EVALUATION OF MARYLAND CRASH DATA REPORTED TO MCMIS CRASH FILE

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Evaluation of Maryland Crash Data Reported to MCMIS Crash File

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16. Abstract

This document 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. Earlier studies showed that reporting to the MCMIS Crash file was significantly incomplete in other states. This report evaluates reporting to the MCMIS Crash file from the state of Maryland.

MCMIS Crash file records were matched to the Maryland Police Accident Report (PAR) file to determine the nature and extent of reporting. Overall, Maryland submitted 31.1% of its reportable crash involvements to the MCMIS Crash File in 2004. Reporting rates varied by crash month, vehicle type, crash severity, and reporting agency. Reporting rates were unusually low in November, December, and January. Reporting rates are 84.6% for fatal crashes, 56.0% for injury cases, and 15.6% for tow/disabled accidents which account for 77.3% of unreported cases. Thus, the reporting rate is mostly influenced by low reporting of reportable tow/disabled cases. Single trucks with 2 axles are reported 26.4% of the time, and school buses are reported 23.5% of the time. The state police reported 39.2% of cases they covered compared with 24.8% for the local police. The Baltimore City local police reported only 2% of reportable cases, and in addition had the largest percentage of unreported cases among local police agencies (18.5%).

Data quality is also reviewed. The MCMIS file is examined for missing data rates and the Maryland PAR file is compared to the MCMIS Crash file with respect to vehicle type for reportable and matched cases.

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1. Introduction

It is essential to assess the magnitude and characteristics of motor carrier crashes so that effective safety measures can be designed to prevent such crashes. For this purpose, the Motor Carrier Management Information System (MCMIS) Crash file was developed by the Federal Motor Carrier Safety Administration (FMCSA) to serve as a file of traffic crashes of specified severity involving trucks and buses. Its usefulness 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. However, the MCMIS Crash file is known to be incomplete. Preliminary studies conducted during earlier phases of MCMIS evaluations suggested that nationally, only about two-thirds of qualifying truck involvements were reported. The reporting rate for buses was found to be even lower, at about 40% [1] (see references at the end of the report). Reporting was more complete for severe crashes, with about 90% of truck fatal involvements and 65% of bus fatal involvements appearing in the file, but rates were much lower for less severe crashes.

Since the states are responsible for reporting qualifying crashes, the solution for underreporting must ultimately reside with the individual states. This report is part of a series of evaluations of reporting from each state. 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 [2, 3, 4, 5, 6, 7, 8, 9, 10]. 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 some overreporting of cases, often due to technical problems with duplicate records.

In this report, we focus on MCMIS Crash file reporting by Maryland. In recent years Maryland has ranked near the median in number of truck and bus fatal involvements, compared with other states. For the MCMIS Crash file to serve its intended purpose, all states should report vehicles that meet the MCMIS reporting criteria.

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

1. The complete police accident report file (PAR file hereafter) from Maryland was obtained for the most recent year available, 2004. This file was processed to identify all cases that qualified for reporting to the MCMIS Crash file.

2. All cases in the Maryland 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 Maryland.

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.

Police accident report (PAR) data recorded in Maryland's statewide files as of August 4, 2005, were used in this analysis. The 2004 PAR file contains the computerized records of 194,216 vehicles involved in 104,103 crashes that occurred in Maryland

2. Data Preparation

The Maryland PAR file and MCMIS Crash file each required some preparation before the Maryland records in the MCMIS Crash file could be matched to the Maryland PAR file. In the case of the MCMIS Crash file, the only processing necessary was to extract records reported from Maryland and to eliminate duplicate records. The Maryland PAR file required more extensive work, primarily to develop means of identifying cases that should have been reported to the MCMIS Crash file. This section discusses the methods used to prepare each file and some of the problems uncovered.

2.1 MCMIS Crash File

The 2004 MCMIS Crash file as of August 1, 2005, was used to identify records submitted from Maryland. For calendar year 2004 there were 1,670 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 such duplicate records was found. Upon further examination, accident hour differed, but accident minute was the same. They appeared to be the same vehicle, as vehicle identification number (VIN), license plate number, driver name and driver date of birth were identical. Since one case contained many unrecorded fields, it appears that the original record was updated. The record with the most recorded fields (and latest transaction date) was kept, and the other one excluded.

In addition, records were examined for identical values for accident date, time, crash county, and vehicle license number, even though their case numbers were perhaps different. One would not expect all of these variables to be identical between two cases. No duplicates were found. After eliminating the duplicate record identified above, the resulting MCMIS file contained 1,669 records.

2.2 Maryland PAR File

The Maryland PAR file for 2004 (dated August 4, 2005) was obtained from the state of Maryland. This file contains records for 104,103 crashes involving 194,216 vehicles. Data for the PAR file are coded from the State of Maryland Motor Vehicle Accident Report completed by police officers [11].

The PAR file was first examined for duplicate records. Inspection of report 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 0401274351 and 04-1274351, for example). A search for records with identical report numbers and VIN numbers found 84 pairs. However, further examination of these potential duplicate records revealed that although VIN was identical, the vehicle make, model, driver date of birth and driver license number variables were different in the majority of cases, implying they were truly different vehicles within the same accident. Another search was done based on report number, VIN, driver license number and driver date of birth. Only 22 duplicate records were found. In some records, one field was unknown on one record of the pair, and recorded in the other. In other cases, there were different valid values in the corresponding fields. These may have been updated records where the first one was not deleted. Thus, one member of each pair was deleted, as described below.

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, hour, minute, county, officer ID, driver license number, and VIN. (Municipality was not included as a location variable, as it was unrecorded in 85% of the cases). A total of 177 duplicate instances were found, representing 87 unique occurrences of the examined variables.

Duplicate pairs were examined more closely for any patterns that might explain why they were occurring. These records could be grouped into two categories: those where report number differed, and those where report number were identical. In the first group, where crash time, location, officer ID and driver license number were the same, but report number differed, one explanation could be 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. If a vehicle is reported as being in a second crash after the first one has stabilized, one would expect accident date, location, vehicle and driver 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 are identical, suggesting they are in fact duplicate records.

The second group of cases were identical on crash time, location, vehicle, and driver information and also had identical report numbers. Since there were differences between the two records in

the values of a few other fields, one record may have been an update. 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 the variables indicating when the records might have been updated or processed were unrecorded in all cases, the member of each pair with the largest vehicle_id (unique number assigned to each record in the vehicle file) was kept, and other members excluded. After deletion of 90 cases, the resulting PAR file has 194,126 records.

The next step in data preparation is to identify records that qualified for reporting to the MCMIS Crash file. It was necessary to develop a set of criteria using the variables in the Maryland PAR file to identify records that should have been reported. The purpose of the criteria 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 1.

Table 1. 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.

There are two primary ways states may identify eligible cases for MCMIS: (1) The officer is expected to understand the MCMIS reporting criteria and, for cases that qualify, is instructed to fill out a separate form or a designated area on the crash report itself. (2) All criteria are incorporated into the crash report form, so that state officials can then determine which cases should be submitted to the MCMIS Crash file.

Unlike several other states, Maryland does not have a separate form that the officer is expected to fill out if the crash meets the MCMIS criteria. Instead, there are vehicle-related variables on the main form that must be completed if a commercial vehicle is involved in the crash. The accident-level crash severity criteria are found elsewhere on the form. Thus, in Maryland it appears that the state makes the final determination of which cases are submitted to the MCMIS Crash file.

One set of instructions for officers that pertains to commercial vehicles states:

> To indicate that the accident you are reporting involves one or more commercial motor vehicles (6 wheels or more in contact with the roadway), place the letters "CVA" in the research block in capital letters. The placement of the "CVA" indicator will also require you to fill in additional information

in block #33 (Accident Description) regarding the number of axles for each <u>commercial vehicle only</u> and the GVW (Gross Vehicle Weight) of each <u>commercial vehicle only [12]</u>. [1]

A second instruction reads:

Completion of information in the COM. VEH. section, blocks 76-79, is required for accidents involving vehicles which meet either (or both) of the following conditions:
1) a truck with at least dual axles and 6 tires or
2) a bus with 16 or more seats including the driver's seat. [2]

Variables included in blocks 76-79 include DOT Number, ICC Number, Commercial Body Type, and CDL. Other variables that should be entered for commercial vehicles include Carrier Name and Address, Vehicle Removed By and Vehicle Removed To.

The vehicle definitions cited above generally correspond with MCMIS requirements. It appears that officers are responsible for determining which vehicles require filling out the Commercial Vehicle(CV)-specific variables. Failure to complete these variables may result in a case not being submitted to MCMIS. This hypothesis could be tested directly (see Reporting Criteria section of this report), as all of the CV-specific variables were present in the PAR file.

Maryland officials do not have to rely on recording of CV-specific variables to determine if a case should be submitted. Variables used to determine if a case qualifies for MCMIS submission (i.e. vehicle type, injury, transported to medical facility, and towed status) are supposed to be completed for all cases. However, since the CV-specific variables are among those required by MCMIS, not completing these data elements results in missing data elements in the Crash file.

Variables available in the Maryland PAR data permit the MCMIS Crash file criteria to be applied reasonably well. The Body_type variable appeared to be sufficient for identifying eligible trucks and buses. Since there was no explanation in the instruction manual for the crash report of the meanings of these vehicle codes, codes were interpreted for their typical meaning. Body_type was coded "NA" or "unknown" in 3.9% of cases. Another variable, Commercial vehicle body_type, was also considered as a variable to use in conjunction with Body_type. However, since the CV body_type variable was often inconsistent with the Body_type variable, identification of eligible trucks was limited to the Body_ type codes shown in bold in Table 2 (single truck-2 axles, single truck-3 axles, and truck tractor).

