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EVALUATION OF 2010 NEW JERSEY CRASH DATA REPORTED TO THE MCMIS CRASH FILE

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16. Abstract

This report is part of a series evaluating the data reported to the Motor Carrier Management Information System (MCMIS) Crash File undertaken by the Center for National Truck and Bus Statistics at the University of Michigan Transportation Research Institute. 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 New Jersey.

MCMIS Crash File records were matched to the New Jersey crash file to determine the nature and extent of underreporting. Overall, it is estimated that for 2010, 75.3% of reportable crash involvements were reported.

Almost 90% fatal crash involvements were correctly reported. Reporting rates were lower for less severe collisions: 84.0% of injured/transported crashes and 72.3% of towed/disabled crashes were reported. Low reporting rates of crashes covered by local enforcement agencies were a primary factor in the overall reporting rate. The New Jersey Highway Patrol had the highest reporting rate. Rates were substantially lower for crashes covered by police departments. State police and municipal police departments covered virtually all reportable crashes.

Missing data rates on records reported to the MCMIS crash file are low for most variables. Corresponding data elements in the MCMIS and New Jersey crash files were reasonably consistent, except for vehicle configuration and cargo body, though even there only roughly 3% to 4% of records differed. Improvements in training to may address this issue. About 75 percent of records were submitted to the MCMIS file within 90 day post-crash period requirement.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

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

APPROXIMATE CONVERSIONS FROM SI UNITS

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

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

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1. Introduction

The Motor Carrier Management Information System (MCMIS) Crash file was developed by the Federal Motor Carrier Safety Administration (FMCSA) to serve as a census database of trucks and buses involved in traffic crashes meeting a specific crash severity threshold. FMCSA maintains the MCMIS file to support its mission to reduce crashes, injuries, and fatalities involving large trucks and buses. The data in the MCMIS crash file are extracted by the States from their own crash records, and uploaded through the SafetyNet system. Accurate and complete crash data are essential to assess the safety of motor carrier operations and to design effective safety measures to prevent such crashes. The usefulness of the MCMIS Crash file depends upon individual states identifying and transmitting the correct records on the trucks and buses involved in traffic crashes that meet the crash file severity threshold.

The present report is one of a series of reports that evaluate the completeness and accuracy of the records submitted to the MCMIS Crash file. Previous reports showed some underreporting which was related to problems in interpreting and applying the reporting criteria within the States' respective crash reporting systems. Smaller trucks, buses, and less severe crashes were more often not recognized as meeting the reporting criteria. States also had issues specific to the nature of their own systems. [See references 3 to 50.] Each State is responsible for identifying and reporting qualifying crash involvements. Accordingly, improved completeness and accuracy ultimately depends upon the efficiency and effectiveness of individual state systems.

This report focuses on MCMIS Crash file reporting by New Jersey in 2010. New Jersey is the 11th largest state by population and in most years ranks about 22nd among the States in terms of the number of annual truck and bus fatal involvements. Between 2005 and 2010, the total annual number of crash involvements reported by New Jersey to the MCMIS crash file varied from 7,737 to 6,388 each year. Over the same time span, the number of fatal truck and bus involvements in New Jersey identified in the standard fatal crash files has varied also: 130 in 2005, 95 in 2006, 88 in 2007, 61 in 2008, 85 in 2009, and 77 in 2010.[2]

Police accident report (PAR) data for 2010 recorded in New Jersey's statewide files as of August 31, 2011 were used in this analysis. The 2010 PAR file contains the crash records for 562,975 vehicles.

The process of evaluating state reporting follows of the following steps:

1. The complete police accident report file (PAR file hereafter) from New Jersey was obtained for the most recent year available, which was 2010.

2. An algorithm was developed using the data coded in the New Jersey file to identify cases that qualified for reporting to the MCMIS Crash file.

3. All cases in the New Jersey 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 New Jersey.

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

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

2. Data Preparation

The first step in the process is to review and prepare data from the State's crash file and from the MCMIS crash file. The New Jersey PAR file and MCMIS Crash file each required some processing before records from the MCMIS Crash file could be matched to the New Jersey PAR file. In the case of the MCMIS Crash file, the major tasks were to extract records reported by New Jersey and to search for and eliminate any duplicate records. The New Jersey PAR file was processed to create a comprehensive vehicle-level file from the Crash, Vehicle, Occupant, and Driver files. This combined vehicle-level file was then reviewed to exclude any duplicate records.

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

2.1 MCMIS Crash Data File

The 2010 MCMIS Crash file, as of July 28, 2011, was used to identify records submitted from New Jersey. For calendar year 2010 there were 6,582 cases reported to the file from New Jersey. An analysis file was constructed using all variables in the MCMIS file. This analysis file was examined for duplicate records (more than one record submitted for the same vehicle in the same crash; i.e., the report number and sequence number were identical). No such duplicates were found.

In addition, records were reviewed to find cases with identical values on accident number, accident date/time, county, city, street, vehicle identification number (VIN), and driver license number, but with different vehicle sequence numbers. The purpose of this review is to find and eliminate cases where more than one record was submitted for the same vehicle, driver, and

crash. Duplicates can be generated when, for example, a corrected record is submitted and the original record is not deleted. This review identified 43 crashes that had two or more records that were identical on date, hour and minute, driver license number, VIN, crash county, and driver date of birth. None of the multiple records appeared to be from different crashes–that is, in each set of multiple records, the number of fatalities, injuries, and the sequence of events were the same. However, the transaction dates were different. It appears that the duplicate records were generated when a corrected record was uploaded to the MCMIS crash file but the original record was not deleted. The resulting MCMIS file, with duplicates eliminated, contains 6,532 unique records.

2.2 New Jersey Police Accident Report File

The New Jersey PAR data for 2010 was obtained from the State. The data were stored as fixed-record length text files, consisting of separate files for accident, vehicle, occupant, person, and pedestrian information. The files contained records for 299,575 traffic crashes involving 562,975 vehicles. Data for the PAR file are coded from the New Jersey Police Crash Investigation Report (NJTR-1, R4/10), completed by police officers (see Appendix A).

The PAR file was first examined for duplicate records (involvements where more than one record was submitted for the same vehicle in the same crash). A search for records with identical case (unique identifier) and vehicle numbers found no instances of duplicates. In addition, examination of case numbers (crsh_uniq_id) showed that the identifiers are recorded in several formats, some incorporating alphabetic characters as well as numeric, and with different systems of hyphenation.

However, there were no instances identified of multiple records with identical case numbers and vehicle numbers. Just as in the preparation of the MCMIS Crash file, cases also were examined to determine if any records contained identical time, place, and vehicle/driver variables, regardless of vehicle number. Records were examined for duplicate occurrences based on the fields for case number, accident date/time, crash county, VIN, and license plate number. Using this process, no clear duplicate pairs were found. The resulting PAR file has 562,975 unique records of motor vehicles involved in a police-report traffic accident in New Jersey in 2010.

3. Matching Process

The next step in the evaluation of the data was to match records from the New Jersey PAR file with corresponding records from the MCMIS file. There were 6,532 records from the MCMIS file available for matching, and 562,975 records from the New Jersey PAR file. All records from the New Jersey PAR data file are used in the match, even those that apparently did not meet the requirements for reporting to the MCMIS Crash file. This allows the identification of cases reported to the MCMIS Crash file that do not meet the reporting criteria.

Matching records between the two files is accomplished by using combinations of variables common to the two files that have a high probability of uniquely identifying crashes and specific vehicles within the crashes. Ideally, the crash record identifier and vehicle number identifier

would be adequate here, but even when the same identifiers are used in both files, matches on other variables are used to validate the match.

Crash Unique ID, which uniquely identifies a crash in the New Jersey PAR data, and Report Number, in the MCMIS Crash file, are obvious first choices. In the New Jersey PAR file, Crash Unique ID is a long (31-character) alphanumeric field, with embedded hyphens; 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 (NJ, in this case), followed by ten alphanumeric values. There was no correspondence between the crash identifier fields in the New Jersey crash data and the MCMIS crash data.

Other data items that are useful in matching at the crash level include Crash Date, Crash Hour, Crash Minute, Crash County, VIN number, license plate number, and driver age. Appropriate combinations of these variables have a usefully high probability of uniquely identifying a specific vehicle in a specific crash. Weather, light condition (light/dark/dusk, etc.), license state, and highway designation or street name were used to validate the matches.

Variables in the MCMIS file that can be used to 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. The New Jersey PAR data file contains all of these variables. The percentages of missing data for these variables are all low enough to be useful in matching the records.

The match was performed in seven steps, using the available variables. At each step, records in either file with duplicate values on all the match variables for the particular step were excluded prior to attempting the match, along with records with missing values for any of the match variables.

The first match included the variables for case number, crash date (month, day), crash time (hour, minute), county, VIN, license place, and driver age. The second match step used the same fields except for license plate. The third match step again used month, day, hour, minute, and county, but substituted license plate number for VIN. The fourth match dropped crash minute, and matched on month, day, hour, county, VIN, and license plate number. The fifth match step used all of those variables except license plate number; and the sixth and final match step used the same variables as in the fifth step, except for substituting license plate number for VIN number. For each match step, the matches were validated by checking other variables, such as highway or road location, weather, light condition, and roadway condition. Note that in each match step, the records must match according to time, geographic location, specific and unique details about the vehicle (VIN or license plate number), and driver age, in match steps 1 through three.

After the six steps of the computerized version of the match were complete, there were still 141 unmatched MCMIS cases. A manual search of the New Jersey PAR file was conducted for each

of these 141 records. In this search, all the crashes occurring in the same county and on the same day were manually reviewed for any evidence they matched one of the crashes in the MCMIS file. For each case, records were reviewed to find a crash on the specific road involving a truck or bus. This process resulted in matching 43 cases. Many of the remaining matches appear to be hit-and-run vehicles, because there was no specific information about the vehicle or driver.

