# 5.0 Data Analysis

This section describes how records in the Serious HM Crash Database were analyzed to assess the benefits of collecting more descriptive information on serious crashes. It is based on a comparison of the information in the database to what was initially available in MCMIS and HMIS.

The screening process employed to select the 214 Serious HM Crash Database records adds some analysis constraints. For example, 1,200 MCMIS crashes were screened to identify the 214 accidents. All crashes in which a fatality occurred were selected. All rollovers were also selected. Analyses results for these classes of accidents are valid but should not be generalized to the whole population of HM crashes. Clearly, if all HM rollovers and fatalities have been selected, then analyses results that look for the relationship between these two factors would be valid. However, it is unlikely that an analysis that analyzed the relationship between non-rollover accidents and fatalities would be valid because the selection process has ignored many non-rollover accidents. The selection of rollover and fatal accidents using MCMIS is incomplete because not all rollover accidents are listed in the MCMIS data. One of the recommendations for Phase 2 is to use statistical sampling methods to select a significant fraction of the crashes for which additional information is to be collected. By using such a selection process, it will be possible to statistically validate dependencies among many crash causes and effects.

The following discussion will address data enhancements in two areas: 1) data quality and 2) use of more extensive field definitions. Tables will be used to present the "before" and "after" data. The final section provides an example of the type of relationship that might be discovered by performing analyses using the Serious HM Crash Database. The case selected is the relationship between rollovers and fatalities.

## 5.1 Data Quality Enhancement

Data obtained from the detailed accident descriptions in the approximately 200 PARs provided by state transportation officials was the single biggest factor that enabled the enhancement of data quality. Before these PARs were obtained, detailed accident descriptions were available only for the 45 separate accidents that were reported in HMIS by the carriers. This represented the "before" state of the data. The enhanced database now contains almost 200 detailed accident descriptions, a more than four-fold increase in the number of quality observations.

Obtaining the PARs had two direct benefits. First, since the MCMIS records were all based on PARs, it was immediately possible to validate the quality of information that was initially placed in the enhanced database when the MCMIS records were imported. Populating the accident description field also allows for investigation of relationships between first harmful event and crash causation. Such analysis was limited to the smaller HMIS data set before the Serious HM Crash Database was created. As described here, these causation studies are defined quite narrowly, as they only examine the event that might have initiated the crash sequence (e.g., driver fell asleep).

Table 5-1 has been prepared to show the difference in the data obtainable from MCMIS and HMIS, the "before" data, and the data "after" obtaining the PARs and making calls to the carriers. The "before" data is shown for two fields: 1) United Nations (UN) number from HMIS and MCMIS records and 2) the quantity spilled data from HMIS. If either of these fields were populated in MCMIS and HMIS they were initially transferred to the enhanced database. If there were conflicts with the UN number, they were resolved by one of two ways – accepting the HMIS entry because it would be expected that the carrier would have better knowledge of the material being shipped, or basing the selection on the accident description field in the PAR. Since both MCMIS and HMIS do not have a field listing the quantity shipped, the data shown in that "after" column in Table 5-1 was obtained through direct contact with the carriers.