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[1] Maryland State Police, Central Records Division, *The Maryland Automated Accident Reporting System (MAARS) Instruction and Reference Manual*, January 1993, p.20.

[2] *Ibid*., p.103.

Buses could be identified using the three Body_type codes of transit bus, cross country bus, and school bus (Table 2, codes in italics). It is also possible that some other vehicles, such as vans, could qualify as buses. They would qualify if they have seats for nine or more passengers and are used for transporting passengers, and not personal transport. However, since number of seats and a description of vehicle use were not available, the decision was made not to include any other vehicles as qualifying buses.

Table 2. Maryland PAR File Vehicle Type Variable Used to Identify Eligible Vehicles

Vehicle type code	Description
5	**Single truck – 2 axles**
6	**Single truck – 3 axles**
7	**Truck tractor**
10	*Transit bus*
11	*Cross country bus*
12	*School bus*

Note: Codes in italics were used to identify eligible buses, and those in bold identify trucks.

The crash form included a variable regarding transport of hazardous materials, Hazardous Materials (Placard) Number. It was used to define the third group of eligible vehicles. Appendix A includes a complete discussion of the variables used to identify qualifying vehicles.

In total, there were 10,797 vehicles meeting the vehicle criteria in the Maryland PAR file (Table 3). These represented 5.6% of all vehicles in the PAR file, which was within the range of corresponding percentages for other states that have thus far been evaluated (ranging from 2.6% to 6.1%).

Table 3. Vehicles Meeting MCMIS Vehicle Criteria, Maryland PAR File, 2004

Vehicle type	N	%
Trucks	7,618	70.6
Buses	3,173	29.4
Non-trucks with hazmat placard	6	0.1
Total	10,797	100.0

Of these vehicles, those in a crash involving a fatality, an injury transported for medical treatment, or a vehicle towed due to disabling damage should have been reported to the MCMIS Crash file. Injuries can be readily identified in the Maryland PAR file. The PAR person file, representing drivers, pedestrians, and other persons involved in the crash, includes the usual crash injury severity variable identifying fatal, incapacitating (A injury), non-incapacitating (B injury), and possible injury (C injury). There is also a "not injured/not known" code level.

In addition, the PAR form contains an area to enter the number, name, and EMS run report number of the emergency medical service unit that transported the injured person. There is also a box to enter "Injured Taken To." However, none of these variables appeared in the PAR file. Thus, it was not possible to directly identify injured persons who were transported for medical

care. Therefore, an alternative method of distinguishing transported from non-transported injured persons was developed. The method will be discussed fully below.

The last MCMIS criterion specifies "vehicles towed due to disabling damage." The Maryland PAR form contains the variables "Vehicle Towed By" and "Vehicle Towed To." Although these variables do not appear on the PAR file there is a Towed_away variable on the file. However, it does not appear to be reliably coded. Out of 194,126 cases there were 1,454 cases with a "Y" or "N", and 52 other cases have a numeric value or an "S". Unfortunately the majority of cases (99.2%) are unrecorded, implying this variable is grossly under reported, and thus could not be used to define towed vehicles. So another variable, Damage Extent, was used to ascertain disabling damage. It is assumed that vehicles suffering damage of "disabled" or "destroyed" would have been towed. Thus, all vehicles with damage reported as "disabled" or "destroyed" were considered towed due to disabling damage.

Since it is not known if an accident involved a transported injury, the decision was made to use A and B injuries as a surrogate for injured and transported. This seems like a reasonable rule, since from the definitions of the injuries, immediate medical attention is warranted or likely. However, the reality of injury coding may not be so straightforward. In fact, experience with Ohio, Missouri, and North Carolina indicates that a considerable percentage of A and B injuries are not transported for treatment. In a recent year of Ohio crashes, 76% of A injuries, 52% of B-injuries, and 29% of C-injuries were also coded as transported. In Missouri the corresponding percentages were 98%, 65%, and 47%. North Carolina percentages were 89%, 71%, and 39%. Note the variation between these three states. Indeed, the proportion of injured persons transported for care can vary between states. Accordingly, any estimate using another state's experience can only provide an approximation of the true proportion. The Maryland estimates below, using Ohio, Missouri, and North Carolina data as a standard reference distribution, should be regarded as an attempt to arrive at approximate figures using the best available data. The identification of reportable cases that are analyzed in the body of this report are not based on these estimates, but on the surrogate definition of transported injury cases described below.

Consequently, the practice of including all involvements in which the most severe injury was A or B, regardless of whether anyone was actually transported, can result in a different set of cases selected for the MCMIS Crash file and a different distribution of crash severity. Since the Ohio, Missouri, and North Carolina data include all relevant variables, it is possible to estimate the distribution of cases that should have been submitted from Maryland if the PAR data had included the transported variable.

The number of Maryland reportable cases, using the North Carolina data as a reference distribution, was estimated by first determining the number of Maryland PAR cases that would have qualified for the MCMIS Crash file based on vehicle type, and then classifying each by the most severe injury in the crash. Then the proportion of such involvements in North Carolina in

which an injured person was transported for treatment was applied to the number of Maryland
involvements to estimate the number of Maryland cases for a given crash severity and tow status
that would have been transported (Table 4). For example, in Maryland there were 437 qualifying
vehicles in a crash in which the most severe injury was an A injury, and at least one vehicle in
the crash was towed due to disabling damage. In North Carolina, 91.6% of these involvements
had at least one transported injury. Applying that percentage to A-injury, towed cases in
Maryland, an estimated 400 A-injury crashes with a towed, disabled vehicle would have been
transported. Similarly, North Carolina proportions of transported injuries were applied to
Maryland numbers for A, B, and C injuries that were not towed. The results were summed to
generate an estimated 1,649 injured, transported cases for Maryland. The remaining non-
transported, but towed figures were added to the number of Maryland non-injured, but towed
cases to arrive at an estimated number of towed, disabled vehicles, 2,868.

Table 4. Estimated Reportable Maryland Cases Based on North Carolina Proportions of Transported Injuries

Injury severity	Maryland figures	North Carolina % transported	Maryland estimates	
			Injured, transp.	not transp, towed
Fatal injury	104			
A injury				
towed *	437	91.6	400	37
not towed	112	64.3	72	
B injury				
towed	748	75.9	568	180
not towed	337	40.6	137	
C injury				
towed	688	46.3	319	369
not towed	599	25.6	153	
No injury				
towed	2,282			2,282
not towed	5,490			
Total eligible vehicles	10,797			
Estimated injured, transported			1,649	
Estimated towed due to disabling damage				2,868

   * Note: In this table 'towed' means 'towed due to disabling damage.' Shaded figures represent
      estimated reportable cases.

The same procedure was followed to estimate Maryland reportable cases based on Ohio and
Missouri data. When this adjustment procedure is applied to each injury severity level in
Maryland, an estimated 4,621 to 4,703 cases should have been reported to the MCMIS Crash
file. Agreement between the three methods is remarkable. After the matching process (discussed
below) cases that were actually reported to the MCMIS crash file could be determined (Table 5).

Table 5: Reported and Estimated Reportable Cases Based on Ohio, Missouri, and North Carolina Data

| Accident Severity | Reported Cases | | Estimated Reportable Cases | | | | | |
| | Maryland | | Based on Ohio | | Based on MO | | Based on NC | |
	No.	%	No.	%	No.	%	No.	%
Fatal	88	6.0	104	2.2	104	2.2	104	2.3
Injured, transported for treatment	915	62.5	1,354	28.9	1,790	38.1	1,649	35.7
Tow, disabled	462	31.5	3,220	68.8	2,809	59.7	2,868	62.1
Total	1,465	100.0	4,678	100.0	4,703	100.0	4,621	100.0

However, for the purposes of this evaluation, it is only possible to use the information that is in the Maryland PAR file. Thus, the subset of PAR cases that can be identified as reportable to MCMIS included the trucks, buses, and vehicles with a hazardous materials placard defined above, in conjunction with one of the following conditions: fatal accident, all injury-only A and B severity accidents (based on maximum accident severity), and towaway accidents (based on whether the accident included a disabled or destroyed vehicle). Using this procedure (surrogate definition), 4,708 records in the Maryland PAR file should have been reported to the MCMIS Crash file. Table 6 shows the distribution of cases identified in the Maryland PAR file that met the reporting criteria thus defined, along with the distribution of records actually reported.

Table 6. Reportable Records in the Maryland PAR File
by Crash Severity, 2004

Crash severity	Reportable records in Maryland PAR file	%	Actually reported	% Reported
Fatal	104	2.2	88	84.6
Injury, A or B	1,634	34.7	915	56.0
Tow, disabled	2,970	63.1	462	15.6
Total	4,708	100.0	1,465	31.1

Note that the distribution of reportable records by crash severity based on the surrogate definition (Table 6) is very similar to the distribution of estimated reportable cases based on proportions from the three other states (Table 5). While there may be differences in identifying individual cases that should be reported, the two methods of determining reportable cases yield similar results at the aggregate level. Appendix A provides details on the variables and code levels used to identify MCMIS-reportable cases for the interested reader.