Computerized and manual review resulted in matching 6,434 (98.5%) of the MCMIS records to records in the PAR file. Only 98 cases could not be matched. Table 1 shows the variables used in each match step and the number of records matched at each step.

Table 1 Steps in MCMIS/New Jersey PAR File Match, 2010

Step	Matching variables	Cases matched
Match 1	Crash month, day, hour, minute, county, VIN, license plate, driver age	5,653
Match 2	Crash month, day, hour, minute, county, VIN, driver age	65
Match 3	Crash month, day, hour, minute, county, license plate, driver age	199
Match 4	Crash month, day, hour, county, VIN, license plate	421
Match 5	Crash month, day, hour, county, VIN	23
Match 6	Crash month, day, hour, county, license plate	30
Match 7	Hand-matching, using all available variables	43
Total cases matched		6,434

The matches 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 6,434 matches, which is 98.5% of the 6,532 records reported to MCMIS.

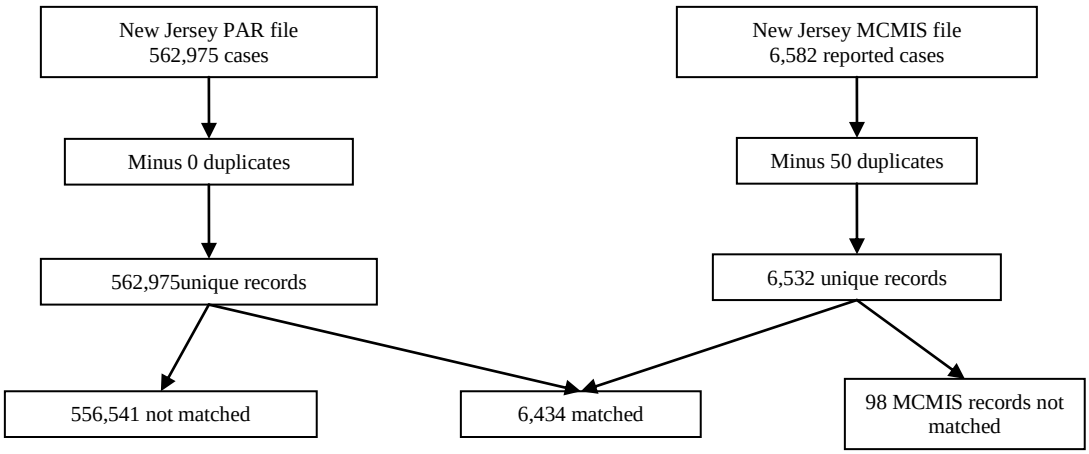

Figure 1 Case Flow in MCMIS/New Jersey Crash File Match

The method of identifying cases reportable to the MCMIS Crash file is discussed in the next section.

4. Identifying Reportable Cases

To evaluate the completeness of reporting to the MCMIS crash file, the necessary first step is to identify records in the New Jersey crash file that should have been reported. Accordingly, vehicles that meet the vehicle type reporting criteria as well as crashes that meet the crash severity criteria must be identified in the State's crash file. The identification is made using the information available in the computerized crash files supplied by New Jersey. "Reportable" records meet criteria specified by the FMCSA. In essence, the MCMIS reporting criteria are applied to all the records in the New Jersey crash file in order to identify those that should be reported.

The method developed to identify reportable records is designed to be independent of any prior selection by the State being evaluated. This approach is necessary if there is to be an independent determination of the completeness of reporting. Accordingly, this process uses the information recorded by the officers on the crash report for all crashes.

The MCMIS criteria for reportable crashes involving qualifying vehicles are shown in Table 2. Reportable records must meet both the vehicle type and crash severity criteria. The method used for vehicle criteria and crash severity 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 9, 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.

Some States place some of the data elements intended for the MCMIS Crash file in a special section of the main form or on a supplemental form, with instructions to the reporting officer to complete that information only for vehicles and crashes meeting the MCMIS selection criteria. This puts the reporting officer in a critical position because the officer in the field must recognize a crash that meets the MCMIS reporting criteria before the data to be reported to the MCMIS crash file are even collected.

New Jersey does not follow this approach. The data that are ultimately uploaded to the MCMIS crash file are thoroughly integrated on the NJTR-1 crash investigation report. There are boxes on the form that apply only to commercial vehicles (e.g., boxes 51/81, commercial vehicle weight), but they are not marked off into a special section. However, the guide for completing the crash report provides a definition of a commercial vehicle and commercial motor carrier that implicitly identifies the vehicles for which critical MCMIS variables are to be completed. The New Jersey

guide defines a "commercial vehicle" as any vehicle with one of more of the following characteristics:

- A truck having a GVWR/GCWR of 10,001 or more pounds.
- A vehicle displaying a hazardous material placard and is required to display or displays a hazmat placard.
- A vehicle that carries 9 or more people, including the driver.
- Any other vehicle that requires a Commercial Driver's License.

This definition and the other guidance in the manual corresponds well to the vehicle criteria for the MCMIS file. [1, p. 20.]

4.1 Vehicle Type

The New Jersey computerized crash file contains several variables that were used to identify reportable vehicles, including vehicle type, cargo body type, vehicle use, vehicle make, model, and the VIN. Vehicle type is a 24-level field that identifies specific vehicle types, such as car/station wagon, passenger van, and sport utility vehicle. The field also includes 10 codes for truck and bus types. Incidentally, these truck and bus types correspond exactly to the truck and bus configuration types in the MCMIS crash file. Cargo body style includes common truck and bus cargo bodies (also mapping directly to the corresponding MCMIS field, with one exception that is addressed below), and vehicle use specifies in general terms how the vehicle was used: Personal use, business or commercial use, government, and so on. Additional information used by us to identify reportable vehicles was extracted from the VIN by decoding it to determine the gross vehicle weight rating (GVWR) and in some cases the type of vehicle configuration the chassis was manufactured for, such as a single-unit truck (SUT), truck-tractor, school bus, or cross-country motorcoach. The VIN-decoding was performed by David Hetzel of NISR, Inc., using software that he developed. All of this information–as recorded by the police on the crash report and decoded from the VIN–was used to identify trucks and buses that meet the MCMIS vehicle type threshold.

Generally, vehicle information was consistent across all of the different fields. That is, a truck identified in the vehicle type field had a consistent cargo body type, was used for commercial purposes, had a typical truck make and model, and the truck type and GVWR decoded from the VIN was consistent with what the officer coded on the crash investigation report. However, there was some inconsistency in the records of about 0.5% of vehicles. For example, the vehicle type field might indicate a light vehicle but the GVWR and vehicle type decoded from the VIN specified a medium or heavy truck. Incidentally, the scale of this inconsistency is not unexpected. Nevertheless, it was necessary to develop a series of decision-rules to determine if a particular vehicle met the MCMIS vehicle type criteria.

The decision-rules were fundamentally based on the New Jersey crash report vehicle type field, as recorded by reporting police officers. If a vehicle was identified as a truck or bus in the vehicle type field, and the cargo body field and VIN information was not inconsistent, then the vehicle was accepted as meeting the MCMIS reporting threshold. If there was some

inconsistency–for example, the vehicle type field indicated a truck but the cargo body code did not–then other fields were examined for corroborating evidence. This includes the GVWR range decoded from the VIN, vehicle type implied by the VIN, and make and model. There were 1,104 records where the vehicle type field in the New Jersey data indicated a light vehicle but the VIN showed that the vehicle was a medium or heavy truck. For these records, the vehicle make and model fields (also recorded by police officers) were reviewed for corroborating evidence to determine whether the vehicle should be accepted as a truck or light vehicle. Where the vehicle make was a known truck make (e.g., "Mack"), and the model was a typical truck type (e.g., "dump"), then the vehicle was taken as a truck. Where the make/model information was not consistent with the VIN but was consistent with the vehicle type field, information in the vehicle type field was accepted.

The decision-rules conformed to the following steps:

- Where the New Jersey crash report vehicle type field indicates a truck/bus and the vehicle VIN indicates a truck/bus, accept as a truck/bus.
- Where the New Jersey crash report vehicle type field indicates a truck/bus and the VIN does NOT indicate a truck/bus, corroborate with the cargo body field, vehicle make, and vehicle model.
- Where the New Jersey crash report vehicle type field does NOT indicate a truck/bus and the VIN does indicate a truck/bus, corroborate with the cargo body field, vehicle make, and vehicle model.

In addition to trucks and buses, any motor vehicle, regardless of size, displaying a hazardous materials (hazmat) placard, also meets the MCMIS vehicle type definition. New Jersey's crash data include a field for hazardous materials placard number and hazmat status, which were used to identify light vehicles transporting hazmat.

The specific algorithm (using the SAS© statistical analysis software language) used to make the assignment is given in Appendix B.

Overall, this approach uses available information to the fullest extent while also being appropriately conservative. Most medium/heavy pickups were excluded because no evidence could be found to establish commercial use, that is, to exclude the possibility that they are personal-use only. Given available information, it is believed the result is the most reasonable classification of the vehicles.

4.2 Crash severity

The second broad selection criteria for inclusion in the MCMIS crash file is crash severity. Crashes that include either a fatality or at least one injured person transported for immediate medical attention or at least one vehicle towed due to disabling damage meet the MCMIS reporting criteria. Any crash satisfying either one of those rules meets the crash severity criteria.

If a vehicle meeting the criteria described in the previous section is involved in a crash that meets the severity threshold, the record for that vehicle must be reported to the MCMIS crash file.

The New Jersey crash file includes injury severity for each person involved in a crash as well as fields that record whether or not a person refused medical treatment and, if transported, the hospital to which an injured person was transported. In theory, this information can be used to identify crashes in which either a person was killed or an injured person was transported for immediate medical attention.

