash file.

In this section of the evaluation, all cases reported to the MCMIS crash file from Vermont for 2008 are used, since the purpose of the analysis is to examine the quality of the data as reported.

Table 17 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.

Variables with relatively high rates of missing data include road access and road trafficway. Rates for events two through four may appear to be high, but probably just reflect that crashes frequently include only one harmful event, the collision itself. The missing data rate for DOT number is calculated only for carriers coded as “Interstate,” which therefore must have a DOT number, but 4.9 percent of the records in MCMIS were found to be missing that information. Overall, the rates of missing data are exceptionally low, reflecting very complete data collection.

Table 17 Missing Data Rates for Selected MCMIS Crash File Variables, Vermont 2008

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	1.9
Accident hour	0.0	Event one	0.4
Accident minute	0.0	Event two	52.8
County	0.4	Event three	74.7
Body type	0.4	Event four	96.3
Configuration	0.4	Number of vehicles	0.0
GVWR class	0.4	Road access	69.5
DOT number *	4.9	Road surface	0.7
Carrier state	0.0	Road trafficway	69.9
Citation issued	0.0	Towaway	0.0
Driver date of birth	0.0	Truck or bus	0.0
Driver license number	0.7	Vehicle license number	0.0
Driver license state	0.0	Vehicle license state	0.0
Driver license class	0.0	VIN	0.0
Driver license valid	0.0	Weather	0.4

* Based on cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	6.3
Percentages of hazmat placarded vehicles only:	
Hazardous cargo release	4.8
Hazardous materials class (1-digit)	0.0
Hazardous materials class (4-digit)	4.8
Hazardous materials name	95.2

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 in 6.3 percent of cases. The other missing data rates shown are limited to the 21 records where the vehicle displayed a hazmat placard, indicating it was carrying hazmat. There was no missing data for the 1-digit hazmat class code, and only one of the 21 cases was missing hazmat cargo release and the 4-digit hazmat class. However, hazardous materials name was missing for 20 out of the 21 records (95.2 percent).

It is also useful to compare the values of variables in the MCMIS Crash file with the values of comparable variables in the Vermont crash file, to check for instances of inconsistency, which may indicate a problem in preparing the data for upload. This comparison was done for all substantive variables, other than those that were used to match records in the two files.

Overall, the result of the comparison showed that values in the Vermont crash file for most variables were translated without alteration to the MCMIS Crash file. For most variables there were only minor inconsistencies. In the light condition variable, four cases were coded daylight in the Vermont data, but left unrecorded in MCMIS. There was instance of inconsistency in the

weather variable; two cases with different values for road surface condition; and one difference on cargo body.

With respect to the hazmat variables, there were more cases that differed. Fifteen cases were coded “no” on hazmat placard, but left as unrecorded in MCMIS. There were two cases with different hazmat class (1-digit) codes, and two cases inconsistent on whether hazmat was released. But there were also 18 cases coded no hazmat released in the Vermont data, but which were left as unrecorded in MCMIS file. It is unfortunate that this information was not correctly transmitted to the MCMIS file, given the importance of hazmat in CMV crashes.

The only truly significant differences relate to handling of vehicle configuration. Table 18 shows the coding of vehicle configuration in the MCMIS Crash file in the left column with the corresponding unit type code from the Vermont crash data. Comparisons that show inconsistencies are shaded. The primary problem is tractor/semitrailers in the Vermont data being coded as truck trailer (straight truck with a trailer) in the MCMIS Crash file. There are a small number of other cases that are inconsistent between the two files, that total 17 records, but the truck/trailer problem primary concern.