3. Matching Process

The next step involved matching records from the Maryland PAR file to corresponding records from the MCMIS file. After removing duplicates, there were 1,669 Maryland records from the MCMIS file available for matching, and 194,126 records from the Maryland PAR file. All records from the Maryland PAR data file were used in the match, even those that were not reportable to the MCMIS Crash file. This allowed the identification of cases in the MCMIS Crash file that should not have been reported.

Matching records in the two files requires finding common variables that match at the accident level as well as match specific vehicles within an accident. Report Number, which is the identifier used to uniquely identify a crash in the Maryland PAR data, and Report Number in the MCMIS Crash file, are obvious first choices. Indeed, there appeared to be a correspondence between the two numbers, and report number was never unrecorded in either file. Report Number in the Maryland PAR file is a ten-digit numeric value, while in the MCMIS Crash file, Report Number is stored as a 12-character alphanumeric value, a combination of alphabetic characters and numbers. It appears that the report number in the MCMIS Crash file is constructed as follows: The first two columns contain the state abbreviation (MD, in this case), followed by ten digits. Since these digits were consistent with the PAR Report Number, the last ten digits of the MCMIS Report Number were extracted and these two variables were used in the match.

Other variables that were available for matching at the accident level included crash month, day, hour, minute, and crash county. A variable designating "city" could not be used, as the PAR file contained a numeric code, but city code on the MCMIS file was unrecorded.

Variables in the MCMIS file that could distinguish one vehicle from another within the same accident included vehicle license plate number, driver license number, vehicle identification number (VIN), and driver date of birth. However, license plate number was always unrecorded in the PAR file, so it could not be used. Driver's license number was unrecorded in 17.3% of PAR cases and in 4.8% of MCMIS cases. VIN was unrecorded 7.7% of the time in the PAR file, and in 10.2% of MCMIS cases. Of the available variables, driver date of birth was the most reliable, as it was always recorded in the PAR data, and unrecorded in only 4.1% of MCMIS cases.

Six 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 accident number, crash month, day, hour, minute, crash county, VIN, driver birthdate, and driver license number. The second match step dropped accident number and driver license number and matched on month, day, hour, minute, county, VIN, and driver birthdate. The third match step matched on accident number, month, day, hour, minute, county and driver birthdate (eliminating driver license number and VIN). After trying various combinations of variables, the fourth match just used accident number and driver date of birth. A fifth match used accident number and the the rightmost six digits of the VIN. At this point 94.2% of the MCMIS records had been matched. To improve the match rate even further, the remaining 96 unmatched MCMIS records were hand-matched to corresponding PAR records with identical accident numbers. Comparing records from the two files that could potentially be matched resulted in 60 additional matched cases.

See Table 7 for the variables used in each match step along with the number of records matched at each step.

Table 7. Variables Used in MCMIS-Maryland PAR File Match, 2004

Match step	Matching variables	Cases matched
Match 1	accident number, crash month, day, hour, minute, crash county, VIN, driver birthdate, and driver license number	690
Match 2	crash month, day, hour, minute, crash county, VIN, and driver birthdate	80
Match 3	accident number, crash month, day, hour, minute, crash county, and driver birthdate	627
Match 4	accident number and driver birthdate	91
Match 5	accident number and 6 digits of VIN	85
Match 6	matched by hand using all available variables	60
Total cases matched		1,633

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 1,633 matches, representing 97.8% of the 1,669 non-duplicate records reported to MCMIS.