Identifying fatally-injured persons in the crash data is easy and likely very reliable. However, identifying injured persons transported for treatment was more problematic. The field recording whether an individual refused medical treatment includes both treatment at the scene as well as transportation for treatment away from the scene. Thus, on its face, using this field would result in over-identifying injuries transported for treatment, because it would include persons treated at the scene but not transported. This lack of discrimination is particularly problematic for injuries of lesser severity, because they are more likely to be treated at the scene. In addition, there is significantly more missing data on this field for the most severe injuries than the least severe. Finally, the least-severe injury type is more than 30 times as common as the most severe non-fatal injury type so over-identifying transported injuries by using this field would bias the identification of reportable crashes substantially.

The hospital code field, if complete and accurate, should be able to identify all people transported for treatment, but the data in the field is a mixture of valid hospital codes, blanks, and other codes that are not valid. In the past this field had been used to record Emergency Medical Service (EMS) runs and it is possible that some jurisdictions or officers still use it for that purpose.

In any case, using the valid codes to identify injuries transported for medical attention gave unexpected results. Nationally, the 2010 General Estimates System sample of police-reported crashes shows that 90% to 95% of persons coded with incapacitating injuries (A-injuries in the KABCO scale commonly used in police-reported data) are transported for medical attention,[1] but in the New Jersey data, 62.5% of A-injuries had a valid hospital code, indicating they were transported. The percentage with valid hospital codes is too high to ignore, but too low to instill confidence that all transported injuries have been identified.

It is not known if this apparent anomaly is the result of differences in how injury severity definitions are applied or if the hospital code is not always captured accurately. It seems clear that relying on the hospital code likely undercounts transported injuries. However, any alternative method of selection also has drawbacks. Using A- and B-injuries as a surrogate for transported injuries would likely result in a substantial over-count of transported injuries, because it is known that only about two-thirds of B-injuries are typically transported, and there

[1] GES is a nationally-representative sample of police-reported motor vehicle crash data, compiled by the National Highway Traffic Safety Administration (NHTSA).

are more than twice as many B-injuries as A-injuries. In the end, it was decided to take only injuries with a valid hospital code as transported injuries. This rule likely undercounts transported injuries, but it does identify a set of records that can be accepted with near-certainty as meeting the injured/transported MCMIS criteria. Evaluating the comprehensiveness of the reporting of this high-reliability set of cases provides insight into the overall completeness of reporting.

The remaining level of crash severity to be considered is crashes in which vehicles are towed due to disabling damage. The New Jersey crash data includes three relevant fields: one recording who removed the vehicle from the crash scene (police, driver, or owner); another recording how the vehicle was removed (driven, towed, or left at scene); and finally, a field recording whether the vehicle was impounded or disabled. However, identifying towed/disabled crashes using these fields is not a simple matter because of the amount of missing data in each field and the number of apparently-inconsistent responses. For example, about half of the towed vehicles have missing data on whether they were disabled or impounded. It is unlikely that none of the records with missing data were neither disabled nor impounded, since, typically, 85% of towed vehicles are towed due to disabling damage. Interestingly, among towed vehicles in the New Jersey crash data where it is known whether they were disabled or impounded, 88.8% were disabled, which is reasonably consistent with the national experience.

Accordingly, a decision-rule was developed to identify vehicles most likely to have been towed due to disabling damage:

- Any vehicle coded as towed and disabled.
- Any vehicle coded as disabled, with missing data on whether it was towed or not.
- Any vehicle removed by the police but not coded as impounded or driven away.
- Any vehicle removed by the owner or driver, but not coded as driven away.

Applying this decision-rule results in identifying 32.7% of vehicles in crashes as towed due to disabling damage. This is reasonably close to the national average of 30.9% in the 2010 GES data.

4.3 Reportable cases meeting vehicle and crash severity criteria

Any crash with one or more vehicles classified as towed/disabled was flagged as a towed/disabled crash. Similarly, any crash with a fatality or a person transported for immediate medical attention was flagged as a fatal or injury/transported crash. If the crash also included a reportable vehicle, that vehicle record was flagged as reportable to the MCMIS crash file.

In total, there were 8,368 vehicles identified in the New Jersey crash data as trucks, buses, or hazmat placarded light vehicles in crashes with a fatal injury, nonfatal injury transported for treatment, or a towed/disabled vehicle. Table 3 shows the distribution by vehicle type. Medium or heavy trucks accounted for 82.6% of the vehicles, while 16.8% were buses, and 0.7% were light vehicles transporting hazmat.

Table 3 Vehicles Meeting MCMIS Crash and Vehicle Criteria
New Jersey PAR File, 2010

Vehicle type	N	%
Truck	6,910	82.6
Bus	1,403	16.8
Light vehicle transporting hazmat	55	0.7
Total	8,368	100.0

As Figure 1 above shows, there were 6,532 unique records reported to the MCMIS Crash file by New Jersey in 2010. Of these, 6,434 were matched to the New Jersey crash data file. Matches could not be found for 98 of the MCMIS records, despite an exhaustive manual search through the PAR file. If all 6,434 matched records were reportable, the reporting rate from New Jersey would be 76.9%. If the 98 unmatched cases were also reportable, then the reporting rate would rise to 78.1%. However, based on the application of the reporting criteria as discussed above, 130 of the cases reported to the MCMIS crash file did not meet the reporting criteria because the crashes did not meet either the severity or the vehicle type criteria. In the end, 6,304 reportable cases were actually reported, for a reporting rate of 75.3%.

This reporting rate of 75.3% is a best estimate, but it should be understood as an approximation, given the level of detail in the New Jersey crash file. At each stage in identifying the vehicles and crashes that fit the MCMIS reporting criteria, there was some uncertainty, either because of missing data or because of some level of inconsistency or ambiguity in the coding of cases. When identifying vehicles and crashes, we attempted to use decision-rules that were reasonable, requiring that at least two fields have consistent data on vehicle type, for example. We believe the decision-rules are reasonable because, with respect to identifying vehicles and towed/disabled crashes, the proportions of each were reasonably similar to the national experience. But missing or incomplete data on injured persons transported for medical attention likely means that the estimated number of MCMIS-reportable cases is less than the true number. It looks like about a third of injuries that are transported for medical attention are not captured in the hospital code. (Possibly they were transported to an urgent care or other non-hospital medical facility that did not have a hospital code.) This results in an under-estimation of the number injured/transported crashes. However, it is likely that this effect is mitigated to some extent by the fact that crashes serious enough to produce a injury serious enough to be transported for medical attention also likely has a vehicle towed due to disabling damage. So crashes missed by the application of the injured/transported criteria are likely picked up by the towed/disabled criteria. Still, it is our view that the number reportable cases is more likely an underestimate than an overestimate.

5. Factors Associated with Reporting

This section discusses factors that apparently influence the probability of correctly reporting records to the MCMIS crash file in New Jersey. The process of moving from the events of a traffic crash to identifying a small subset of all crashes and then uploading their records to the

MCMIS crash file is complex and involves many steps, from the reporting officer collecting comprehensive and complete information at the crash scene, to the procedure for identifying and extracting, in this case, about 8,400 records from almost 563,000. The purpose of this section is to compare the characteristics of the reported records with those that were not reported, to identify types of records that may be more likely to be overlooked. The goal is to assist the process of achieving complete reporting by understanding why records that should have been reported were not.

5.1 Overreporting

Complete and accurate reporting includes making sure that cases that do not meet the reporting criteria are not reported. There were 130 records reported that apparently did not meet either the crash severity or vehicle type criteria. (Table 4) Almost all of the overreported records (126) were light vehicles that did not qualify as a truck, bus, or light vehicle displaying a hazmat placard. Some of these vehicles were classified as trucks in the vehicle type field, but decoding the VIN clearly showed that they were light vehicles, and this was confirmed by reviewing make and model. The other four were buses, but these buses were in crashes that did not have a fatality, transported injury, or vehicle towed due to disabling damage. It cannot be known absolutely, of course, whether the data coded in the crash record is accurate, but if it is, these 130 records did not meet the reporting criteria. They amount only to about 2.0% of reported records.

Table 4 Vehicle Type and Crash Severity of Cases Reported but Not Reportable
New Jersey 2010

	Crash severity				
Vehicle type	Fatal	Injured/ transported	Towed/ disabled	Other	Total
Truck	0	0	0	0	0
Bus	0	0	0	4	4
Light veh., hazmat placard	0	0	0	0	0
Other	1	35	84	6	126
Total	1	35	84	10	130

5.2 Underreporting

This section considers a wide variety of factors that might influence the probability that a reportable case would be correctly identified and properly reported. The factors considered include the reporting criteria (vehicle type and crash severity), type of reporting agency, vehicle characteristics, and other factors.

5.2.1 Reporting Criteria

Table 5 shows reporting rates, the number of unreported cases, and the proportion of unreported cases for the levels of the MCMIS crash severity criteria. The format of the table will be used throughout this report. The first column of numbers shows the total number of reportable records

identified in the New Jersey crash file. The next column shows the reporting rate for each category of reportable records. The next column shows the number of reportable records that were not reported. Finally, the last column shows the proportion of all unreported cases accounted for by each category of reportable cases. The column giving the proportion of unreported cases can be used to identify opportunities where the greatest improvement in reporting rates may be realized.

Reporting rates differed for each level of crash severity, with the highest rates for the most severe crashes and the lowest rates for the least severe. The reporting rate for fatal crash involvements was 89.5%. The rates for injured/transported and towed/disabled crashes were 84.0% and 72.3% respectively. The differences between reporting rates for each level of severity are statistically significant, meaning that the differences are unlikely to be due to chance alone. Fatal crashes may be handled by a different process than lesser severity crashes. Fatal crashes are likely given a higher level of scrutiny than non-fatal, and therefore are more likely to be recognized as meeting the reporting criteria. That may also be true for the other two levels of crash severity. More consistent reporting of hospital codes, towing, and disabling damage would likely improve these rates.