**Table 5-1. Example of Before and After Entries to Data Fields**

| Data Prior to Collection of Additional Data | | | | | Augmented Database | | | |
|---|---|---|---|---|---|---|---|---|
| MCMIS AC_REPORT_NUM | MCMIS UN Number | HMIS UNNUM | HMIS RQUAN | HMIS RUNIT | UN Number | Quantity Shipped | Quantity Spilled | Material Units |
| AK0000120641 | UN1230 | UN1230 | 8 | GAL | UN1230 | 9300 | 8 | GAL |
| AL001001641A | UN1824 | UN1824 | 5 | GAL | UN1824 | 6500 | 5 | GAL |
| AL001003101A | UN1203 | NA1993 | 2000 | GAL | UN1203 | 9200 | 2000 | GAL |
| AL001024192A | UN1075 | UN1075 | 100 | GAL | UN1075 | 2600 | 100 | GAL |
| AL001045675A | UN1075 | UN1075 | 400 | GAL | UN1075 | 2400 | 400 | GAL |
| AR0001008315 | | | | | UN0083 | 10247 | | LBS |
| CA0100154124 | UN1203 | | | | UN1203 | 4000 | | GAL |
| CA0100154124 | | | | | UN1993 | 4000 | 25 | GAL |
| CA100087141A | UN1993 | | | | UN1993 | 8000 | 7500 | GAL |
| CA100098421A | UN1075 | | | | UN1075 | 9450 | 9400 | GAL |
| CA100204585A | UN1267 | | | | UN1267 | 3600 | 100 | GAL |
| CA100204585A | UN1267 | | | | UN1267 | 3900 | 3900 | GAL |
| CO2001010386 | | UN1203 | 8100 | GAL | UN1203 | 8200 | 8100 | GAL |
| CO2001010432 | UN1203 | UN1203 | 500 | GAL | UN1203 | 8600 | 500 | GAL |
| CO2001010657 | UN1203 | | | | UN1203 | 8300 | 1562 | GAL |
| CO2001011112 | UN1977 | | | | UN1977 | 2000 | 0 | GAL |
| CO2001011140 | UN1203 | | | | UN1203 | | | |
| FL6022704901 | UN1942 | | | | UN1942 | 49280 | | LBS |
| FL6022752301 | UN1203 | NA1993 | 1000 | GAL | UN1993 | 7500 | 1000 | GAL |
| FL6029492801 | UN1075 | | | | UN1075 | 0 | 0 | GAL |
| FL6035862101 | UN1203 | | | | UN1203 | 9000 | 0 | GAL |
| MN0131261800 | | | | | UN3262 | 60 | | LBS |
| MO001192011A | UN1203 | NA1993 | 2662 | GAL | UN1203 | 6400 | 2562 | GAL |
| MO001192011A | | | | | UN1203 | 2000 | 100 | GAL |
| MO001337014A | | | | | UN3267 | 848 | | LBS |
| MO001337014A | | | | | UN3264 | 119 | | LBS |

**Table 5-1. Example of Before and After Entries to Data Fields (Continued)**

| Data Prior to Collection of Additional Data | | | | | Augmented Database | | | |
|---|---|---|---|---|---|---|---|---|
| MCMIS AC_REPORT_NUM | MCMIS UN Number | HMIS UNNUM | HMIS RQUAN | HMIS RUNIT | UN Number | Quantity Shipped | Quantity Spilled | Material Units |
| MO001337014A | | | | | UN2366 | 1026 | | LBS |
| MO001337014A | | | | | UN1993 | 949 | | LBS |
| MO001337014A | | | | | UN1760 | 699 | | |
| MO001341012A | | | | | | | 41316 | LBS |
| MT011550802A | UN1005 | | | | UN1005 | 37560 | | LBS |
| MT014070101A | UN1075 | UN1075 | 0 | | UN1075 | 9398 | 0 | GAL |
| MT014990405A | UN1789 | | | | UN1789 | | | |
| NC100270855A | UN1075 | | | | UN1075 | | | |
| NY0012227770 | UN1203 | UN1203 | 3953 | GAL | UN1203 | 12000 | 3953 | GAL |

Table 5-1 shows the amount of data enhancement (i.e., corrections and additions) made by obtaining the PARs and contacting carriers. In several cases, the UN numbers were corrected or completed. In the case of the quantity shipped, that information can typically only be obtained from the carrier. Since responses by the carrier were completely voluntary, some carriers, perhaps because of concerns over pending lawsuits, refused to provide this information. The quantity spilled is captured by HMIS, so this field could also be filled out for incidents reported in HMIS. While there are still some missing entries in the database, the number has been significantly reduced. The accuracy of the results is also much improved.

As another example of data enhancements and corrections, Table 5-1 shows the "before" data for many HM crashes are completely blank in both the MCMIS and HMIS columns. In many cases, that information is available from the PAR; it just simply was not coded into the MCMIS report (e.g. *AR0001008315).* Table 5-1 also shows that there are large spills that were not reported by the carrier at the time the HMIS record was completed (e.g. *CA100087141A).* Report number *CA0100154124* shows the state representative filling out the MCMIS report has a dilemma when more than one HM commodity is shipped. There is no provision in MCMIS for listing multiple hazardous materials. In this case, the reporter chose to encode the more hazardous material, *gasoline*, even though 25 gallons of *diesel* was spilled. The best example of multiple hazardous materials on a shipment is shown in accident report number *MO001337014A*. In this accident, there were 5 different hazardous materials on the same vehicle and, after contacting the carrier, it was determined that none were released. The MCMIS reporter solved that dilemma by reporting no HM information. While some of the rows in Table 5-1 were picked for illustrative purposes, additional rows were selected at random to show the information that was obtained from the PARs and calls to the carriers. A complete summary of all the changes made to quantity shipped, quantity spilled and HM number designation is presented in Appendix B.