Table 18 Comparison of Vehicle Configuration in MCMIS and Vermont Crash Files, 2008

Vehicle Configuration	Unit Type		
MCMIS Crash File	Vermont Crash File	Cases	%
Unrecorded	SUT	1	0.4
Light truck (HM placard)	Pickup truck	2	0.8
Bus (seats 9-15,incl dr)	Bus	2	0.8
Bus (seats >15,incl dr)	Bus	14	5.3
	Other	1	0.4
SUT, 2-axle, 6-tire	Other	5	1.9
	Pickup truck	5	1.9
	SUT	54	20.6
	Tractor/trailer	1	0.4
SUT, 3+ axles	Farm/constr equip	1	0.4
	Other	2	0.8
	SUT	34	13.0
	Tractor/trailer	2	0.8
	Unknown	1	0.4
Truck trailer	Tractor/trailer	43	16.4
Truck tractor (bobtail)	Pickup truck	1	0.4
	Truck/tractor (bobtail)	4	1.5
Tractor/semitrailer	Pickup truck	1	0.4
	SUT	2	0.8
	Tractor/trailer	79	30.2
Tractor/double	Tractor/twin trailers	1	0.4
Unknown heavy truck, >10,000 lbs. GVWR	Other	5	1.9
	SUT	1	0.4
Total		262	100.0

Reporting latency also reflects data quality. 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 2008 MCMIS Crash file as of June, 2009, approximately 180 days after the end of 2008, was used to identify records submitted from Vermont, so all 2008 cases should have been reported by that date. Figure 2 shows the cumulative percent of cases submitted by latency in days, i.e. the number of days between the crash date and the date the case was uploaded to the MCMIS Crash file. Crash reports are required to be submitted to the MCMIS Crash file within 90 days of the crash. Almost 80 percent of the records were submitted within 90 days of the crash. The median time between crash occurrence and record upload is about 42 days. Two-thirds are submitted within 56 days, and 90 percent were submitted within 121 days.

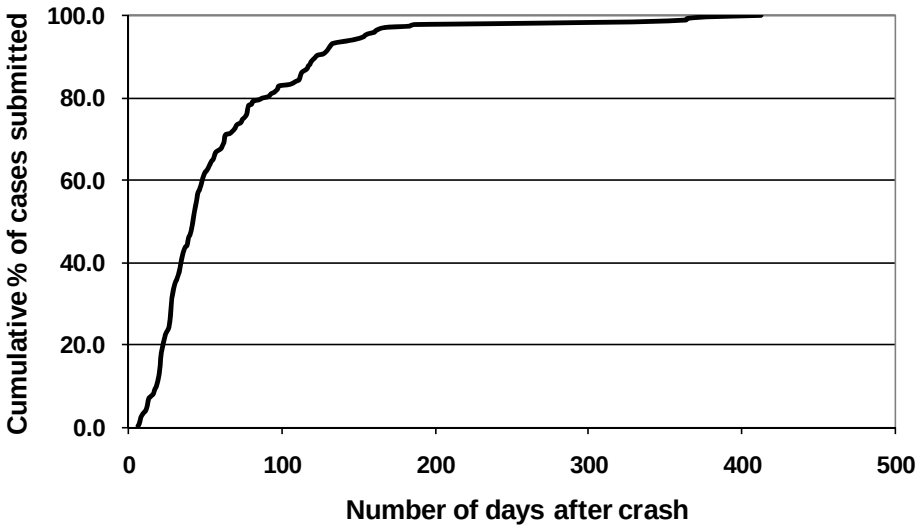

Figure 2 Cumulative Percent of Cases Submitted to MCMIS Crash File by Number of Days After Crash, Vermont 2008

The first date on which crash records from 2008 were uploaded was January 22, 2008, when two records were uploaded. On average, uploads occurred every 6.3 days between then and May 7, 2009, when the last upload occurred. An average of 3.6 records were uploaded per upload. There were a few uploads with between 10 and 18 records, and the largest single upload was of 22 records, but most uploads consisted only of a few records, with one record being the most common number uploaded.

7. Summary and Discussion

Preparing a suitable data file to evaluate the comprehensiveness of reporting from Vermont to the MCMIS Crash file presented unusual problems that required a creative solution. We typically develop an algorithm, using data from a state's crash file, to identify crash involvements that meet the MCMIS Crash file reporting criteria. This is accomplished using the state's vehicle configuration information, along with data on whether a person was injured and if so, was the person transported, and data on whether any vehicle was disabled, and, if so, whether it was towed. The Vermont crash file seemingly had information that would allow the development of such a selection process. However, when the selection was made, the number of cases seemed to be much too high, and the distribution of cases diverged significantly from what has been

observed in other states as well as from the national experience as represented by the GES file. The number of injured/transported involvements was proportionately too low, while the number of towed/disabled involvements was unexpectedly high.