Table 5 Reporting Rate by MCMIS Crash Severity, New Jersey 2010

Crash severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	86	89.5	9	0.4
Injured/transported	2,046	84.0	328	15.9
Towed/disabled	6,236	72.3	1,727	83.7
Total	8,368	75.3	2,064	100.0

Reporting rates were also calculated for crash severity measured by the KABCO injury severity scale, which is used by New Jersey and other States. In this scale, injuries are classified as fatal (K), incapacitating (A), non-incapacitating but evident (B), possibly injury (C), or no injury (O). Using this more fine-grained classification, reporting rates also seemed to vary linearly with the level of injury severity, ranging from 89.5% and 86.1% for fatal and A-injuries respectively, to 70.9% where no one was injured. The level of injury severity clearly is associated with reporting rates.

Table 6 Reporting Rate by Most Severe Injury in the Crash, New Jersey 2010

Injury severity	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Fatal	86	89.5	9	0.4
A-injury	137	86.1	19	0.9
B-injury	812	83.5	134	6.5
C-injury	2,549	80.1	507	24.6
Injured, unknown severity	5	80.0	1	0.0
None	4,755	70.9	1,385	67.1
Unknown	24	62.5	9	0.4
Total	8,368	75.3	2,064	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. Table 7 shows the rates for the different top level types of vehicles. The reporting rate for trucks was 75.9%, slightly higher than the overall rate and virtually identical with the rate for buses, which was 75.2%. There is apparently no effective difference in how trucks and buses are handled in the process of identifying and upload records to the MCMIS crash file. Light vehicles transporting hazmat are almost entirely ignored, with only 4 out of 55 cases actually reported.

Table 7 Reporting Rate by MCMIS Vehicle Class, New Jersey 2010

MCMIS vehicle class	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck	6,910	75.9	1,665	80.7
Bus	1,403	75.2	348	16.9
Light veh., hazmat placard	55	7.3	51	2.5
Total	8,368	75.3	2,064	100.0

Table 8 provides more insight into the effect of vehicle configuration on reporting rates. It shows reporting rates by the vehicle type field, as recorded on the NJTR-1 crash investigation report. The top row aggregates a number of light vehicle types that, on their face do not meet the vehicle type criteria but which proved to be qualifying trucks or buses based on decoding the VIN and confirmed by examining the make and model fields. These vehicles were primarily misclassified as passenger cars or minivans, small passenger vans, small cargo vans, sport utility vehicles, or pickups. Note that these misclassifications account for 37.5% of all unreported records, so improving the identification of the vehicles on the crash report could contribute substantially to improving the overall reporting rate. (See the far-right column in the table.) Among the other vehicle types, reporting rates are fairly consistent across the range of truck configurations. Often there is an effect to truck size, such that medium trucks are reported at a lower rate than heavy trucks, but that does not appear to be the case here. Two-axle single unit trucks and tractor-

semitrailers account for the next-largest shares of unreported cases at 17.4% and 18.2% respectively.

Table 8 Reporting Rate by PAR Vehicle, New Jersey 2010

PAR vehicle type	Reportable cases	Reporting rate	Unreported	% of total unreported
Light vehicle types	790	2.0	774	37.5
Single unit (2 axle)	2,113	83.0	360	17.4
Single unit (3+ axle)	786	85.4	115	5.6
Light truck w/trailer	81	74.1	21	1.0
Single unit truck w/trailer	370	80.8	71	3.4
Truck tractor (bobtail)	146	85.6	21	1.0
Tractor semi-trailer	2,307	83.7	375	18.2
Tractor double	56	85.7	8	0.4
Tractor triple	10	90.0	1	0.0
Other truck	518	82.6	90	4.4
Bus/large van (9 or more seats)	1,098	87.2	140	6.8
Other	13	7.7	12	0.6
Unknown	80	5.0	76	3.7
Total	8,368	75.3	2,064	100.0

Table 8 shows reporting rates by the truck or bus type as recorded by the police officer. Table 9 shows reporting rates by the vehicle type as indicated by the VIN, including the GVWR range. There is some evidence here that larger trucks are somewhat more readily recognized as fitting the reporting requirements than smaller trucks, even though the smaller ones also qualify. Smaller SUTs, those with a GVWR between 10,000 lbs. and 19,500 lbs. (class 3 through 5) are reported at a 58.2% rate, accounting for over a fifth of all unreported cases. Larger trucks, as identified by VIN, are reported at rates of 83.0% to 87.3%. Only 12.3% of medium/heavy pickups were reported. These are vehicles whose VINs indicate a GVWR over 10,000 lbs. and were coded in the vehicle use field as being used for business/commercial purposes. It appears that the smallest of the reportable truck types are reported at a significantly lower rate than larger trucks. The smallest reportable truck types are often misclassified as light vehicles in the vehicle type field, which probably explains their lower reporting rates. On the other hand, reporting rates for buses are uniformly high.

Table 9 Reporting Rate by Vehicle Type from the VIN, New Jersey 2010

VIN Vehicle Type	Reportable cases	Reporting rate	Unreported cases	% of total unreported
Bus	1	0.0	1	0.0
School bus	325	85.5	47	2.3
Transit/commuter bus	174	86.2	24	1.2
Cross-country intercity	211	86.7	28	1.3
Step van	87	72.4	24	1.2
Step/walk-in van	1	0.0	1	0.0
Medium/heavy pickup	130	12.3	114	5.5
SUT 10k-19.5k	1,047	58.2	438	21.1
SUT 19.5k-26k	682	83.0	116	5.6
SUT >26k	1,753	83.2	295	14.2
Truck tractor	1,908	87.3	243	11.7
Truck or bus	503	66.6	168	8.1
Trailer	80	80.0	16	0.8
Other	178	87.6	86	4.2
Unknown	1,288	64.1	463	22.4
Total	8,368	76.1	2,064	100.0

5.2.2 Crash month

It was also tested whether delays in transmitting cases, or some process related to the time of year may account for some proportion of the underreporting observed in the 2010 data. This was done by calculating reporting rates by the month of the crash. Figure 2 shows that reporting rates by the month of the crash form an interesting pattern. Overall, it appears that reporting rates vary within a fairly narrow range across the year, between 72.4% and 79.9%. Differences in monthly reporting rates of about 5% or more are statistically significant at the 0.05 level, but they do not appear to be practically significant, i.e., they do not suggest any sort of seasonal or annual pattern.

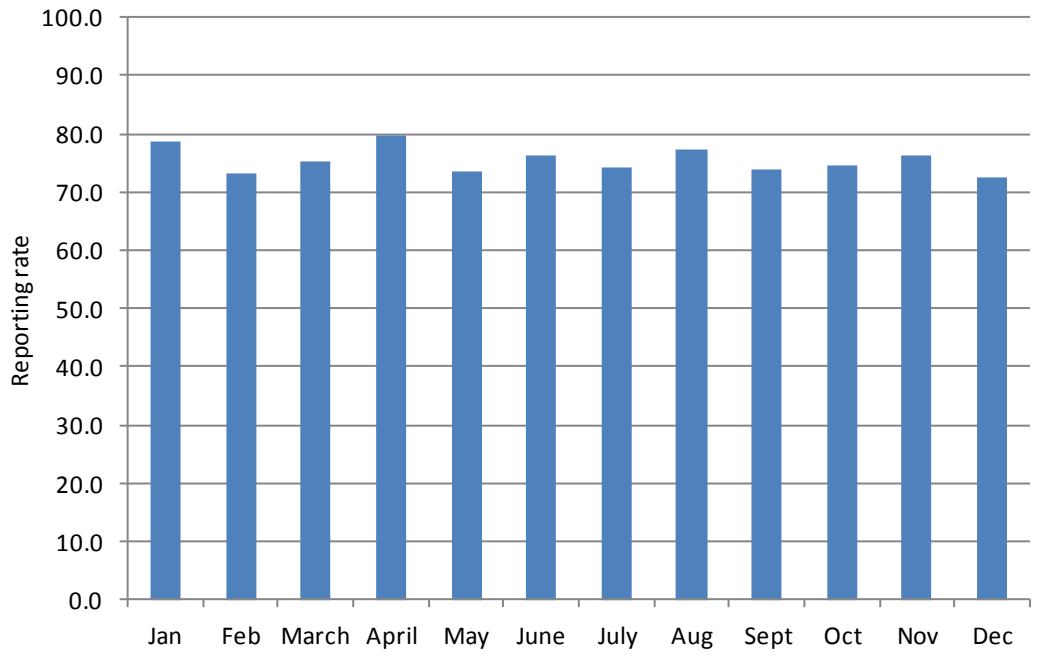

Figure 2 Reporting Rate by Crash Month, New Jersey 2010

5.2.3 Vehicle License State

Vehicle registration state, as reflected by the license plate state, may be used as a partial proxy for whether a carrier operates in interstate commerce. Clearly, many in-state registered trucks are in interstate commerce, but those licensed out of state *must* be in interstate commerce. Table 10 shows reporting rates broken down by whether the vehicle displayed a New Jersey plate or a license plate from some other state. The reporting rate for in-state licensed vehicles was 74.8%, compared with 84.0% for vehicles licensed out of state, which is almost 10% higher. This difference is substantial and statistically significant. New Jersey-plated vehicles account for almost 70% of the unreported records, so improving reporting for this group would significantly improve the overall reporting rate. The difference between in-state and out-of-state reporting rates cannot be related to vehicle type, since reporting rates vary only slightly by vehicle type, and then it is only medium duty trucks and medium/heavy pickups that are operated for commercial use that are reported at significantly lower rates than other trucks. It seems clear that in-state licensed trucks as such are recognized as reportable to the MCMIS crash file at lower rates than out-of-state trucks.