Figure 1 shows the case flow during the match. There were 36 (2.2%) MCMIS records that could not be matched to the Maryland PAR file. Of the 4,708 (3,243+ 1,465) reportable cases in the Maryland PAR data, 1,465 were actually reported, along with 168 cases that were not reportable, but nevertheless were reported. Thus, the reporting rate for reportable cases was 1,465/4,708=31.1%. About 31% of crash involvements that qualified for reporting to the 2004 MCMIS Crash file were actually reported.
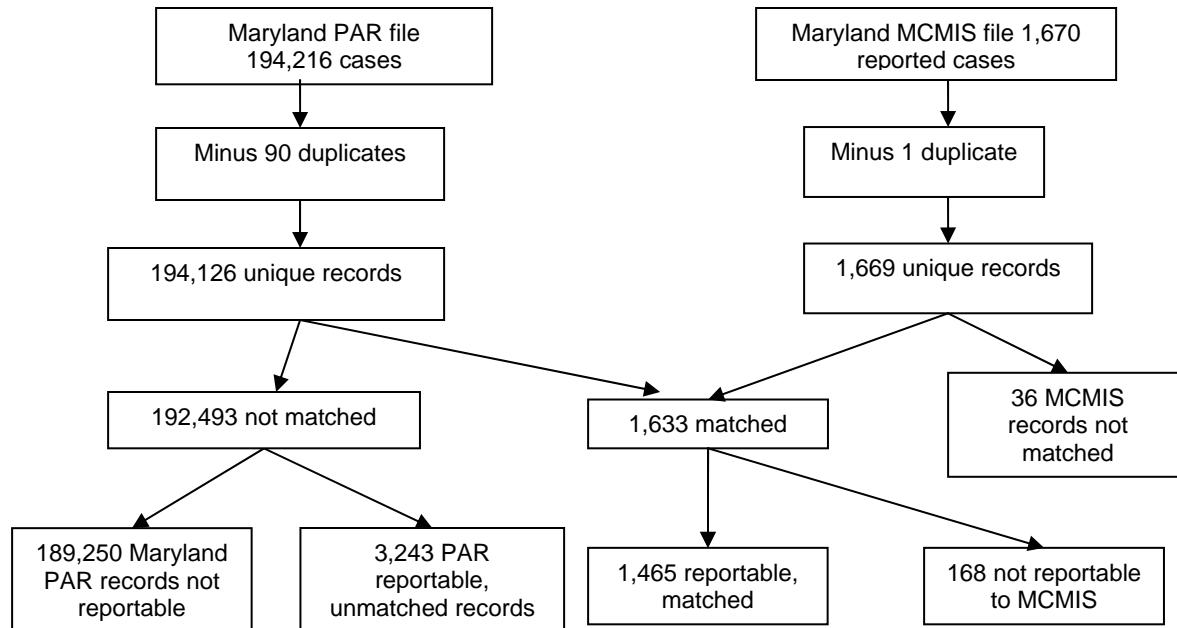
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┌─────────────────────┐              ┌─────────────────────┐
│  Maryland PAR file  │              │ Maryland MCMIS file │
│   194,216 cases     │              │  1,670 reported     │
│                     │              │      cases          │
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│189,250  │ │3,243 PAR │ ┌──────────┐   ┌──────────────┐
│Maryland │ │reportable│ │1,465     │   │168 not       │
│PAR      │ │unmatched │ │reportable│   │reportable    │
│records  │ │records   │ │matched   │   │to MCMIS      │
│not      │ │          │ │          │   │              │
│reportable│ │          │ │          │   │              │
└─────────┘ └──────────┘ └──────────┘   └──────────────┘
```

Figure 1. Results of MCMIS-Maryland PAR File Match, 2004

In addition, 168, or 10.1%, of reported cases should not have been reported. They did not qualify as reportable because they did not involve either qualifying vehicles or qualifying severity. Table 8 shows why these cases did not meet the reporting criteria.

Seven of these cases were trucks, buses, or vehicles transporting hazmat, of which five involved no injuries or towed vehicles and thus were definitely not reportable cases. The remaining two cases were C injuries (reported, but not evident), with no towed vehicle. These cases could have been transported, and therefore would qualify for MCMIS reporting. However, there is no way to determine in the Maryland PAR data if a person was transported for care.

Table 8. Distribution of Non-Reportable Cases in MCMIS by Reporting Criteria, Maryland PAR File, 2004

| Vehicle type | Crash severity | | | | |
	Fatal	A or B injury	Tow/disabled	Other crash severity	Total
Truck	0	0	0	5	5
Bus	0	0	0	1	1
Vehicle transporting hazmat	0	0	0	1	1
Other vehicle (not transporting hazmat)	5	78	67	11	161
Total	5	78	67	18	168

An additional 150 (5+78+67) cases were involvements in which the crash met the severity test, but the vehicles were not trucks, buses, or a vehicle transporting hazmat. Of these, 105 were

pickup trucks, and 30 were ambulances or fire trucks. Finally, eleven cases were neither serious enough nor did they involve qualifying vehicles.

Omitting the 36 cases that could not be matched and the 168 MCMIS cases not considered reportable in the PAR file, 1,465 reportable MCMIS records were matched to the PAR file, or 31.1% of the 4,708 cases that should have been reported. The analysis that follows will investigate why the remaining 68.9% of cases were not reported.

4. Sources of Underreporting

This section explores the sources of underreporting to the MCMIS Crash file. The approach is to compare reported with unreported cases across several dimensions to search for patterns that might suggest why some cases were reported and others were not. All tables include only reportable cases. Therefore, they exclude the 168 MCMIS cases not considered reportable in the PAR file and the 36 MCMIS cases that could not be matched to the PAR file. The reporting rate shown in the following tables is the number of reported cases per 100 reportable cases.

4.1 Analysis of Commercial Vehicle-Related Variables

The presentation in this section is an attempt to discover if items filled out on the Maryland PAR form act as triggers for reporting to the MCMIS Crash file. The goal is to possibly identify and make a distinction between the roles that officers and the state play in the MCMIS reporting process based on information derived from the Maryland Crash Report Form and data contained in the Maryland PAR file. There is a section on the Maryland PAR form that is to be completed by the officer if a crash involves a commercial motor vehicle. Certain information is to be filled in that is specific to commercial vehicles such as DOT Number, ICC Number, Commercial Body Type, and CDL. These variables correspond to blocks 76-79 on the Maryland Crash Report Form, respectively (see discussion beginning on the second from last paragraph at the bottom of page 4, and also blocks 76-79 on the Maryland Crash Report Form included in Appendix B). One hypothesis is that completion of blocks 76-79 triggers reporting to the MCMIS Crash file. The four variables in blocks 76-79 are recorded in the PAR file, making it possible to check this hypothesis.

The four variables will be checked separately by cross-classifying the 4,708 reportable vehicles according to whether a vehicle was actually reported to the MCMIS Crash file or not, and whether information was recorded for the variable of interest. Two-way classifications will be shown in the form of 2x2 tables. If completion of a block by the officer triggers reporting to the MCMIS Crash file, then entries on the main diagonal of the 2x2 table should be large. Examples illustrate this procedure.

To investigate whether recording of the DOT Number in the PAR file triggers reporting, Table 9 shows the cross-classification of DOT Number by reporting to the MCMIS Crash file for all

reportable vehicles. The diagonal entries correspond to recorded and reported, and not recorded and not reported. If entering information about DOT Number by the officer triggers reporting, almost all the data should fall into the diagonal cells of the table. The diagonal entries are 638 and 2,282, and an odds ratio calculation suggests that a reportable vehicle was about 1.8 times more likely to be reported when DOT Number was recorded than when DOT Number was not recorded. Although this represents a positive association, one would expect the association to be much stronger if recording the information actually triggers reporting. There appear to be too many vehicles falling into the off-diagonal entries in the table which correspond to recorded and not reported, and not recorded and reported. Thus, recording of DOT Number in the PAR file does not seem to trigger reporting to the MCMIS Crash file in any kind of systematic way. Note that the reporting rate when DOT Number is recorded is 638/1,599 = 39.9% and the reporting rate when DOT Number is not recorded is 827/3,109 = 26.6%.

Table 9. Cross-Classification of DOT Number by Recording Status and Reporting Status for Vehicles Reportable to the MCMIS Crash File

	Reported	Not Reported	Total
Recorded	638	961	1,599
Not Recorded	827	2,282	3,109
Total	1,465	3,243	4,708

Similarly, investigation of the ICC Number and Commercial Body Type variables leads to similar conclusions. Table 10 shows results for the ICC Number, and Table 11 shows results for the Commercial Body Type variable. Although positive associations exist between reporting to the MCMIS Crash file and recording of information in the PAR file, the associations are not strong enough to conclude that information contained in these variables triggers reporting to the MCMIS Crash file. The numbers of vehicles falling into the off-diagonal entries in these two tables are large. The reporting rate when ICC Number is recorded is 181/446 = 40.6% and the reporting rate when ICC number is not recorded is 1,284/4,262 = 30.1%. Similarly, the reporting rate when Commercial Body Type is recorded is 721/1,880 = 38.4% and the reporting rate when Commercial Body Type is not recorded is 744/2,828 = 26.3%.

Table 10. Cross-Classification of ICC Number by Recording Status and Reporting Status for Vehicles Reportable to the MCMIS Crash File

	Reported	Not Reported	Total
Recorded	181	265	446
Not Recorded	1,284	2,978	4,262
Total	1,465	3,243	4,708

Table 11. Cross-Classification of Commercial Body Type by Recording Status and Reporting Status for Vehicles Reportable to the MCMIS Crash File

	Reported	Not Reported	Total
Recorded	721	1,159	1,880
Not Recorded	744	2,084	2,828
Total	1,465	3,243	4,708

In the PAR file, CDL is recorded for all vehicles, not just commercial motor vehicles. The CDL variable has no missing values and is recorded as either yes or no. Table 12 shows results for the CDL variable. The reporting rate for drivers with a CDL is 780/2,185 = 35.7% and the reporting rate for drivers without a CDL is 685/2,523 = 27.2%. The off-diagonal entries in the table are large suggesting that CDL also does not act as a trigger for MCMIS reporting.

Table 12. Cross-Classification of CDL by Recording Status and Reporting Status for Vehicles Reportable to the MCMIS Crash File

	Reported	Not Reported	Total
Yes	780	1,405	2,185
No	685	1,838	2,523
Total	1,465	3,243	4,708

It seems most likely that some other mechanism is at work and that the state determines which cases should be submitted to the MCMIS Crash file using additional criteria. This makes sense since a reportable vehicle to the MCMIS Crash file will not necessarily have a DOT Number or an ICC Number. In addition, the drivers of many vehicles that are reportable to the MCMIS Crash file are not required to have a CDL since the MCMIS GVWR criterion is 10,000 pounds and the CDL requirement for GVWR is 26,000 pounds. Investigation of the four variables in combination gave similar results.

4.2 Case Processing

Delays in transmitting cases may partially account for the incompleteness of the MCMIS Crash file. The time lag in extracting and submitting reports to the MCMIS Crash file might explain some portion of the unreported cases. All reportable crash involvements for a calendar year are required to be transmitted to the MCMIS Crash file within 90 days of the date of the crash. The MCMIS file used in this evaluation was dated August 1, 2005, so all 2004 cases should have been reported by that date. An examination of PAR reporting by accident month tends to confirm the hypothesis that cases at the end of the year, along with cases in January, were not submitted as often as other months. As shown in Table 13, the reporting rates in the months of January, November, and December were 10.5%, 11.8%, and, 6.9%, well below the reporting rates in other months. Note that the number of reportable cases every month is fairly consistent and that the

percentage of total unreported cases in January, November, and December is 34.7%
(11.3+10.9+12.5). Thus, if reporting in these three months improved to the average reporting