Because the usual procedure produced a set of "reportable" records that we could not be confident was correct, we limited the evaluation to a subset of the involvements that had a very high probability of meeting the reporting criteria. These were crashes involving either a fatality, or an A- or B-injury. Analysis of the GES file showed that approximately 95 percent of these involvements meet at least one of the crash severity thresholds of the MCMIS reporting criteria.

Vehicles that meet the MCMIS standard were identified by using the Unit Type field primarily. Most of the code levels in that field can be sorted either as a vehicle that meets the description or does not. However, some of the code levels identify vehicles that arguably could meet the 10,000 lb. GVWR threshold. For these vehicle types, where there was a VIN available, we reviewed the VIN to determine the vehicle met the GVWR requirement. An expert in decoding VINs examined the VINs of 1,530 vehicles that were coded as Pickup Trucks, Panel Truck, Van or Bus. About 8 percent of these vehicles were included, either because they met the GVWR threshold or because they were identified as buses.

Limiting the evaluation just to crash involvements that included a K, A-, or B-injury, a total of 111 crash involvements were identified for evaluation. Of these 111 cases, 72 were reported to the MCMIS Crash file, for a reporting rate of 64.9 percent of this restricted subset.

The evaluation of factors that influenced reporting rates was limited to the subset of serious (K, A-, or B-injury) involvements. Fatal crash involvements were reported at a higher rate than the nonfatal, even though all of the nonfatal crashes were quite serious. These differences are consistent, though not statistically significant because of the small sample size. Trucks are more likely to be reported than buses, with only about half of the reportable bus involvements actually reported. Among truck involvements, the smallest trucks—vehicles coded as pickups even though their GVWR exceeded the 10,000 lb. threshold—were reported at a very low rate, but all other truck types were reported at rates that ranged from 78.8 percent to 100.0 percent, in the case of the single bobtail tractor.

Vermont collects much of the information uploaded to the MCMIS Crash file in a special section of the crash report, which the reporting officer is trained to complete if the vehicle and crash meet the reporting criteria. Analysis showed that the extent to which this information was filled in was highly influential in whether a crash was reported or not. No reportable cases in which all of the fields were left blank were reported. Cases in which only a few items were completed were reported at a 28.6 percent rate, but cases with many or most of the fields filled in were reported at a better than 80 percent rate. Clearly, how well the reporting officer recognizes cases that meet the reporting criteria is highly influential in determining whether a case is reported, though it is not decisive, since many cases with data in the CMV section were not uploaded.

The influence of the reporting officer may also be observed in two other comparisons. Vehicles with in-state licenses were less likely to be reported than those from out-of-state, possibly because out-of-state vehicles are most readily recognized as of interest to the special data collection for the Federal government. And, as in other states, it was observed that the reporting

rate for the state police was much higher than for crashes covered by either city police or county sheriffs. This difference could be because of training, enforcement focus, or experience.

In addition to problems in accurately identifying all reportable cases, there were some problems in the timeliness of reporting. Reportable crashes must be uploaded to the MCMIS Crash file within 90 days of occurrence, and about 80 percent of crashes were reported within that time frame.

With respect to the reported data itself, missing data rates for most fields reported to the MCMIS Crash file are quite low, though there were some problems. Data for road access and trafficway both were missing in about 70 percent of the records. Hazardous material name was missing in almost all hazmat records. Missing data rates for the other hazmat variables was very low, on the other hand.