One of the key Phase I findings is that there are many information elements contained in the PAR that are not captured in MCMIS because fields are not provided to capture the information. One of the most useful missing elements is the accident description that is part of all PARs. This description enabled data entry personnel to verify the accuracy of many entries. If the data in a field was inconsistent with the prose contained in the PAR accident description, the information in the data field was changed to be consistent with the PAR.

Table 5-2 shows the reclassification of MCMIS cargo body types that occurred following the collection of the PARs. While there are still some uncertain cargo body types (e.g., a *dry box semi trailer* might be a *van enclosed box)*, most could be deduced either from the configuration or accident description field. Some of the changes were the result of using a larger number of configurations (e.g., separating cargo tank/refrigerated from cargo tank/liquid). However, a large number of cargo body types were simply misclassified as noted by the large increase in cargo tank/liquid configurations that were involved in HM crashes.

**Table 5-2. Changes in Cargo Body Configuration from PAR's**

| MCMIS Cargo Body Type | Serious Accident Cargo Body Type | Number of Vehicles |
|---|---|---|
| Cargo Tank | Cargo Tank/liquid | 48 |
| Cargo Tank | Cargo Tank/refrigerated liquid | 2 |
| Cargo Tank | Dry box semi trailer | 38 |
| Cargo Tank | Flatbed | 2 |
| Cargo Tank | Van Enclosed Box | 4 |
| Dump | Flatbed | 2 |
| Dump | Flatbed with permanent equipment | 1 |
| Flatbed | Cargo Tank/liquid | 97 |
| Flatbed | Cargo Tank/refrigerated liquid | 7 |
| Flatbed | Dry box semi trailer | 2 |
| Flatbed | Flatbed | 7 |

An effort was also made to understand why so many cargo body types were misclassified. In reviewing the PARs, several disparities were identified. First, while the forms differed from one state to another, most used codes to enable police to quickly fill out the form. While much of that information is captured in MCMIS, translation of the information into a common national form for entry into MCMIS was not always straightforward.

Since the forms are filled out by state officials and not nationally, differing interpretations of the meaning of fields could also be a source of reporting inconsistencies. Furthermore, since the forms are for all truck accidents, some common configurations used for HM transport, like cargo tank configurations, are not coded on the forms. Fortunately, the accident descriptions in all PARs commonly use the word cargo tanker when describing the vehicle. Thus, just capturing the accident description information that is not coded in MCMIS provides a wealth of information that can be used to identify improperly coded fields and correct the data entry.

The HMIS database provides information on the quantity of hazardous material spilled but does not provide any data on the quantity shipped. Table 5-3 summarizes the results after carriers were contacted to obtain this information. The last two columns are the results of calls to the carriers to obtain the quantity of material shipped and reconfirm the quantity of material spilled. As expected, the carrier typically confirmed the quantity spilled. However, there were some cases where the numbers differed from those reported in HMIS. If the carrier listed the quantity shipped as less than the quantity spilled as reported in HMIS, the quantity shipped was used as the quantity spilled.