rates in the other nine months, the overall reporting rate could increase by approximately 10
percent. A timing problem would help to explain the low reporting rates in November and
December, if cases at the end of the year have not yet been submitted to the MCMIS Crash file.
However, this would not explain the low reporting rate in January. Some other cyclical timing
problem could be causing the low reporting rates in January, November, and December.

Table 13. Reporting to MCMIS Crash File by Accident Month, Maryland PAR File, 2004

Crash month	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
January	409	10.5	366	11.3
February	307	40.7	182	5.6
March	310	37.1	195	6.0
April	393	38.9	240	7.4
May	423	41.8	246	7.6
June	406	43.1	231	7.1
July	380	43.2	216	6.7
August	372	37.1	234	7.2
September	416	32.5	281	8.7
October	458	35.6	295	9.1
November	400	11.8	353	10.9
December	434	6.9	404	12.5
Total	4,708	31.1	3,243	100.0

Table 14 shows the average latency in case submission by month, where latency is the number of
days between crash date and the date the case was uploaded to the MCMIS Crash file minus the
90-day grace period. The average is 138 days, which is more than four months after the 90-day
grace period. January shows the longest delay in case submission at 184 days, while November
and December exhibit the shortest delay times at 98 and 99 days, respectively. Between March
and October the latency periods are fairly consistent.

Table 14. Average Latency (in Days, Minus 90) in Reporting to the MCMIS Crash File, Maryland Reported Cases, 2004

Crash month (in 2004)	Average latency in days (minus 90) for reported cases
January	184
February	150
March	141
April	139
May	141
June	144
July	144
August	129
September	134
October	127
November	98
December	99
Overall average	138

4.3 Reporting Criteria

As discussed in an earlier section, Maryland does not have a separate form that the officer is expected to fill out if a vehicle is involved in a crash that meets the MCMIS reporting criteria. Instead, certain items on the main form should be completed if a commercial vehicle is involved in the crash. For example, the officer is instructed to place the letters "CVA" in the research block in capital letters. In addition, other commercial vehicle-related information should be recorded whenever a commercial vehicle, as defined, is involved in a crash, not just crashes that are reportable to the MCMIS Crash file. The MCMIS vehicle type and crash severity criteria, with the limitations discussed earlier are available for all cases. Cases reported to MCMIS are identified at the state level. These cases could be identified using the vehicle type and crash severity type available for all cases. In this section, reporting rates by the selection criteria will be examined to determine the sources of underreporting.

Table 15 shows reporting to the MCMIS Crash file by vehicle type. Reporting rates by vehicle type do not show a great deal of variability, but some important differences exist. Truck tractors and single trucks with three axles have the highest reporting rates at 35.7% and 35.3%, respectively. Among trucks, single trucks with two axles had the lowest reporting rate of 26.4 and the largest percentage of total unreported cases at 40.8%. Thus, the overall reporting rate could improve if single trucks with two axles were reported more frequently. Transit buses and cross country buses show reporting rates very close to the overall reporting rate. However, the reporting rate for school buses is lower at 23.5 %. Two automobiles, one recreation vehicle, and one van qualify for reporting to the MCMIS Crash file since they are hazmat placarded vehicles. Although they are few in number, none of the four reportable cases were reported.

Table 15. Reporting to MCMIS Crash File by Vehicle Type, Maryland PAR File, 2004

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Automobile	2	0.0	2	0.1
Single truck 2 axles	1,795	26.4	1,322	40.8
Single truck 3 axles	590	35.3	382	11.8
Truck tractor	1,654	35.7	1,063	32.8
Recreation	1	0.0	1	0.0
Transit bus	355	33.2	237	7.3
Cross country bus	29	31.0	20	0.6
School bus	281	23.5	215	6.6
Van	1	0.0	1	0.0
Total	4,708	31.1	3,243	100.0

In several previous investigations concerning other states such as Michigan, Missouri, Florida, Illinois, and New Mexico, reporting rates have been consistently higher for vehicles involved in more severe crashes. In those studies, states were much more likely to report vehicles involved in fatal crashes to the MCMIS Crash file. This appears to be the case in Maryland. Table 16 shows that 56 % of injury cases and only 15.6 % of towed and disabled involvements were reported, compared to 84.6 % of crashes involving a fatality. Note that 77.3 % of total unreported cases were crashes involving at least one vehicle towed due to disabling damage. Thus, the overall reporting rate stands to improve considerably if vehicles in crashes satisfying the towed and disabled criteria were reported with greater frequency.

Table 16. Reporting to MCMIS Crash File by Crash Severity, Maryland PAR File, 2004

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	104	84.6	16	0.5
A/B Injured	1,634	56.0	719	22.2
Towed/Disabled	2,970	15.6	2,508	77.3
Total	4,708	31.1	3,243	100.0

Table 17 shows reporting to the MCMIS Crash file by maximum injury severity and disabling damage. The table provides supplemental information to the results presented in Table 16. Note that 59.6 % of total unreported cases were crashes involving no injury, but disabling damage was evident. The reporting rate in this case is 15.3 %. The reporting rates for A-injuries and

**Table 17 Reporting to MCMIS Crash File by Maximum Injury and Disabling Damage,
Maryland PAR File, 2004**

Maximum injury in crash	Disabling damage	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	yes	88	85.2	13	0.4
	no	16	81.3	3	0.1
A-injury	yes	437	57.0	188	5.8
	no	112	58.9	46	1.4
B-injury	yes	748	57.1	321	9.9
	no	337	51.3	164	5.1
C-injury	yes	688	16.4	575	17.7
	no	0	NA	0	0.0
No injury	yes	2,282	15.3	1,933	59.6
	no	0	NA	0	0.0
Total		4,708	31.1	3,243	100.0

B-injuries were similar, regardless of towed status. According to the methods applied in this report, reporting rates are not applicable for crashes involving C-injuries or no injuries without disabling damage.

Reporting rates may also be related to misunderstanding that intrastate vehicles are to be included, not just those involved in interstate commerce. Carriers operating in interstate commerce, as well as those carrying hazardous materials, are required to register with the Federal Motor Carrier Safety Administration. They are issued a Department of Transportation Number, and their name and DOT number must be displayed on the side of their trucks. The Maryland PAR file contains information about the carrier's DOT number and the ICC number, indicating the carrier is authorized for interstate commerce. As shown in Table 18, 40 % of interstate vehicles are reported to the MCMIS Crash file, compared to 26.4 % of vehicles without ICC or DOT numbers. Vehicles for which a DOT/ICC number is recorded are more likely to be reported than intrastate trucks.

Table 18 Reporting to MCMIS Crash File by Interstate/intrastate Status, Maryland PAR File, 2004

Carrier type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Interstate	1,633	40.0	980	30.2
Intrastate	3,075	26.4	2,263	69.8
Total	4,708	31.1	3,243	100.0

4.4 Reporting Agency and Area

Beyond the application of the reporting criteria, there can be differences related to where the crash occurs or the type of agency that covered the crash. More densely populated areas with a

large number of traffic accidents may not report as completely as areas with a lower work load. The level and frequency of training or the intensity of supervision can also vary. If there are such differences, they may serve as a guide to focus resources in areas and at levels that will produce the greatest improvement. The next set of tables examines areas of the state to see if there are inconsistencies in reporting patterns.

Reporting rates for Maryland's 24 counties ranged from 13.0 % of reportable cases (Baltimore City) to 68.8 % (Somerset), although Somerset County only had 16 reportable cases. Table 19 shows the top ten counties in Maryland, ordered by the number of unreported cases. Together, these ten counties account for 88.7 % (2,876) of the total unreported cases in Maryland for 2004. The reporting rates among the counties are fairly similar except that one county clearly stands out as having a low reporting rate. The reporting rate for Baltimore City was 13.0 %. In addition, it has the third highest percentage of total unreported cases at 14.4 %.

Table 19. Reporting to MCMIS Crash File by County, Maryland PAR File, 2004

County	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Prince Georges	899	29.3	636	19.6
Baltimore	808	32.4	546	16.8
Baltimore City	537	13.0	467	14.4
Montgomery	595	32.3	403	12.4
Anne Arundel	320	25.3	239	7.4
Howard	261	33.3	174	5.4
Harford	198	34.8	129	4.0
Washington	167	39.5	101	3.1
Frederick	155	38.7	95	2.9
Carroll	121	28.9	86	2.7
Sum of top ten	4,061	29.2	2,876	88.7
Total	4,708	31.1	3,243	100.0

It is also possible that reporting rates could be related to the level of reporting agency. Here, agency type may be taken as an indicator of the focus and training of the department. The Maryland PAR file identifies three types of reporting agencies: Maryland State Police (MSP), county sheriff's offices, and local police departments.

In Maryland during 2004 the MSP were responsible for 42.4 % of all reportable cases (Table 20), and local police departments covered 52.4 % of cases. The reporting rate for the MSP was 39.2%, compared with 24.8 % for local police. Reporting rates vary between the three agency types, with state police having the highest rate and local police departments having the lowest rate. These differences may be the result of differences in focus, training, and supervision. Local police agencies were responsible for 1,857 (57.3 %) of cases not reported to the MCMIS Crash file, so improved reporting from such agencies would contribute the most to improving reporting

from Maryland. These same trends, although to varying degrees, were discovered in other MCMIS evaluations.

Table 20. Reporting to MCMIS Crash File by Reporting Agency, Maryland PAR File, 2004

Reporting agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Local police	2,468	24.8	1,857	57.3
Sheriff	246	29.3	174	5.4
State police	1,994	39.2	1,212	37.4
Total	4,708	31.1	3,243	100.0