Some inconsistencies between the data in the Vermont crash file and the record in MCMIS were also noted. For most variables, only a handful of cases were found that were inconsistent. A typical example is that four records differed on light condition—coded daylight in the Vermont crash file, but left unrecorded in the MCMIS file. The explanation could be that the Vermont record was updated, but that update not reflected in the record in MCMIS. A more significant difference occurred with respect to vehicle configuration. The crash report used by Vermont does not use the same code levels for configuration as are used in the MCMIS Crash file, so there must be some procedure to adapt the Vermont configuration list to the MCMIS list. For most of the MCMIS vehicle configuration levels, there were a handful of records that had an inconsistent Unit Type in the Vermont data. For example, two records in the MCMIS file classified as three-axle single unit trucks (SUTs) were coded as tractor-semitrailers in the Vermont crash data. Where just a few records are inconsistent, these may be simple mistakes and it is not known which record has the correct information. More serious, however, are the 43 records coded as truck/trailer in the MCMIS file, but tractor/trailer in the Vermont file. This seems to be a simple coding error, where the meaning of the truck/trailer code level in MCMIS is not clearly understood.

The primary problems noted, however, have to do with the way injured/transported persons and towed/disabled vehicles are identified. It appears that the method used in Vermont results in underreporting transported persons and overreporting towed vehicles. Reporting officers enter text strings, (translated into codes in the case of the Destination Hospital field for the computerized version of the data), and the meaning of the text string is inferred with respect to whether the person was transported or the vehicle towed due to damage. There is no other information that can be used to cross-check either field.

In the case of the towed-by field, a simple yes/no vehicle towed field, along with an estimate of vehicle damage severity, could be very valuable to officers in explicitly recording whether a vehicle was towed and why. A simple yes/no person transported field could also improve the identification of injured persons transported for medical attention (whether to a hospital or any other medical facility). These fields could allow cross-checking the data and improve the accuracy of identification. Moreover, if these fields were available, a computerized selection routine could be developed to automat selection of reportable cases, which would likely improve the reporting rates substantially.

Finally, it must be noted that a reporting rate of approximately 65 percent for serious crashes, coupled with the fact that reporting rates are usually higher for serious injury crashes than for towaway crashes, implies that the overall reporting rate is probably lower than 65 percent.

8. References

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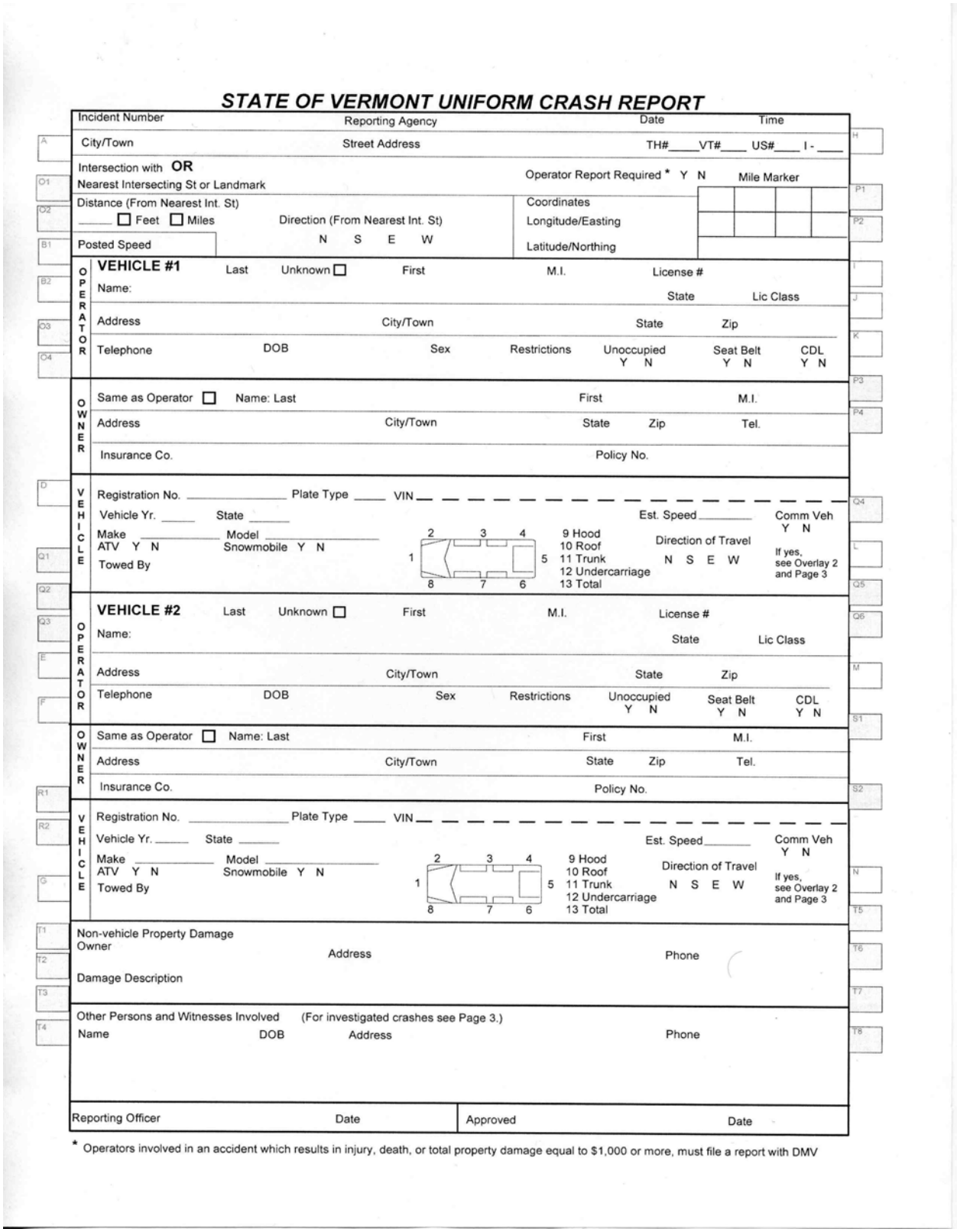
Appendix A Vermont Traffic Accident Reports