Table 10 Reporting Rate by Vehicle License Plate State, New Jersey 2010

Vehicle license plate state	Reportable cases	Reporting rate	Unreported	% of total unreported
New Jersey	5,674	74.8	1,430	69.3
Out of state	2,324	84.0	373	18.1
Unrecorded	370	29.5	261	12.6
Total	8,368	75.3	2,064	100.0

5.2.4 Reporting agency

Local, municipal police departments cover most reportable crashes (68.4%), but 30.1% are covered by the New Jersey State Police. The remainder (1.5%) are covered by county police, Port Authority police, and other enforcement agencies. The NJSP and local police thus covered almost all MCMIS-reportable crashes. The reporting rate for NJSP-covered crashes was 83.1%, or over 10 percentage points higher than the rate for local, municipal police. Unreported cases covered by local police departments account for almost 80% of the unreported cases, so the difference in reporting rate by enforcement agency contributes significantly to the overall reporting rate in New Jersey. It is likely that there are differences in training and enforcement priorities between the NJSP and local police departments, which may account for differences in the ultimate reporting rates, but the relatively high NJSP rate gives an indication of what is achievable.

Table 11 Reporting Rate by Reporting Agency Type, New Jersey 2010

Reporting Agency	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Municipal police	5,725	71.9	1,611	78.1
State police	2,520	83.1	426	20.6
County police	92	79.3	19	0.9
Port Authority police	13	84.6	2	0.1
Other	18	66.7	6	0.3
Total	8,368	75.3	2,064	100.0

There were some differences in reporting rates between different police departments. Table 12 shows reporting rates for the top 20 municipal departments, ranked in terms of the number of reportable records. Reporting rates vary substantially across these 20, but the sources of the observed variation are not known. It was thought that the variation may be related to size, on the theory that big municipalities may have other, diverse responsibilities, but statistical analysis showed that the variation does not seem to have anything to do with size. It happens that the largest department in terms of reportable cases, Newark, also happens to have one of the lowest rates (42.7%), but if Newark is left out, statistical analysis showed that the number of reportable cases a municipality happens to work has nothing to do with the reporting rate for the municipality. Even if Newark is left in the analysis, the relationship is only weak. Very little of the variation in reporting rates is related to department size.

Table 12 Reporting Rate for Selected Municipal Police Departments, New Jersey 2010

Municipality	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Newark City	241	42.7	138	8.6
Jersey City	239	63.6	87	5.4
Paterson City	107	63.6	39	2.4
Clifton City	98	67.3	32	2.0
Edison Twp	110	71.8	31	1.9
Kearny Town	68	58.8	28	1.7
Elizabeth City	126	81.7	23	1.4
North Bergen Twp	64	64.1	23	1.4
Franklin Twp	67	71.6	19	1.2
Ridgefield Borough	38	50.0	19	1.2
Linden City	64	71.9	18	1.1
Perth Amboy City	49	63.3	18	1.1
Hoboken City	26	38.5	16	1.0
Lakewood Twp	71	77.5	16	1.0
Union City	33	51.5	16	1.0
Woodbridge Twp	89	82.0	16	1.0
North Brunswick Twp	69	78.3	15	0.9
Trenton City	44	65.9	15	0.9
Bridgewater Twp	50	72.0	14	0.9
Passaic City	40	65.0	14	0.9
Other	4,032	74.9	1014	62.9
Total	5,725	71.9	1611	100.0

Reporting rate differences between the NJSP and municipal police departments in aggregate are among the significant explanations for the overall reporting rate in New Jersey. The factors identified thus far as associated with different rates of reporting include crash severity; truck size, at least discriminating between class 3 and heavier trucks; and vehicle license state. For each of these items, municipal departments report at significantly lower rates than the NJSP. For example, 97.4% of the 38 reportable fatal involvements covered by the NJSP were actually reported to the MCMIS crash file, compared with 84.1% of the 44 covered by municipal departments. (Table 13) Within each reporting agency type, more severe crashes tend to be reported at higher rates, but at each level of crash severity, the municipal police department rate is significantly lower than the NJSP rate.

Table 13 Reporting Rates by Crash Severity and Reporting Agency Type, New Jersey 2010

Crash severity	NJSP	Municipal police	Overall
Fatal	97.4	84.1	89.5
Injury/transported	88.7	81.6	84.0
Towed/disabled	80.9	68.6	72.3
Total	83.1	71.9	75.3

5.2.5 Fire Occurrence

FMCSA has a special interest in ensuring that reportable crash involvements in which a vehicle fire occurred are accurately reported. In 2010, there were only 6 reportable crashes identified in the New Jersey crash data in which there was a vehicle fire, all involving a truck. The number of fires is unexpectedly small, given the number of total number of reportable records. But only 6 cases had fire reported in the sequence of events for the vehicles. The reporting rate for these crashes was actually somewhat higher than the overall reporting rate, 83.3%, which may be because crashes with fires tend to be more severe, and thus more likely to be reported than other crashes. On the other hand, there were only six fires, and it is unwise to draw firm conclusions with so few cases.

Table 14 Reporting Rate for Crashes Involving Fire, New Jersey 2010

Vehicle type	Reportable cases	Reporting rate	Unreported cases	% of total unreported cases
Truck	6	83.3	1	100.0
Bus	0	n/a	0	0.0
Light veh. with hazmat	0	n/a	0	0.0
Total	6	0.0	1	100.0

6. Data Quality and Reporting Latency of Reported Cases

In this section, the quality of data reported to the MCMIS crash file is considered, as well as reporting latency (time elapsed 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 affect the usefulness of a data file because records with missing data cannot contribute to an analysis. The second aspect of data quality considered here is the consistency of coding between records as they appear in the State crash file and in the MCMIS Crash file. Inconsistencies may indicate problems in translating information recorded on the crash report to the values in the MCMIS Crash file.

All cases reported to the MCMIS crash file from New Jersey for 2010 are used in the evaluation of data quality, since the purpose of the analysis is to examine the quality of the data as reported.

6.1 Missing data

Table 15 shows missing data rates for selected, important variables in the MCMIS Crash file. Missing data rates on most variables are either zero or only a few percent. On most fundamental, structural variables, such as date, time, number of fatalities and number of injuries, missing data rates are zero or close to zero. This reflects thoroughness and care in preparing and maintaining the data, despite the enormous size of the New Jersey crash file.

None of the fields not related to hazmat have significantly high rates of missing data. The missing data rate for DOT number is computed only for carriers coded as “Interstate,” which

therefore must have a DOT number, and is only 1.1%. The highest missing data rates are for driver and vehicle license variables and range from 6.1% to 7.3%. (High rates of missing data for events two through four are not meaningful since most crashes only have one event.) Overall, the rates of missing data are low, reflecting reasonably complete data collection on these variables.

Table 15 Missing Data Rates for Selected MCMIS Crash File Variables, New Jersey 2010

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	2.5
Accident day	0.0	Light	0.1
Accident hour	0.4	Event one	0.1
Accident minute	0.4	Event two	84.0
County	0.1	Event three	92.9
Body type	0.8	Event four	97.6
Configuration	0.7	Number of vehicles	0.0
GVWR class	1.0	Road access	0.2
DOT number*	1.1	Road surface condition	0.1
Carrier state	0.0	Road trafficway	0.1
Citation issued	6.1	Towaway	0.0
Driver date of birth	6.4	Truck or bus	0.0
Driver age	6.4	Driver name	6.1
Driver license number	0.0	Vehicle license number	7.3
Driver license state	7.3	Vehicle license state	0.0
Driver license class	7.3	VIN	0.4
Driver license valid	6.1	Weather	0.3

* Based on cases where the carrier is coded interstate.

Hazardous materials variable	Percent unrecorded
Hazardous materials placard	0.1
Percentages of hazmat placarded vehicles only:	
Hazardous cargo release	41.8
Hazardous materials class (1-digit)	100.0
Hazardous materials class (4-digit)	23.4
Hazardous materials name	100.0

The bottom portion of the table shows missing data rates for the hazardous materials (hazmat) variables. Whether the vehicle displayed a Hazmat Placard was unrecorded in only 0.1% percent of cases. Realistically, it is likely that missing data for this field means that the vehicle did not display a placard. The other missing data rates shown are limited to the 141 New Jersey MCMIS records where the vehicle displayed a hazmat placard, indicating it was carrying hazmat. Hazmat cargo release was not recorded in 41.8%. No MCMIS hazmat records had any data for hazmat 1-digit class or hazmat materials name. However, 23.4% of vehicles recorded as displaying a hazmat placard had the hazmat 4-digit class number recorded.

6.2 Inconsistent codes

The second check on data quality is to compare values for records in the New Jersey crash data with values for comparable variables in the MCMIS Crash file. Inconsistencies between the two files may indicate a problem in preparing the data for upload. Inconsistencies may also reflect corrections made to one file (most likely the New Jersey crash file) that were not propagated to the other file, which is not unusual in active data systems.

Data were compared for as many substantive variables as possible, excluding variables used to match records in the two files. (Obviously, all variables used in the matching process were identical between the two crash files. See the discussion of matching in section 3 for more information.) Records were counted as inconsistent only if specific values marked in each file were contradictory. Cases that were blank or marked unknown in one file but with specific data in the other were not counted as inconsistent. Likewise, cases that might have a definitive value in one but a more general but not inconsistent value in the other were not counted as inconsistent. For example, some records were coded "other truck" in the MCMIS crash file, but "SUT, 3+ axles" in the New Jersey data. These cases were not counted as inconsistent because the more specific type is a subset of the more general type. But cases marked "truck tractor" in one file and "school bus" in the other were counted as inconsistent. Likewise, a truck identified as an SUT, 2-axle, 6 tire in one and SUT, 3+ axle in the other were considered to be inconsistent.