Table 21 shows reporting rates by agency type and crash severity. The state police have consistently higher reporting rates. County sheriff offices reported all fatal involvements, but there were only a total of three. Clearly, the rates are lowest in the towed/disabled category for all three reporting agencies. Local police have the lowest reporting rate in this category at 10.0%. In addition, local police had the largest number of reportable cases in this category at 1,607. Therefore, the overall reporting rate would be most improved if local police reported cases meeting the towed/disabled criteria more frequently. The MSP had 1,191 reportable cases in the towed/disabled category and reported 22.8 % of those cases. Therefore, improvement in reporting by the MSP in this category would also increase the overall reporting rate.

Table 21. Reporting to MCMIS Crash File by Reporting Agency and Accident Severity, Maryland PAR File, 2004

Reporting agency	Reporting rates (%) by crash severity		
	Fatal	A/B injured	Towed/ disabled
Local police	78.0	51.0	10.0
Sheriff	100.0	54.9	17.4
State police	88.3	61.6	22.8
Total	84.6	56.0	15.6

Reporting rates by vehicle type also vary among reporting agencies. For all vehicle types the MSP had the highest reporting rates (Table 22). Regardless of vehicle type, sheriff's offices have similar reporting rates. However, local police and state police report larger trucks at a higher rate than single unit 2-axle trucks. For local police and sheriff's offices, buses were reported at about the same rate as larger trucks. For state police, the reporting rate for buses is less than the rate for larger trucks.

Table 22. Reporting to MCMIS Crash File by Reporting Agency and Vehicle Type, Maryland PAR File, 2004

Reporting agency	Reporting rates (%) by vehicle type			
	Single truck 2-axle	Single truck 3-axle	Truck tractor	Bus
Local police	21.7	26.6	27.1	28.0
Sheriff	29.6	29.3	28.3	30.6
State police	34.9	45.0	40.2	36.6
Total	26.4	35.3	35.7	29.0

Table 23 shows reporting to the MCMIS Crash file by reporting agency and interstate/intrastate status. The state police report interstate and intrastate carriers at higher rates than the other two reporting agencies. Local police and sheriff's offices report interstate carriers at about the same rate, but sheriff's offices are more likely to report intrastate carriers.

Table 23 Reporting to MCMIS Crash File by Reporting Agency and Interstate/intrastate Status, Maryland Par File, 2004

Reporting agency	Reporting rates (%) by Interstate/intrastate status	
	Interstate	Intrastate
Local police	33.2	22.1
Sheriff	33.7	26.6
State police	44.8	34.1
Total	40.0	26.4

The Maryland PAR file contains data so that each reporting agency can be analyzed separately. Table 24 shows reporting rates for the top ten local police agencies, sorted in descending order, according to the number of unreported cases. Sixty-seven local police agencies were identified in the Maryland PAR file with reportable cases. The top ten account for 87.3 % of unreported cases. There were 1,857 unreported cases, which account for 57.3 % of all unreported cases (see Table 19), and the overall reporting rate was 24.8 %. The most problematic local police agency was Baltimore City, which reported only 7 of 350 reportable cases, resulting in a reporting rate of just 2 %. Baltimore City had the largest percentage of total unreported cases at 18.5 %.

Table 24 Reporting Rates for Top Ten Local Police, Maryland PAR File, 2004

Local police agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Baltimore City	350	2.0	343	18.5
Montgomery County	458	33.2	306	16.5
Prince Georges County	374	21.7	293	15.8
Baltimore County	397	29.5	280	15.1
Anne Arundel County	205	24.9	154	8.3
Howard County	150	34.0	99	5.3
MTA	95	34.7	62	3.3
Fort McMHenry Tunnel	56	26.8	41	2.2
Laurel	31	19.4	25	1.3
Hagerstown	22	13.6	19	1.0
Sum of top ten	2,138	24.1	1,622	87.3
Total	2,468	24.8	1,857	100.0

Table 25 shows reporting rates for sheriff's offices. Only twelve offices had reportable cases so Table 25 shows results for all twelve. In total, sheriff's offices account for 246 reportable cases, which is small compared to local police or state police. The overall reporting rate was 29.3 % which is close to the reporting rate of 31.1 calculated for the state of Maryland. Taking into account the small numbers, the reporting rates are not too variable. Any sheriff's office with 19 or more reportable cases had a reporting rate greater than 20 %. Carroll County had a reporting rate of 13.3 %, but only 15 reportable cases were found.

Table 25 Reporting Rates for Sheriff's Offices, Maryland PAR File, 2004

Sheriff's office	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Harford County	38	23.7	29	16.7
Frederick County	36	22.2	28	16.1
Saint Mary's	38	31.6	26	14.9
Washington County	32	25.0	24	13.8
Charles County	30	30.0	21	12.1
Calvert County	19	21.1	15	8.6
Carroll County	15	13.3	13	7.5
Garrett County	14	50.0	7	4.0
Worcester County	8	37.5	5	2.9
Queen Anne County	9	66.7	3	1.7
Talbot County	5	60.0	2	1.1
Allegany County	2	50.0	1	0.6
Total	246	29.3	174	100.0

Table 26 shows reporting rates for the top ten state police agencies according to number of unreported cases. Twenty-six state police agencies had reportable cases based on analysis of the

Maryland PAR file. The top ten agencies account for 79.3 % of unreported cases. As shown earlier (see Table 16), among the three law enforcement agencies state police have the highest reporting rate at 39.2 %. Note that reporting rates do not differ from 39.2 by more than plus or minus 10 percent. While some state police have higher rates than others, the rates are fairly consistent and overall variability is not so great.

Table 26 Reporting Rates for Top Ten State Police, Maryland PAR File, 2004

State police	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Golden Ring	325	32.9	218	18.0
College Park	222	37.8	138	11.4
Forestville	220	38.2	136	11.2
JFK Memorial Highway	185	40.0	111	9.2
Waterloo	112	32.1	76	6.3
Westminster	95	30.5	66	5.4
Rockville	89	32.6	60	5.0
Hagerstown	112	48.2	58	4.8
Frederick	103	47.6	54	4.5
Bel Air	75	41.3	44	3.6
Sum of top ten	1,538	37.5	961	79.3
Total	1,994	39.2	1,212	100.0

5. Data Quality Issues

In addition to examining the number of records reported to the MCMIS Crash file, it is important to evaluate completeness of data reported. Missing data rates are important in evaluating the utility of a data file, since records with missing data cannot contribute to an analysis. Table 27 shows the unrecorded rates for required variables. For many variables, the recording rate for Maryland is less than 100%. Missing data rates are higher for body type, DOT number, interstate, officer badge number, VIN and crash events two through four. The event variables may be difficult to record, contributing to their high numbers of unrecorded values. In addition, there are a large number of towaway cases which may have had only one catastrophic event. For the four vehicles displaying a hazardous materials placard, the one-digit materials class was always omitted.

Table 27. Unrecorded Rates for Selected Variables, Maryland MCMIS File, 2004

Variable	Percent unrecorded	Variable	Percent unrecorded
Accident year	0.0%	Event one	4.7
Accident month	0.0	Event two	64.3
Accident day	0.0	Event three	100.0
Accident hour	0.0	Event four	100.0
Accident minute	0.0	Number of vehicles	0.0
Body type	47.3	Officer badge number	79.5
Configuration	1.4	Report number	0.0
County	0.4	Road access	1.0
DOT number	9.3 *	Road surface	3.0
Driver date of birth	4.1	Road trafficway	4.8
Driver license number	4.8	Towaway	0.0
Driver license state	4.7	Truck or bus	0.0
Fatal injuries	0.0	Vehicle license number	5.3
Non-fatal Injuries	0.0	Vehicle license state	5.0
Interstate	15.2	VIN	10.2
Light	2.3	Weather	2.3

* Counting cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	5.0%
Percentages of placarded vehicles only * :	
Hazardous cargo release	0.0%
Hazardous materials class (1-digit)	100.0%
Hazardous materials class (4-digit)	25.0%
Hazardous materials name	25.0%

*   There were only 4 placarded vehicles.

The following table compares the actual data values in the Maryland PAR file with the values in the MCMIS Crash file to determine if the data are consistent between the two datasets. It is possible that errors of translation and formatting can occur when the data are prepared for submission to the MCMIS crash file. Table 28 displays the consistency between the vehicle type variable as recorded in the Maryland PAR file and the coding of configuration in the MCMIS Crash file. The levels of the variables are not exactly the same. For example, Maryland codes buses as transit, cross country, and school buses, whereas the MCMIS file designates buses according to number of seats. However, the goal is to detect major inconsistencies when, for example, a bus is coded as a large truck.

Of 118 transit buses in the Maryland PAR file, 113 are coded as buses in the MCMIS Crash file. One transit bus is coded as a SUT with 2 axles, two transit buses are coded as SUT with 3+ axles, and two are unrecorded in MCMIS. Of nine vehicles coded as cross country buses in the PAR file, eight are coded as buses and one is coded as a tractor triple in the MCMIS file. Of 66 vehicles coded as school buses in the PAR file, two are coded as truck trailers in the MCMIS Crash file. Thus, of 193 vehicles in the Maryland PAR file coded as one of three types of buses, 183, or 94.8 %, are identified in the MCMIS file as buses.

Table 28. Vehicle Type Coding in Maryland PAR Compared with MCMIS Crash File, 2004

Maryland PAR vehicle type variable	MCMIS configuration variable	N	%
Transit bus	Unrecorded	2	0.1
	Bus (seats 9-15, incl dr)	10	0.7
	Bus (seats >15, incl dr)	103	7.0
	SUT, 2-axle, 6-tire	1	0.1
	SUT, 3+ axles	2	0.1
	Total	118	8.1
Cross country bus	Bus (seats >15, incl dr)	8	0.5
	Tractor triple	1	0.1
	Total	9	0.6
School bus	Unrecorded	2	0.1
	Bus (seats 9-15, incl dr)	3	0.2
	Bus (seats >15, incl dr)	59	4.0
	Truck trailer	2	0.1
	Total	66	4.5
Single truck, 2-axle	Unrecorded	6	0.4
	Bus (seats >15, incl dr)	7	0.5
	SUT, 2-axle, 6-tire	406	27.7
	SUT, 3+ axles	36	2.5
	Truck trailer	9	0.6
	Truck tractor (bobtail)	1	0.1
	Tractor semitrailer	6	0.4
	Unknown heavy truck	2	0.1
	Total	473	32.3
Single truck, 3-axles	Unrecorded	1	0.1
	Bus (seats >15, incl dr)	1	0.1
	SUT, 2-axle, 6-tire	6	0.4
	SUT, 3+ axles	195	13.3
	Truck trailer	3	0.2
	Tractor semitrailer	2	0.1
	Total	208	14.2
Truck tractor	Unrecorded	1	0.1
	Bus (seats >15, incl dr)	1	0.1
	SUT, 2-axle, 6-tire	8	0.5
	SUT, 3+ axles	17	1.2
	Truck trailer	553	37.7
	Tractor semitrailer	11	0.8
	Total	591	40.3