STATE OF VERMONT UNIFORM CRASH REPORT

Incident Number | Reporting Agency | Date | Time

City/Town | Street Address | TH#____VT#____ US#____ I - ____

Intersection with **OR**
Nearest Intersecting St or Landmark | Operator Report Required * Y N | Mile Marker

Distance (From Nearest Int. St)
____ ☐ Feet ☐ Miles | Direction (From Nearest Int. St) N S E W | Coordinates Longitude/Easting | Latitude/Northing

Posted Speed

OPERATOR — VEHICLE #1
Name: Last | Unknown ☐ | First | M.I. | License # | State | Lic Class
Address | City/Town | State | Zip
Telephone | DOB | Sex | Restrictions | Unoccupied Y N | Seat Belt Y N | CDL Y N

OWNER
Same as Operator ☐ | Name: Last | First | M.I.
Address | City/Town | State | Zip | Tel.
Insurance Co. | Policy No.

VEHICLE
Registration No. _____ Plate Type ____ VIN ____
Vehicle Yr. ____ State ____
Make _____ Model _____
ATV Y N | Snowmobile Y N
Towed By
Est. Speed _____ | Comm Veh Y N
Direction of Travel N S E W
If yes, see Overlay 2 and Page 3

9 Hood
10 Roof
11 Trunk
12 Undercarriage
13 Total

OPERATOR — VEHICLE #2
Name: Last | Unknown ☐ | First | M.I. | License # | State | Lic Class
Address | City/Town | State | Zip
Telephone | DOB | Sex | Restrictions | Unoccupied Y N | Seat Belt Y N | CDL Y N

OWNER
Same as Operator ☐ | Name: Last | First | M.I.
Address | City/Town | State | Zip | Tel.
Insurance Co. | Policy No.