Note that this only compares values as recorded in the files; it is not a comparison of "correct" and "incorrect" values. When there are differences between the files, it is impossible to know which version is accurate without reinvestigating the case. Values for 6,434 records were compared.

Overall, the coded values were consistent between the two files on the variables compared, with specific exceptions related to vehicle configuration, cargo body, and hazardous materials. Table 16 identifies the 18 fields that were compared and summarizes the results. The variables for light condition, road condition, and weather condition differed only in one or zero cases. Road trafficway also differed for only 1 case. Driver license and vehicle license state differed for 19 and 15 cases, respectively. First event differed for only 3 cases, and in each of those, the MCMIS value indicated collision with a parked vehicle and the New Jersey value indicated collision with a motor vehicle in transport. This suggest that there was a correction to one file that, for whatever reason, was not reflected in the other.

Table 16 Consistency of Data in MCMIS and New Jersey Crash Files

Variable	Comment
Number killed	No inconsistency.
Injuries in crash	No inconsistency (there were slight differences in counts, because the MCMIS variable counts only transported injuries).
Number of vehicles	3 cases inconsistent. (MCMIS variable includes bicycles in the count.)
Road surface condition	No inconsistencies.
Trafficway flow	1 inconsistency.
Weather	No inconsistencies.
Light condition	1 inconsistency.
Body type	227 inconsistencies; no intermodal chassis (105 records) assigned to correct MCMIS cargo body type.
Vehicle configuration	252 inconsistencies; 3.9% of submitted records.
Vehicle license state	15 inconsistencies.
Driver license state	19 inconsistencies.
Event sequence	1st event: 3 inconsistencies. (collision with parked vehicle vs. MV in transport) 2nd event: 1 inconsistency. 3rd event: 0 inconsistencies. 4th event: 0 inconsistencies.
Hazmat 4-digit	With the exception of a few records with non-numeric characters, all consistent.
Hazmat release	1 inconsistency.
Hazmat placard	55 cases coded “Y” in the MCMIS data but blank in the New Jersey crash data; 16 cases coded “N” in the MCMIS data but coded on-board or spilled in the New Jersey crash data.

More significant differences were found when comparing vehicle configuration between the two files. Over 250 cases with inconsistent configurations were found, amounting to 3.9% of the records submitted. There did not appear to be any consistent pattern to the differences that might suggest a programming error. There were some types of inconsistencies that were more frequent than others. There were 53 records that were coded as a bus type in the MCMIS data, but as 2- or 3-axle SUT in the New Jersey data. Another common inconsistency was trucks identified as 2-axle (or 3-axle) in one file, but 3-axle (or 2-axle) in the other. Fifty-three vehicles were coded as a light truck with trailer in the New Jersey data, but as a truck-trailer in the MCMIS file. One can readily consider these inconsistencies to be examples of corrections to the vehicle configuration when uploaded to the MCMIS file. Nevertheless, improvements in the accuracy of identification of trucks and buses in the New Jersey data would help here and elsewhere, including in the original process of identifying reportable cases for upload.

The list of possible body types in the New Jersey crash file is similar but not identical to the cargo body list in the MCMIS file. There are 227 records with inconsistent cargo bodies between the two files. Differing bus types accounted for 98 of the problems–records were coded as 9-15 passenger buses in one file and >15 passenger buses in the other, or as a van/enclosed box in one and a bus type in the other. The other significant area of inconsistency is in the handling of

intermodal chassis. No intermodal chassis were recorded in the MCMIS crash data, but 104 in the New Jersey data, despite the fact that the MCMIS cargo body field includes a level for intermodal chassis. The problem may relate to the fact that the code levels for cargo body type line up almost, but not quite, perfectly. Code descriptions and values are identical up through level 11 (pole trailer) but in the MCMIS file 12 is not applicable and 13 is intermodal trailer. In the New Jersey data 12 is intermodal chassis. It is possible that there is a programming error here that could be easily corrected.

In addition, a significant number of records were inconsistent on hazmat placard. There were 55 records coded "Y" in the MCMIS data but left blank the New Jersey data. Hazmat placard was coded "N" for 16 MCMIS records but the corresponding New Jersey records indicate that hazmat was on-board or spilled. Hazardous materials in cargo are relatively infrequent so this amount of inconsistency is significant.

The origin of these inconsistencies is not known. They may reflect corrections applied in one file but not in the other (or not in the one supplied to us); errors introduced by manually transcribing certain data elements; or programming errors. In the case of intermodal chassis cargo bodies, one suspects a programming error, if it was not realized that the MCMIS field has an intermodal chassis level. The source of the hazmat problem is not known.

6.3 Reporting latency

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, so all crash records should be in the file by March 31. The 2010 MCMIS Crash file as of August 31, 2011, 243 days after the end of 2010, was used to identify records submitted from New Jersey, so all 2010 cases should have been reported by that date.

Crash reports are required to be submitted to the MCMIS Crash file within 90 days of the crash (not within 90 days of the end of the calendar year). Figure 3 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. Over three-quarters (75.6%) of the records were submitted within 90 days of the crash. Ninety percent of the records were submitted with 179 days of the crash, which is about twice as long as the 90 day grace period. The median time between crash occurrence and record upload was 57 days, and the greatest interval was 492 days. For about 5% of the records, the period between the crash and record submission was 250 days or more. Still, a significant majority of records are submitted within the 90 reporting period.

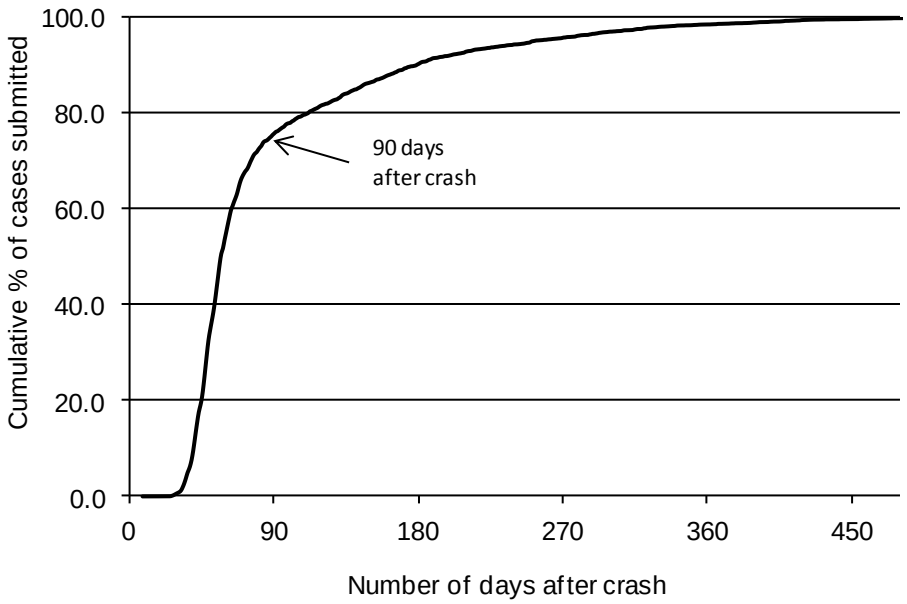

Figure 3 Cumulative Percent of Cases Submitted to MCMIS Crash File by Number of Days After Crash, New Jersey 2010

The first date on which crash records from 2010 were uploaded was February 24, 2010, when 36 records were uploaded. On average, uploads occurred every 2.2 days between then and May 25, 2011, when the last upload occurred. About a quarter of the records were submitted after the close of the calendar year. Generally speaking the number of records uploaded per submission was significant. An average of 32.0 records were submitted per upload. About 50 percent of the uploads contained 15 or more records. The largest single upload was of 272 records.

7. Summary and Discussion

The overall reporting rate from New Jersey to the MCMIS crash file was computed to be 75.3%. This rate varied by a number of factors. Fatal involvements were reported at a substantially higher rate than nonfatal, with almost 90% of fatal involvements reported, compared to only 84.0% of injured/transported and 72.3% of towed/disabled involvements. Rates also varied almost linearly by the most severe injury in the crash, from the high rate for fatal crashes to 70.9% where there were no injuries, just a vehicle towed due to disabling damage. Reporting rates were virtually identical for trucks and buses as such, and for different classes of heavy trucks, but were significantly lower for medium-duty trucks, i.e., trucks close to the lower limit of the reporting threshold. Over 80 percent of reportable crashes were reported for trucks that were GVWR class 6 and above by VIN. This compares with only 58.2% of class 3 and 4 2-axle SUTs and only 12.3% of class 3 pickups used for commercial purposes. There is a tendency for reporting to capture the biggest trucks in the most serious crashes.

Trucks (and buses) that were miscoded as light vehicles formed the largest single group of cases that were not reported correctly. Misidentified light vehicles (Table 8) accounted for 37.5% of

the records that should have been reported but were not. These are all trucks or buses that were identified on the police report as a light vehicle, but which were shown, by VIN as well as by vehicle make and model–which are recorded by police officers–to be medium or heavy trucks. Trucks are more diverse and specialized than passenger vehicles, and many people only have limited experience with the details of different truck types. Specific training in identifying trucks, beyond just supplying definitions, may be helpful in improving correct identification, which should lead to improved reporting. Overall, the rate of misidentification is not unreasonably high, but since trucks and buses constitute are minority of motor vehicles in crashes, a small rate of misidentification can significantly affect the reporting rate.