Total		1,465	100.0

Most of the trucks coded as single unit trucks in the PAR file are coded as single unit trucks in the MCMIS file, but there are some exceptions. Of 473 trucks coded as single trucks with 2-axles in the PAR file, 406 are coded as SUT with 2-axles in the MCMIS file, but 36 are coded as SUT with 3-axles, 7 are coded as buses, and 7 are coded where the power unit is a tractor. Of 208

trucks coded as single trucks with 3-axles, 195 are coded as SUT with 3+axles, but 6 are coded as SUT with 2-axles, 2 are coded as tractor semitrailers, and 1 is coded as a bus.

There appears to be a large discrepancy about what is reported in the Maryland PAR file as truck tractors. In the PAR file, a total of 591 vehicles are classified as truck tractors, but 553 of these vehicles are classified under the truck trailer configuration in the MCMIS file. In the MCMIS file, if a truck is classified as a truck trailer it refers to a straight truck with a trailer. It appears that when reporting to the MCMIS Crash file, these vehicles were misclassified since truck tractor in the MCMIS file refers to a truck tractor (bobtail) configuration. In addition, the MCMIS file has categories for tractor/semitrailer, tractor/double, and tractor/triple. Therefore, if the PAR file had more classifications than just truck tractor, this error might not have occurred.

6. Summary and Discussion

The 2004 Maryland PAR file was matched against the 2004 MCMIS Crash file to assess reporting to the MCMIS Crash file by the state of Maryland. The idea is to identify vehicles in the Maryland PAR file that were involved in crashes that satisfy the vehicle and crash severity threshold for reporting to the MCMIS Crash file. This is accomplished by examination of variables available in the Maryland PAR file such as vehicle type, injury severity, and hazmat placard number. The two files are then matched on common variables and vehicles are classified into categories such as matched and reportable, and unmatched and reportable. This facilitates calculation of reporting rates and helps to identify potential sources of underreporting to the MCMIS Crash file. In addition, since all records in both files are processed, PAR records not reportable, and MCMIS records that should not have been reported can be identified. Therefore, overreporting can also be detected if a state submitted records that do not meet the criteria for MCMIS reporting.

Information contained in the Maryland PAR file allowed the criteria for a MCMIS reportable case to be applied reasonably well. The Body_type variable contains information for identifying eligible trucks and buses. Trucks are categorized as single trucks with 2 axles, single trucks with 3 axles, and truck tractors. Qualifying buses can also be identified since buses are categorized as transit buses, cross country buses, and school buses. A hazardous materials placard number was available for identifying the third group of eligible vehicles. In total, 10,797 vehicles were found in the Maryland PAR file satisfying the MCMIS vehicle criteria.

Using the injury severity variable at the person level in the PAR file, the maximum injury severity in a crash was calculated according to the familiar KABCO scale, making it possible to identify vehicles involved in fatal and injury crashes. As found in some other states, the PAR file does not record whether an injured person was transported to a medical facility for immediate attention. In this study, vehicles in crashes involving A or B injuries were used to satisfy the injured and transported MCMIS criteria. Although this method is not exact, empirical results

suggest that this strategy results in reasonably close estimates. A procedure was used to estimate the number of reportable cases to the MCMIS Crash file using injured and transported data recorded in the PAR files from the states of North Carolina, Ohio, and Missouri. Using estimates from these states as standard reference distributions, the numbers of vehicles that should have been reported from Maryland were estimated as if the Maryland PAR data had included the transported variable. The results provided in Table 5 and Table 6 demonstrate that the method used in this study to identify reportable cases leads to a distribution that is very similar to the distributions of estimated reportable cases based on proportions from the three other states.

After removing duplicates, there were 1,669 records from the MCMIS Crash file available for matching, and 194,126 records from the Maryland PAR file. Six matches were performed using variables common to both files. Variables were chosen based on compatibility between the two files and amounts of missing data. Table 7 shows the variables used in each step. The matching procedure resulted in 1,633 matches, or 97.8% of the 1,669 available records. Matched records were verified using other variables common to both files to ensure the match was valid. The remaining 36 records in the MCMIS Crash file could not be matched.

In the 2004 Maryland PAR file, 4,708 vehicles were identified as being reportable to the MCMIS Crash file. In addition, 168 vehicles were reported that were identified as being not reportable. Of these 168 vehicles, 150 were not trucks, buses, or vehicles displaying a hazardous materials placard. Of the 4,708 reportable cases, 1,465 were actually reported, resulting in an overall reporting rate for reportable cases of 1,465/4,708=31.1%. Reporting rates varied by several factors including crash month, vehicle type, crash severity, and reporting agency.

Four data items that Maryland officers are instructed to fill out on the Maryland Crash Report Form and are recorded in the Maryland PAR file were checked to investigate whether these variables might trigger reporting to the MCMIS Crash file. The four variables are DOT Number, ICC Number, Commercial Body Type, and CDL. While some positive association exists between recording of these variables in the PAR file and MCMIS reporting, the evidence is not strong enough to suggest that recording of these variables triggers reporting. Some other mechanism appears to be causing the state to submit certain cases.

Examination of reportable cases by crash month suggests a timing issue that is not necessarily related to applying the MCMIS criteria properly. Reporting rates were well below the overall 31.1% rate in the months of January, November, and December. The reporting rates in those months were 10.5%, 11.8%, and 6.9%, respectively. In addition, the percentages of unreported cases in those three months were highest, suggesting that improved reporting in those months would be useful. The reporting rates in the remaining months were fairly consistent. Lag times between date of the crash and the date cases were uploaded to the MCMIS Crash file were also investigated. All reportable cases should be uploaded within 90 days of the crash. From January to December there appears to be a declining trend in lag times, suggesting that Maryland is

reporting cases sooner as the year progresses. However, the average lag time is 138 days after the 90 day period, indicating that considerable time elapses before cases are uploaded to the MCMIS Crash file.

With respect to vehicle type, single trucks with 2 axles had a reporting rate of 26.4% and had the highest percentage of unreported cases at 40.8%. It is possible that lighter and medium trucks are not recognized as reportable compared to heavier trucks such as truck tractors. The reporting rate for school buses was 23.5%, but school buses accounted for only 6.6% of unreported cases.

As in other previous MCMIS evaluations, states were more likely to report vehicles involved in severe injury crashes. The reporting rate was 84.6% for fatal crashes, 56.0% for A or B injury crashes, and 15.6% for towed/disabled crashes. The low rate for towed/disabled crashes is noticeable. Vehicles involved in crashes in which at least one vehicle was towed due to disabling damage accounts for 77.3% of unreported cases, suggesting that the overall reporting rate would improve considerably if vehicles in crashes satisfying these criteria were reported with greater frequency.

Reporting rates were also found to vary by reporting agency and area. The county of Baltimore City had a reporting rate of 13.0%, and of all counties had the third highest percentage of unreported cases (14.4%). In terms of reporting agencies, state police had the highest reporting rate at 39.2%, followed by sheriff's offices at 29.3%, and local police had the lowest rate at 24.8%. In addition, local police accounted for 57.3% of unreported cases. Sheriff's offices accounted for only 5.4% of unreported cases. With respect to crash severity, vehicle type, and interstate/intrastate status, local police had consistently lower reporting rates than either state police or sheriff's offices (Tables 21, 22, 23). An examination of individual local police departments showed that the Baltimore City Police Department had a reporting rate of 2.0%, and accounted for more unreported cases, 18.5% of unreported cases for all police departments, than any other local police department.

Data quality was also checked. In the MCMIS Crash file, 47.3% of the body type variable, 15.2% of the interstate variable, and 10.2% of the VIN variable were unrecorded. A comparison of the vehicle type variable in the PAR file and the configuration variable in the MCMIS file for matched and reportable vehicles indicates that 553 of 591 vehicles coded as truck tractors in the PAR file were misclassified into the truck trailer category in the MCMIS file. The truck trailer category in the MCMIS file refers to straight trucks with a trailer. This error might have been avoided if the PAR file contained more truck categories for tractors other than just truck tractor. The truck tractor configuration in the MCMIS file refers to bobtails. Other configurations such as buses, single unit trucks with 2 axles, single unit trucks with 3 axles, compared favorably between the two files.

References

1. Blower, D., and Matteson, A., *Evaluation of the Motor Carrier Management Information System Crash File, Phase One.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. March 2003. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

2. Blower, D., and Matteson, A*., Patterns of MCMIS Crash File Underreporting in Ohio.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. August 2003. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

3. Blower, D., and Matteson, A*., Evaluation of Missouri Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. January 2004. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