VEHICLE
Registration No. _____ Plate Type ____ VIN ____
Vehicle Yr. ____ State ____
Make _____ Model _____
ATV Y N | Snowmobile Y N
Towed By
Est. Speed _____ | Comm Veh Y N
Direction of Travel N S E W
If yes, see Overlay 2 and Page 3

9 Hood
10 Roof
11 Trunk
12 Undercarriage
13 Total

Non-vehicle Property Damage
Owner | Address | Phone
Damage Description

Other Persons and Witnesses Involved (For investigated crashes see Page 3.)
Name | DOB | Address | Phone

Reporting Officer | Date | Approved | Date

* Operators involved in an accident which results in injury, death, or total property damage equal to $1,000 or more, must file a report with DMV

Incident Number _____

Crash Narrative

Reporting Agency _____

Officer's Signature _____

Additional Sheets Attached: Y N

Page 2

Incident Number_____

Vehicle Number _____ **Large Truck/Bus (Commercial Motor Vehicle)**

Carrier's Identification Numbers

US DOT_____ ICC MC_____ Interstate Carrier: ☐ State Name ____ State Number _____

Carrier's Name _____

Carrier's Address _____ City _____ State _____ Zip _____

Source: (Check all that apply) _____ Vehicle Side _____ Shipping Papers _____ Driver _____ Carrier

Vehicle Information

Axles on Vehicle (Including Trailers) _____ Gross Vehicle Wt Rating _____lbs or _____kg

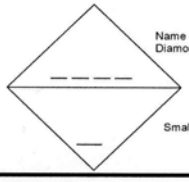
Length of Vehicle (Incl. Trailer) _____ft or _____meters Length of Trailer _____ft or _____meters

Trailer 1 License Number _____ State_____ Trailer 1 VIN Number _____

Trailer 2 License Number _____ State_____ Trailer 2 VIN Number _____

Hazardous Material

Placard: ☐ Spill: ☐



Non-commercial Trailer

Vehicle 1

Year ____ Make_____ Model_____ Plate No. _____ State _____

Vehicle 2

Year ____ Make_____ Model_____ Plate No. _____ State _____

Additional Operator Information

Alcohol Test
1. None Given
2. Refused
3. Blood/Serum
4. Urine
5. Other
6. Breath Preliminary
7. Breath Evidentiary

Vehicle 1 ☐ Test Result 0. ☐☐☐ BAC

Vehicle 2 ☐ Test Result 0. ☐☐☐ BAC

Drug Test
1. None Given
2. Refused
3. Blood/Serum
4. Urine
5. Other

Veh 1 ☐ Veh 2 ☐

Drug Test Result
1. Marijuana
2. Cocaine
3. Opiate
4. Amphetamine
5. PCP
6. Other
7. Pending

Veh 1 ☐☐ Veh 2 ☐☐

Citations issued - Veh 1

Ticket # ___ ___ ___ ___ ___ ___ ___ Violation Code ___ ___ ___

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

Citations issued - Veh 2

Ticket # ___ ___ ___ ___ ___ ___ ___ Violation Code ___ ___ ___

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

___ ___ ___ ___ ___ ___ ___ ___ ___ ___

EMS Run number **EMS Agency** **Destination Hospital**

Operators, Occupants, Pedestrians, Cyclists - Excluding Witnesses

Name	Veh #	Type	Sex	Age	Seat	Injury	Eject	Restr	Air Bag	Extract	P/C - Action	P/C - Location

CODES

Type
1. Operator
2. Occupant
3. Pedestrian
4. Bicyclist
5. Unknown

Seat Location

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

Injury
1. Fatal
2. Injury - Incapacitating
3. Injury - Non-incapacitating
4. Possible Injury
5. No injury
6. Unknown
7. Untimely Death

Restraint
0. Unknown
1. None Used
2. Shoulder Belt Only
3. Lap Belt Only
4. Shoulder and Lap Belt
5. Child Safety Restraint
6. Helmet Used - Eye Protection
7. Helmet Used - No Eye Prot.
8. Not Reported

Ejected
1. Not Ejected
2. Totally Ejected
3. Partially Ejected
4. Not Applicable
5. Unknown