A primary factor in reporting rates proved to be the type of enforcement agency that covered the crash. The New Jersey Highway Patrol consistently has the highest reporting rates, averaging 83.1% of reportable crash involvements. Reporting rates for the NJSP are significantly higher than for municipal police departments, regardless of crash severity, type of vehicle (truck or bus), or the size of the vehicle. For example, it was found that crashes covered by the NJSP were reported at higher rates than crashes covered by local police departments for each level of crash severity. This consistent difference may reflect differences in training and enforcement priorities. Changes in training, including periodic refresher courses, could greatly improve the overall MCMIS crash reporting rate.

Finally, it should be noted that the New Jersey crash file has almost all the information needed to select reportable crashes, but not quite. Identifying injured persons is readily done, and in fact the New Jersey data has good detail on injuries (such as injury type and body part injured) which is very helpful for classifying injuries where severity is left unknown. But there are problems in identifying transported injuries. Using the field for “refused medical attention” risks over-identifying transported injuries because the field includes injuries treated at the scene. And the field recording the code of the hospital to which the injured were transported very likely under-identifies the number of transported injuries, because of the number of blank or invalid hospital codes.

The situation is similar with respect to identifying crashes with disabled vehicles that were towed. Many records are left unknown on how the vehicle was removed from the scene (which includes towing) and whether the vehicle was impounded or disabled. The amount of missing data makes it impossible to identify towed/disabled crashes cleanly and comprehensively. The fact that the field to record that a vehicle is disabled is used also to record whether it was impounded contributes to the difficulty. In this case, one field is used to record two different pieces of information, since a disabled vehicle can be impounded. Each field should record only one type of information and the categories should all be mutually exclusive.

Because of the ambiguities in recording crash severity, it was necessary to exercise judgment and considerable manual, case-by-case, review to capture a set of cases that most likely were reportable. At each step, we chose the more conservative alternative to avoid over-identifying reportable vehicles and crashes.

But this also points out the opportunity to make small changes in the way data are recorded on the NJTR-1 to facilitate the process of selection and extraction for upload to the MCMIS crash file. With respect to injury, a single field to record whether the person was transported for medical attention or not transported would resolve any ambiguity (as long as it was conscientiously completed). And with respect to vehicle towing, a field to record towed/not towed and another to record disabled/not disabled would unambiguously resolve any doubts. Again, missing data would have to be kept low, but that is a training issue. The result would be all the data required coded into the computerized crash record to select the appropriate vehicles and crashes.

There were also some inconsistencies between code values in the State crash data and the corresponding record in the MCMIS crash file, particularly with regard to vehicle configuration and cargo body. The rates of difference were relatively small, especially considering the number of records in the New Jersey crash file, but they stand out because of the good consistency found in other variables and because vehicle configuration and cargo body type are important variables in safety analysis.

It is the goal of this report to contribute to complete and accurate reporting to the MCMIS crash file. Addressing the weaknesses and building on the strengths identified in this report should result in an improved data collection and reporting process.

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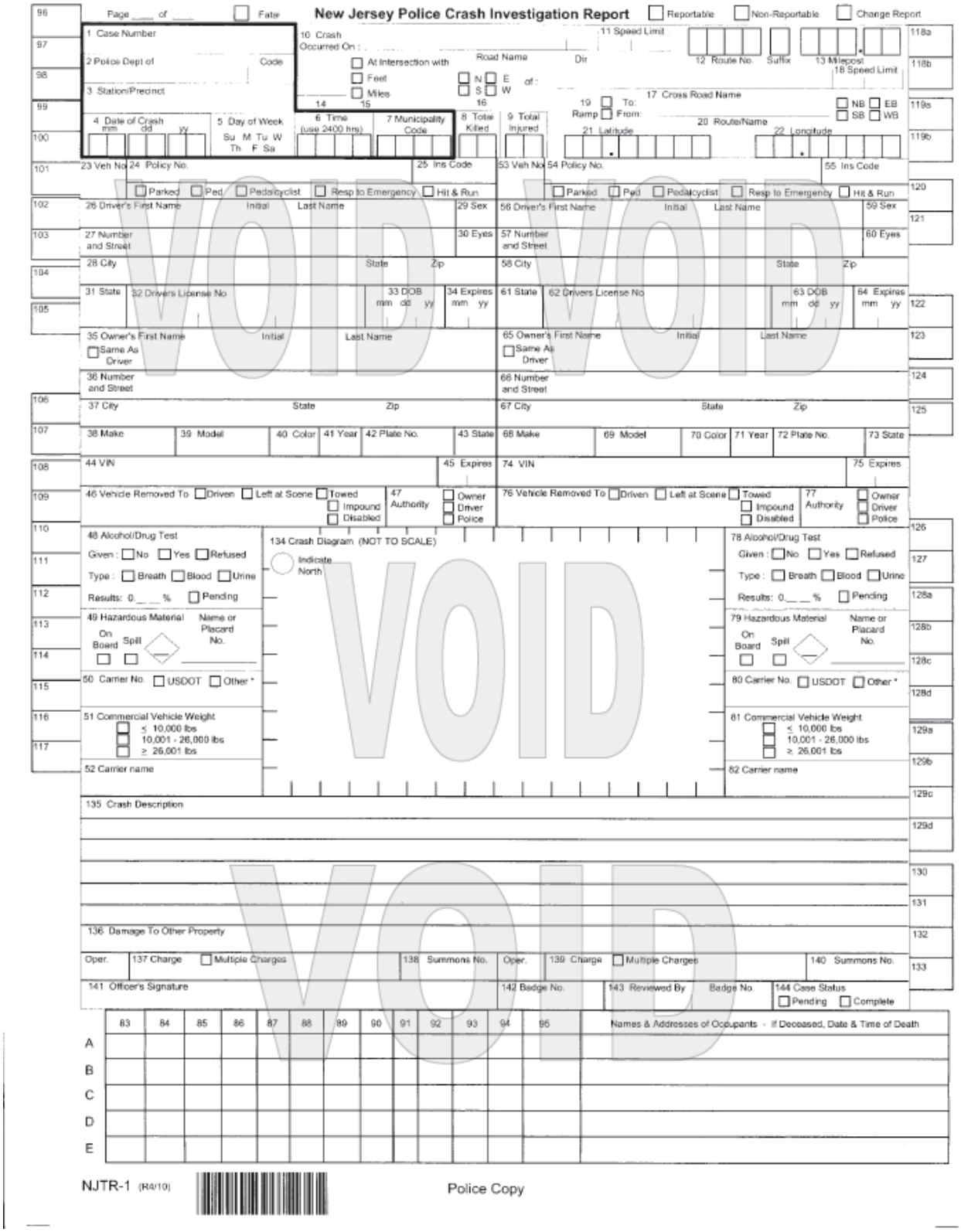
Appendix A New Jersey Crash Report Form



Page _____ of _____

New Jersey Police Crash Investigation Report Motor Vehicle Crash Description	Police Dept: _____ Code: _____ Station: _____ Case No: _____

(Refer to vehicle by number)

	Veh Occ	Pos In/On	Ejct	Phys Cond	Age	Sex	Loc Inj	Type Inj	Ref Used	Equip Avail	Equip Used	Bag Depl	Hosp Code	
	83	84	85	86	87	88	89	90	91	92	93	94	95	Names & Addresses of Occupants - If Deceased, Date & Time of Death
ALL INVOLVED F														
G														
H														
I														
J														

135 Crash Description

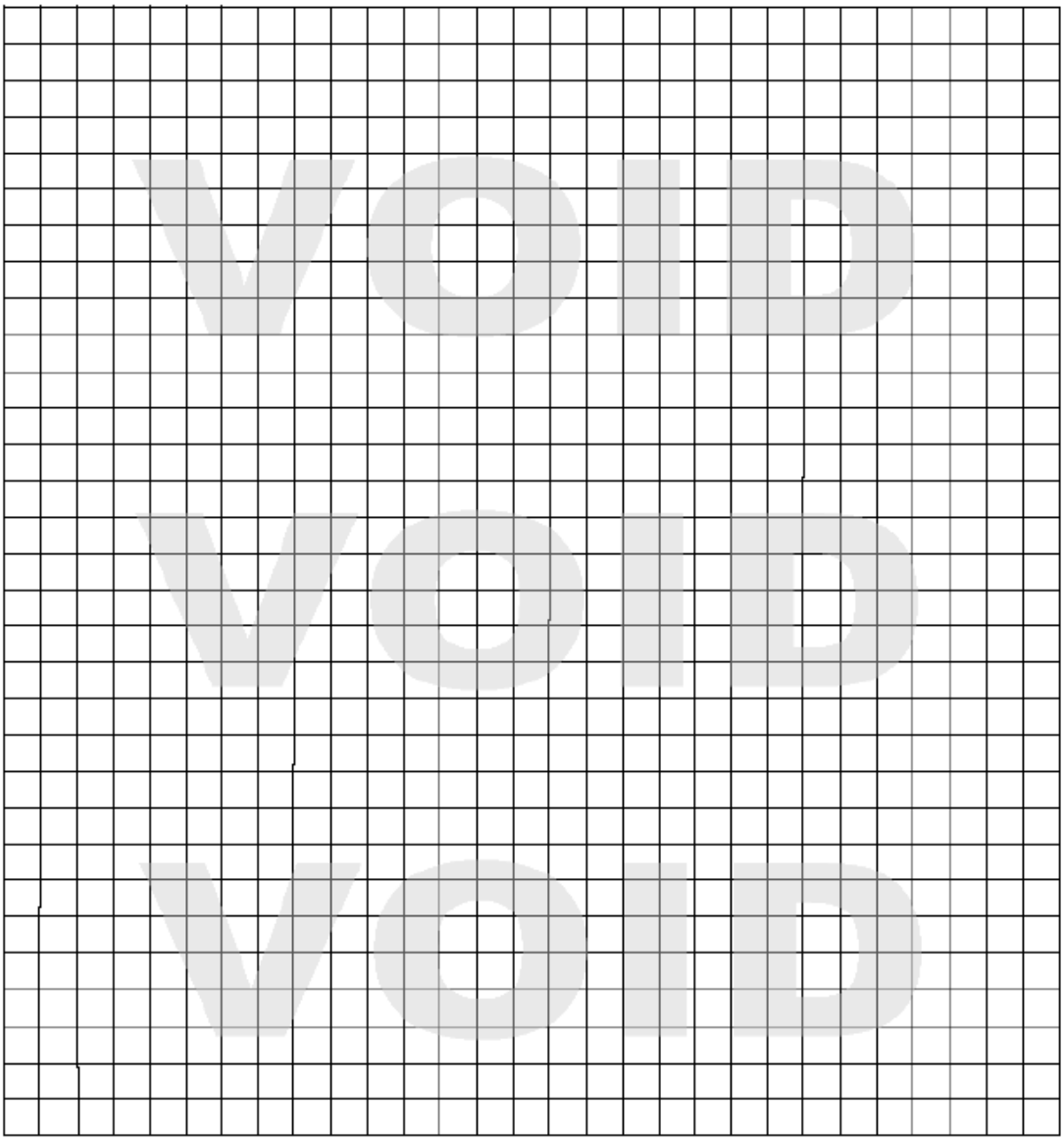
NJTR-1A (rev. 03/2006) Officer's Signature Badge Number