4. Blower, D., and Matteson, A*., Evaluation of Michigan Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. September 2004. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

5. Blower, D., and Matteson, A*., Evaluation of Florida Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. December 2004. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

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

7. Green, P.E*.,* and Blower, D*., Evaluation of New Jersey Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann Arbor, Michigan. February 2005. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

8. Green, P.E., and Blower, D., *Evaluation of New Mexico 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.

9. Matteson, A., and Blower, D., *Evaluation of North Carolina Crash Data Reported to MCMIS Crash File.* University of Michigan Transportation Research Institute, Ann

Arbor, Michigan. May 2005. Sponsor: Federal Motor Carrier Safety Administration, U.S. D.O.T.

10. 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.

11. *State of Maryland Motor Vehicle Accident Report*, revision March 1995.

12. Maryland State Police, Central Records Division, *The Maryland Automated Accident Reporting System (MAARS) Instruction and Reference Manual*, January 1993.

Appendix A: Variables Used for Maryland PAR Data to Identify a MCMIS-Reportable Crash.

MCMIS Reporting Criteria	Implementation in Maryland PAR Data

Truck with GVWR over 10,000 or GCWR over 10,000	Body Type was the only variable available for all vehicles, and thus was used to select trucks meeting the MCMIS criteria. In cases where the Body Type variable was vague or coded "NA" or "Unknown", an attempt was made to incorporate the Commercial Body Type variable. However, since Commercial Body Type was often inconsistent with Body Type, it was decided to identify eligible trucks as follows:
	
	 Body_type = 5 (Single truck – 2 axles)
	                6 (Single truck – 3 axles)
	                7 (Truck tractor)

***or* Bus with seating for at least nine, including the driver**	The following codes were used to identify eligible buses:
	
	 Body_type = 10 (Transit bus)
	                11 (Cross country bus)
	                12 (School bus)
	
	 It is also possible that some other vehicles, such as vans, could qualify as buses. They would qualify if they have seats for nine or more passengers and are used for transporting passengers, and not personal transport. However, since number of seats and a description of vehicle use were not available, the decision was made not to include any other vehicles as qualifying buses.

***or* Vehicle displaying a hazardous materials placard**	A variable pertaining to transporting hazardous materials was included on the crash report. For this study, placarded vehicles were identified using the Hazardous Materials (Placard) Number: If a Hazardous Materials (Placard) Number was recorded, then the vehicle was considered to be placarded. An additional variable, Hazardous Materials Spill, was examined to determine if all vehicles with a spill also had a placard number recorded. There were 413 cases with a hazmat spill, but no placard number. In some cases a spill may not relate to the truck's cargo, since the definition in the Maryland PAR manual for hazardous spill is "hazardous materials were released either as a cause or a result of the accident." So it is possible that

MCMIS Reporting Criteria	Implementation in Maryland PAR Data
	these could be cases where a vehicle fluid such as gasoline or oil spilled, and thus no placard number would be indicated. So for this study, only cases with a Hazmat Materials (Placard) Number recorded were considered to be placarded.
AND	
at least one fatality	The Maryland PAR Person file, representing drivers, pedestrians, and other persons involved in the crash, includes an injury severity variable coded as follows: Injury_severity = code 1 (Not injured/not known), code 2 (possible injury), code 3 (non-incapacitating injury), code 4 (disabled, incapacitated), and code 5 (fatal injury). A fatal accident was defined as any person in the accident with: Injury_severity= code 5 (fatal)
or **at least one person injured and transported to a medical facility for immediate medical attention**	The Injury Severity variable defined above was used to identify injury accidents. However, from the available variables it was not possible to determine if an injured person was transported for medical care. The PAR form contains an area to enter number, name, and EMS run report number of the emergency medical sevice unit that transported the injured person. There is also a box to enter "injured taken to". However, none of these variables appeared in the PAR file. Thus, it was not possible to directly identify injured persons who were transported for medical care. Therefore, an alternative method of distinguishing transported from non-transported injured persons was used. Since persons with Type A or B injuries would likely require medical treatment, accidents involving an A or B-injured individual were considered to be "injury, transported" accidents. Thus, an injury/transported accident was defined as a crash with at least one person with: Injury_severity = Code 4 (incapacitating injury, Type A) or code 3 (non-incapacitating injury, Type B.)
or **at least one vehicle towed due to disabling damage**	The Maryland PAR form contains the variables "Vehicle Towed By" and "Vehicle Towed To." Although these variables do not appear on the PAR file there is a Towed_away variable on the file. However, it does not appear to be reliably coded. Out of 194,126 cases there were 1,454 cases with a "Y" or "N", and 52 other cases have a numeric value or an "S". Unfortunately the majority of cases (99.2%) are unrecorded, implying this variable is grossly

MCMIS Reporting Criteria	Implementation in Maryland PAR Data
	under reported, and thus could not be used to define towed vehicles. So another variable, Damage Extent, was used to ascertain disabling damage. It is assumed that vehicles suffering damage of "disabled" or "destroyed" would have been towed. Thus, all vehicles with damage reported as "disabled" or "destroyed" were considered towed due to disabling damage: Vehicle_damage_extent = 4 (disabling) or 5 (destroyed)

Appendix B: Maryland Crash Report Form

State of Maryland Motor Vehicle Accident Report

REPORT NO. 1	PAGE OF 2	ACCIDENT DATE 3	ACCIDENT TIME 4	REPORT TYPE 5 ☐ FATAL ☐ INJURY ☐ PDO ☐ HIT & RUN ☐ NON-TRAFFIC	RESEARCH 6	LOCAL CASE NUMBER 7	LOCAL CODES 8	PHOTOS ? 9 ☐ NO ☐ YES

08357135

INVESTIGATING OFFICER ID 10	AGENCY AND AREA 11	SUPERVISING OFFICER ID 12	REVIEWER ID # 13	CODE – AND – NAME OF MUNICIPALITY 14	COUNTY 15

| RD CHAR 16 | RTE NUM Accident Occurred On 17 | ROAD NAME | IN LANE 19 | TRAF SIG 20 ☐ NO ☐ YES | ON RAMP 21 ☐ NO ☐ YES | Ramp Number (Direction) 1 N–W 2 W–N 3 E–N 4 N–E 5 S–E 6 E–S 7 W–S 8 S–W 9 Other 22 0–Not Ramp | IN INTERSECTION 23 ☐ NO ☐ YES |

| RD COND 24 | INT-RTE 25 | INTERSECTING ROAD NAME or Log Mile Reference Manual description. 26 | MILEPT 27 | DIR 28 | Dist. of Acc fr INT–RTE/Ref. & Dir. 29 ☐ Ft ☐ Mi |

| RD DIV 30 | ACCIDENT DIAGRAM | Show & Label: Roads, Traffic Units, the Travel Direction consistent with the Log Mile Reference Manual, and Movement of Traffic Units. 31 | NORTH: 32 (N) | DESCRIBE ACCIDENT briefly: identify units by numbers. Also identify the following a) the OBJECT DAMAGED & NATURE OF DAMAGE (Property other than vehicles) and b) the NAME & ADDRESS OF OWNER when applicable. 33 |

| SRF COND 34 |
| C/M ZONE 35 ☐ NO ☐ YES |
| JUNCT'N 36 |
| EVENT–1 37 |
| EVENT–2 38 |
| FIX OBJ 39 |
| COLL TY 40 |
| LIGHT 41 |
| WEATHER 42 |

| UNIT # 43 | NAME (First, Middle, Last) 44 | SEX 45 | UNIT # 43 | NAME (First, Middle, Last) 44 | SEX 45 |
| 0 1 | | | 0 2 | | |

| TYPE OF UNIT 46 ☐ DRIVER ☐ "PED" | ADDRESS (No., Street, City, State, Zip) 47 TEL ☐ Work ☐ Res | INJ 48 EMS 49 | TYPE OF UNIT 46 ☐ DRIVER ☐ "PED" | ADDRESS (No., Street, City, State, Zip) 47 TEL ☐ Work ☐ Res | INJ 48 EMS 49 |

| MOVEMENT 50 | CONDITN 51 | SUBST 52 | TEST 53 | RESULT 54 | FOR PEDS ONLY | AGE 55 | TYPE 56 | LOCAT'N 57 | OBEY 58 | VISIBL 59 | MOVEMENT 50 | CONDITN 51 | SUBST 52 | TEST 53 | RESULT 54 | FOR PEDS ONLY | AGE 55 | TYPE 56 | LOCAT'N 57 | OBEY 58 | VISIBL 59 |

| SPEED LIMIT 60 | SAF. EQU 61 | EQ PROB 62 | EJECT 63 | CITATION NUMBER (S) | FAULT 64 ☐ NO 65 ☐ YES | SPEED LIMIT 60 | SAF. EQU 61 | EQ PROB 62 | EJECT 63 | CITATION NUMBER (S) | FAULT 64 ☐ NO 65 ☐ YES |

| GOING 66 | DRIVER'S LICENSE NUMBER 67 | STATE 68 | CLASS 69 | GOING 66 | DRIVER'S LICENSE NUMBER 67 | STATE 68 | CLASS 69 |

| CONTINU 70 | DR DATE OF BIRTH 71 | IRREGULAR CONDITION 72 ☐ PARKED ☐ CAUGHT FIRE ☐ HIT & RUN ☐ DRIVERLESS | HM SPILL 73 ☐ N ☐ Y | HAZ MAT NUMBER 74 | CONTINU 70 | DR DATE OF BIRTH 71 | IRREGULAR CONDITION 72 ☐ PARKED ☐ CAUGHT FIRE ☐ HIT & RUN ☐ DRIVERLESS | HM SPILL 73 ☐ N ☐ Y | HAZ MAT NUMBER 74 |

| BODY TY 75 | COMMER. VEHICLE ONLY | U. S. DOT NUMBER 76 | ICC NUMBER 77 | BODY TY 78 | CDL? 79 ☐ NO ☐ YES | BODY TY 75 | COMMER. VEHICLE ONLY | U. S. DOT NUMBER 76 | ICC NUMBER 77 | BODY TY 78 | CDL? 79 ☐ NO ☐ YES |

| MOST HE 80 | OWNER OR CARRIER NAME (Write "SAME" if Driver) TEL ☐ Work ☐ Res 81 | MOST HE 80 | OWNER OR CARRIER NAME (Write "SAME" if Driver) TEL ☐ Work ☐ Res 81 |

| CONTRIB CIRCUM- STANCES 82-1 | OWNER / CARRIER ADDRESS 83 | TOWED VEH (S) 84 | CONTRIB CIRCUM- STANCES 82-1 | OWNER / CARRIER ADDRESS 83 | TOWED VEH (S) 84 |

| 82-2 | YEAR & MAKE OF VEHICLE | MODEL 85 | 86 | 1st IMPACT PT. 87 MAIN IMPACT 88 | 82-2 | YEAR & MAKE OF VEHICLE | MODEL 85 | 86 | 1st IMPACT PT. 87 MAIN IMPACT 88 |

| 82-3 | EXP YR & REGISTR # STATE | AREAS DAMAGED 89 90 | INSURER 91 | 82-3 | EXP YR & REGISTR # STATE | AREAS DAMAGED 89 90 | INSURER 91 |

| 82-4 | VEHICLE ID NUMBER 92 | POLICY NUMBER 93 | 82-4 | VEHICLE ID NUMBER 92 | POLICY NUMBER 93 |

| DAM EXT 94 | VEHICLE REMOVED BY 95 | VEHICLE REMOVED TO 96 | DAM EXT 94 | VEHICLE REMOVED BY 95 | VEHICLE REMOVED TO 96 |

TRAFFIC UNIT # 97	SEATING POSITION 98	CODE all injured & uninjured PASSENGERS below. Use "W" for witness in TRAF UNIT and SEAT columns. WRITE NAME & ADDRESS of Injured Passengers and Witnesses.	Witness telephone #. 99	SEX 100	AGE 101	SAFETY EQUIP 102	EQUIP PROB. 103	INJUR SEVER 104	EJEC- TION 105	EMS UNIT 106

| E UNIT MS 107 A | INJURED TAKEN BY: 108 | INJURED TAKEN TO: 109 | EMS RUN REPORT # 110 | E UNIT MS 107 B | INJURED TAKEN BY: 108 | INJURED TAKEN TO: 109 | EMS RUN REPORT # 110 |

MSP FORM #1 (3/95)

POLICE DEPARTMENT COPY