**Table 5-3. Quantity Shipped Data for HMIS Records**

| ID | UN Number | Serious Accident DB | | HMIS |
|---|---|---|---|---|
| | | Quantity Shipped | Quantity Spilled | Quantity Spilled |
| AK0000120641 | UN1230 | 9300 | 8 | 8 |
| AL001001641A | UN1824 | 6500 | 5 | 5 |
| AL001003101A | UN1203 | 9200 | 2000 | 2000 |
| AL001024192A | UN1075 | 2600 | 100 | 100 |
| AL001045675A | UN1075 | 2400 | 400 | 400 |
| AL001073232A | UN1977 | 4375 | 3125 | 3125 |
| AL001086867A | UN1203 | 7601 | 7601 | 7601 |
| AZ000000965A | UN1203 | 0 | 0 | 0 |
| AZ0000037645 | UN1203 | 0 | 8307 | 8307 |
| AZ0009420027 | UN1203 | 8900 | 4000 | 4000 |
| CA100200076A | UN1863 | 8000 | 8000 | 8035 |
| CA100200077A | UN1203 | 8600 | 8600 | 8705 |
| CO2001010386 | UN1203 | 8200 | 8100 | 8100 |
| CO2001010432 | UN1203 | 8600 | 500 | 500 |
| CO2001011026 | UN1993 | 7200 | 65 | 65 |
| FL5194766401 | UN1203 | 9200 | 0.13 | 0.13 |
| FL6022752301 | UN1993 | 7500 | 1000 | 1000 |
| FL6024659501 | UN1203 | 7001 | 7001 | 7001 |
| FL6144561801 | UN1863 | 9400 | 210 | 210 |
| ID0195300310 | UN1863 | 5200 | 50 | 50 |
| KS2001003923 | UN1075 | | 0.02 | 0.02 |
| KS2001004331 | UN1963 | 9353 | 9353 | 11000 |
| ME2001125930 | UN1203 | 8600 | 30 | 30 |
| MN0140974000 | UN1203 | 8500 | 5000 | 8000 |
| MN0150700000 | UN1005 | 133.68 | 113.63 | 113.63 |
| MN01900512A0 | UN1203 | 8803 | 8803 | 8803 |

**Table 5-3. Quantity Shipped Data for HMIS Records (Continued)**

| ID | UN Number | Serious Accident DB | | HMIS |
|---|---|---|---|---|
| | | Quantity Shipped | Quantity Spilled | Quantity Spilled |
| MO001192011A | UN1203 | 2000 | 100 | 2662 |
| MO001192011A | UN1203 | 6400 | 2562 | 2662 |
| MO001311009A | UN1805 | 5677.5 | 5 | 5 |
| MT014070101A | UN1075 | 9398 | 0 | 0 |
| NC100337821A | UN1203 | 8000 | 2498 | 2498 |
| NY0012227770 | UN1203 | 12000 | 3953 | 3953 |
| NY011253510A | UN3149 | 600 | 400 | 400 |
| OK0096273009 | UN1203 | 5768 | 2661 | 2661 |
| OR001260126A | UN1993 | 8300 | 5538 | 5538 |
| PA0103210700 | UN1075 | 3000 | 400 | 400 |
| PA102221200A | UN1075 | 2000 | 10 | 3 |
| PA102901700A | UN1993 | 3100 | 2300 | 2300 |
| PA103395100A | UN1993 | 3300 | 180 | 180 |
| WI000033682A | UN1987 | 8000 | 131 | 131 |
| WI000033885A | UN1203 | 8500 | 4 | 4 |
| WY01120I021A | UN2448 | 16000 | 25 | 200 |
| WY01143F281A | UN1203 | 8000 | 876 | 876 |
| WY01S22G291A | UN1203 | 12000 | 3181 | 3181 |

Figure 5-1 shows the type of analysis for cargo tank trucks that is possible if quantity shipped and quantity spilled data are available. For example, the figure shows that fifty percent of all rollovers result in at least thirty percent of the cargo being spilled. As discussed previously, the rollover curve is statistically valid because all rollovers were analyzed. However, a similar curve constructed for non-rollover accidents probably would not be statistically valid because the Serious HM Crash Database selection process screened out many non-rollover crashes (e.g., only Class 3 spills that did not rollover were considered). Relationships such as the one shown in Figure 5-1, would be validated using data from the larger, more representative sample collected in Phase 2.

The collection of the PARs also made it possible to verify data on vehicle configuration. In previous analyses, some of the HM vehicles were listed as auto car transporters and cement mixers. Table 5-4 shows the HM vehicle configurations for those crashes where a HM description was provided. The HM field was used as a convenient screening tool to remove all vehicles involved in crashes that were not carrying HM.