Page _____ of _____

New Jersey Police Crash Investigation Report	Police Dept: _____ Code: _____
Motor Vehicle Crash Diagram	Station: _____ Case No: _____

134 Crash Diagram (NOT TO SCALE)

Indicate North



NJTR-1B (rev. 03/2006)

Officer's Signature

Badge Number

Appendix B Reportable Vehicle Identification Algorithm

```
Trkbush
      1=truck,2=bus,3=hazplac,8=other

Body_type
/* codes 1-19 are passenger vehicles */
 1 = 'Car/station wagon/minivan'
 2 = 'Passenger van (< 9 seats)'
 3 = 'Cargo van (10k lbs or less)'
 4 = 'Sport utility vehicle'
 5 = 'Pickup'
 6 = 'Recreational vehicle'
 7 = 'All terrain vehicle'
 8 = 'Motorcycle'
 9 = '(reserved)'
 10 = 'Any codes 1-8 with trailer'
 11 = 'Moped'
 12 = 'Streetcar/trolley'
 13 = 'Pedalcycle'
 19 = 'Other pass vehicle'
 /* codes 20-30 are trucks or buses */
 20 = 'Single unit (2 axle)'
 21 = 'Single unit (3+ axle)'
 22 = 'Light truck w/trailer'
 23 = 'Single unit trk w/trailer'
 24 = 'Truck tractor (bobtail)'
 25 = 'Tractor semi-trailer'
 26 = 'Tractor double'
 27 = 'Tractor triple'
 29 = 'Other truck'
 30 = 'Bus/large van (9 or more seats)'
 99 = 'Other'
 00 = 'Unknown'
 ;
 value p_cargbody_f /* Cargo body type *(commercial vehicle only) */
 1 = 'Bus (9-15 seats)'
 2 = 'Bus (>15 seats)'
 3 = 'Van/enclosed box'
 4 = 'Cargo tank'
 5 = 'Flatbed'
 6 = 'Dump'
 7 = 'Concrete mixer'
 8 = 'Auto Transporter'
 9 = 'Garbage/refuse'
 10 = 'Hopper (grain/gravel/chips)'
 11 = 'Pole (trailer)'
 12 = 'Intermodal chassis'
 13 = 'No cargo body'
 99 = 'Other'
 00 = 'Unknown'
 ;

VIN_vehtype
 value hetz_typf
 1='CAMPER/MTR HM'
 2='CAMPER/MTRHM/CNVRS'
```

```
3='MINIVAN'
4='UTIL STATION WAGON'
5='LARGE UTILITY'
6='LARGE VAN'
7='MED/HVY TRK-BSD MTRHM'
8='COMPACT PICKUP'
9='COMPACT UTILITY'
10='STANDARD PICKUP'
11='MEDIUM/HVY PICKUP'
12='STEP VAN'
13='STP/WLK-in VAN'
14='BUS'
15='OTH BUS MTRHM CNVR'
16='SCHOOL BUS'
17='TRANSIT/COMMUTER BUS MTRHM'
18='TRANSIT/INTERCITY'
19='X CNTRY INTRCTY MTRH'
20='CAB CHASSIS BASED'
21='MEDIUM TRUCK'
22='SUT 10K-19.5'
23='SUT 19.5K-26'
24='SUT >26K'
25='TRUCK TRACTOR'
26='TRUCK or BUS'
27='TRAILER';

value hrngf
1='0-6,000 lbs'
2='< 3,000 lbs'
3='3,001-4,000 lbs'
4='4,001-5,000 lbs'
5='5,001-6,000 lbs'
6='6,001-10,000 lbs'
7='6,001-7,000 lbs'
8='7,001-8,000 lbs'
9='8,001-8,500 lbs'
10='8,001-9,000 lbs'
11='8,501-9,000 lbs'
12='9,001-10,000 lbs'
13='10,000 or less lbs'
14='10,001 OR MORE lbs'
15='10,001-14,000 lbs'
16='14,001-16,000 lbs'
17='16,001-19,500 lbs'
18='19,501 OR MORE lbs'
19='19,501-23,500 lbs'
20='19,501-26,000 lbs'
21='23,501-26,000 lbs'
22='26,001 OR MORE lbs'
23='26,001-33,000 lbs'
24='33,001-40,500 lbs'
25='40,501-48,500 lbs'
26='48,501-58,000 lbs'
27='58,001-69,500 lbs'
28='> 33,000 lbs'
29='> 55,000 lbs'
30='> 70,000 lbs'
```

```
 31='GLIDER KIT';

/* flag for truck or bus identified in par or by vin */
 if veh_type in(20,21,23,24,25,26,27,29,30) then nj_trk=1;
 else if veh_type=22 and veh_use in(2,3) then nj_trk=1;
 else nj_trk=0;

 if hetz_veh_type in(14,16,17,18,19,21,22,23,24,25) or (hetz_veh_type
in(11,12,26) and 14<=hetz_rng<=30) then vin_trk=1;
 else vin_trk=0;

/*
 algorithm to identify reportable vehicles
*/
 if nj_trk=0 and vin_trk=0 then rept_flg=0;
 else if nj_trk=1 and vin_trk=1 then rept_flg=1;
/* don't take if vin shows light vehicle
 unless it's a bus, either by nj veh type or body type
*/
 else if nj_trk=1 and vin_trk=0 then do;
 if veh_type=30 or carg_bod_typ in(1,2) then rept_flg=2;
 else if 1<=carg_bod_typ<=12 and hetz_rng not
in(1,2,3,4,5,6,7,8,9,10,11,12,13) then rept_flg=3;
 else if 14<=hetz_rng<=31 then rept_flg=4;
/* light truck and trailer needs to be commercial or valid body*/
 else if veh_type in(22,23) and (veh_use=2 or 1<=carg_bod_typ<=12) then
rept_flg=2;
/* clear large truck and vin does not indicate light vehicle */
 else if veh_type in(21,25,26,27) and hetz_rng not
in(1,2,3,4,5,6,7,8,9,10,11,12,13) then rept_flg=3;
 else rept_flg=-1;
 end;
 else if nj_trk=0 and vin_trk=1 then do;
 if veh_make in('AUDI','BMW','JEEP','MERCEDES BENZ','LAND
ROVER','TOYOTA','HONDA','HYUNDAI','INFINITI',
 'MERCURY','MINI COUPER','PONTIAC','VOLKSWAGEN','AMERICAN
MOTORS','AMG','HUMMER','KAWASAKI'
 ,'NISSAN','MAZDA','CADILLAC','RENAULT','SATURN','MIN','RANGE ROVER') then
rept_flg=-2;
 else if (hetz_veh_type=11 and veh_use=2) or (hetz_veh_type=12 and
14<=hetz_rng<=30 and veh_use=2) then rept_flg=5;
/* (2 pieces of evidence the vehicle is a truck or bus) */
 else if hetz_veh_type in(14,16,17,18,19,21,22,23,24,25,26) and
1<=carg_bod_typ<=12 then rept_flg=6;
/* these were all examined and make/model consistent with vin (note
transit/motorhome excluded) */
 else if hetz_veh_type in(14,16,18,21,22,23,24,25) then rept_flg=7;
 else rept_flg=-3;
 end;

 if carg_bod_typ in(1,2) and hetz_veh_type not in(1,2,3,4,7,8,9,10,15,27)
then rept_flg=8;
/*
also check out del_flg by checking against veh_type and veh_use
*/

/* recode for excluded uses (emergency, equipment in use) */
```

```
 if veh_use=4 then del_flg=1;
/* used as equipment and not a known cargo body type (to avoid deleting
concrete mixers, etc. */
 else if veh_use=5 and carg_bod_typ in(.,0,13,99) then del_flg=1;
 else del_flg=0;

 if del_flg=1 then rept_flg=0;
/*
 identify trucks, buses, and hazmat
*/
 if haz_stat in('O','S') then haz_flg=1;
 else haz_flg=0;

 if 1<=rept_flg<=8 then reportable=1;
 else reportable=0;

 if reportable=1 and (veh_type=30 or carg_bod_typ in(1,2)) then trkbush=2;
 else if reportable=1 then trkbush=1;
 else if reportable=0 and haz_flg=1 then trkbush=3;
 format trkbush trkbushf.;
```