Airbag Deployed:
1. Yes
2. No
3. Unknown

Extracted
1. Yes
2. No

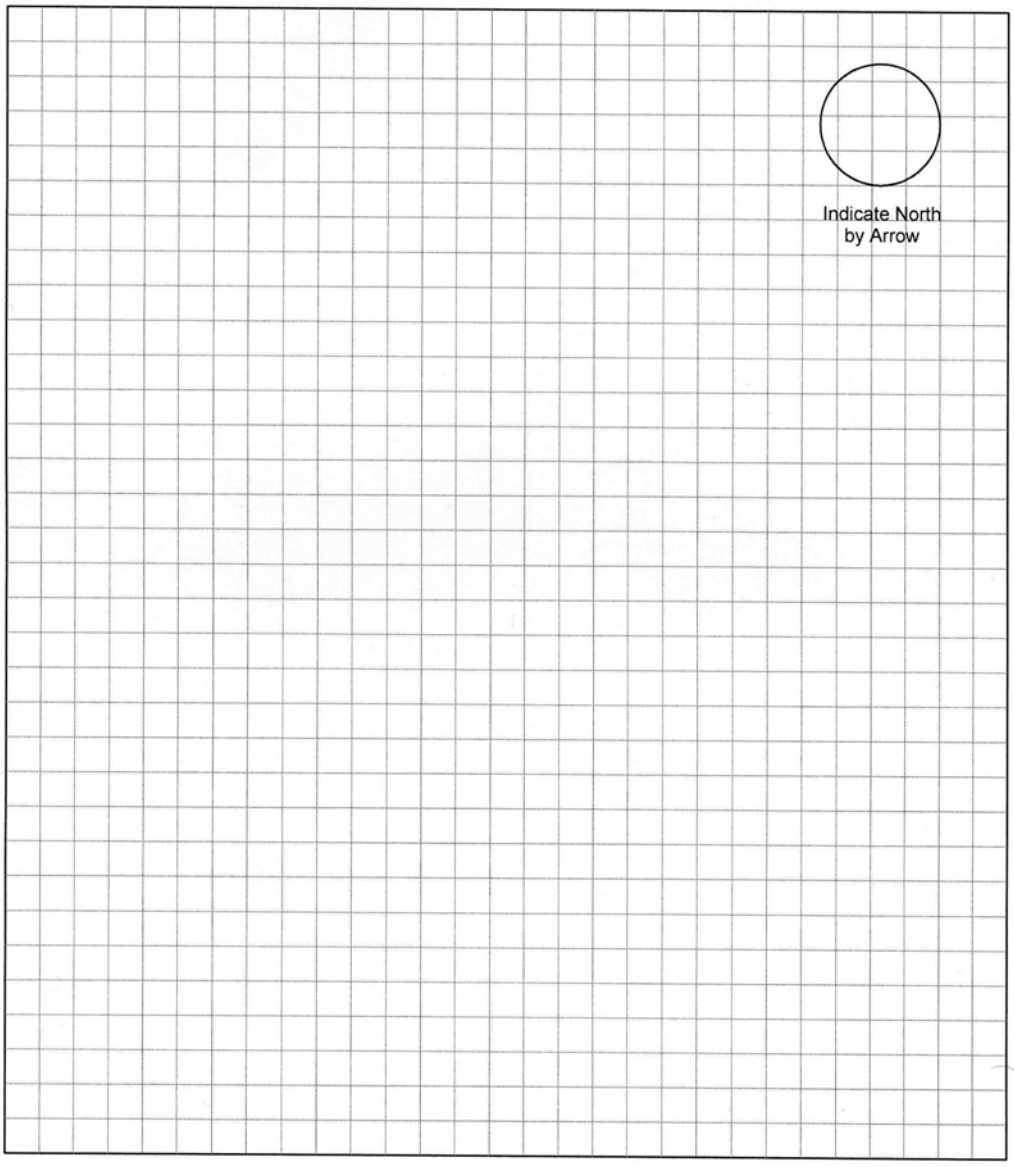
Pedestrian/Cyclist Codes on Overlay 1

Page 3

Crash Diagram

Incident Number _____

Vehicle Moved Y N



Additional Sheets Attached: Y N

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