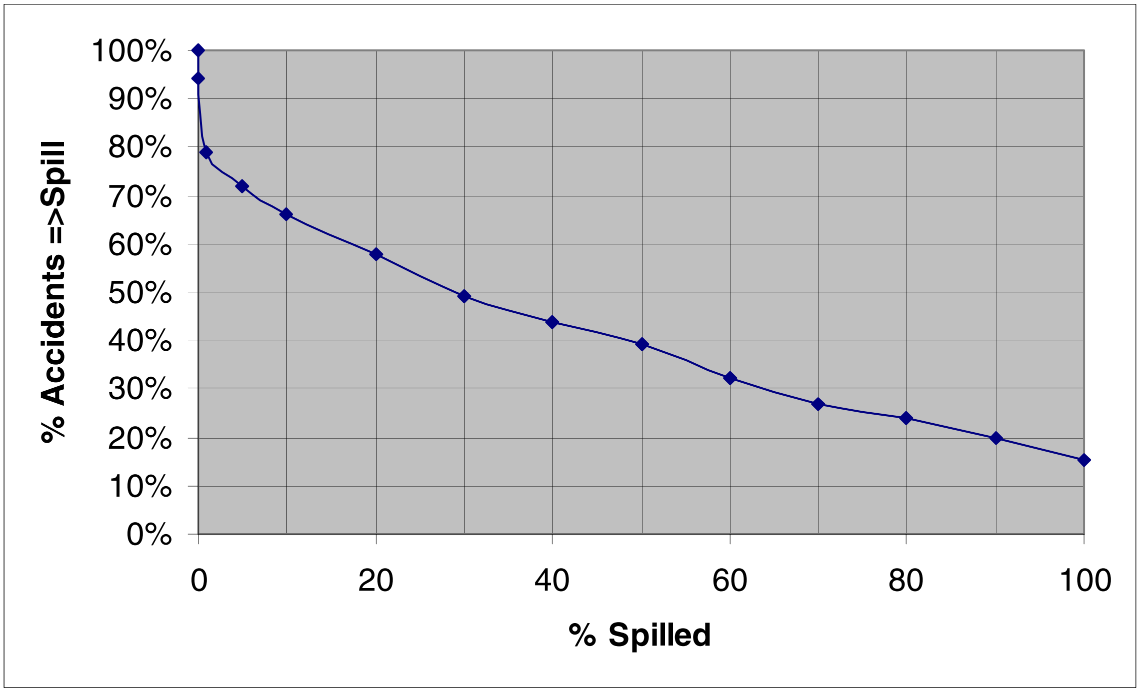


**Figure 5-1. Percentage of HM Spilled in Rollovers**

**Table 5-4. Hazmat Vehicle Configurations Based on PAR**

| Vehicle Configuration | Number of Vehicles |
|---|---|
| Bobtail | 20 |
| Light Truck or Utility Vehicle | 2 |
| Other Truck Configurations | 16 |
| Straight Truck, No Trailer | 2 |
| Tractor, Three Trailers | 3 |
| Tractor, Two Trailers | 37 |
| Tractor/Semitrailer | 138 |
| Van | 2 |
| Unknown | 3 |
| **Total** | **223** |

## 5.2 Cargo Configuration

Data quality enhancements occurred in many areas. One of the most significant of these was cargo configuration. Of particular note is that the number of multiple trailer configurations in the Serious HM Crash Database represents almost 15 percent of the total. The data in Table 5-5 confirms what was implied in Table 5-2, namely that there are many more cargo tank crashes included in the sample than expected. The crash selection process supposedly identified all cargo tank crashes included in MCMIS, a total of 45. As can be seen from Table 5-5, however, a total of 114 cargo tanks were actually selected. This means that more than half the hazardous material crashes selected were cargo tanks, more than double the number identified if one were to rely on MCMIS.

**Table 5-5. Hazmat Cargo Body Type Configuration from the PARs**

| Cargo Body Type | Number of Vehicles |
|---|---|
| Cargo tank/liquid | 148 |
| Cargo tank/refrigerated liquid | 9 |
| Dry box semi trailer | 45 |
| Flatbed | 11 |
| Flatbed with permanent equipment | 1 |
| Van enclosed box | 6 |
| Unknown | 3 |
| **Totals** | **223** |

## 5.3 Data Enhancements Realized by Expanding Field Definitions

Table 5-6 shows the data as it exists in MCMIS for the 64 crashes that were selected for more detailed analysis. About 20% of these records have the trafficway designation of *blank*. As a result of obtaining the PARs, many of these blank entries could be assigned to one of the other categories (see Table 5-7). It should also be noted that in the Serious HM Crash Database, there are two more fatalities (not crashes) than what was recorded in MCMIS. In addition to the trafficway table, the Serious HM Crash Database contains an expanded table of road types as shown in Table 5-8. This information, contained in the PAR, is not available in MCMIS. Collectively, these tables illustrate an improved understanding of the crash environment that might be possible by applying the Serious HM Crash Database design and data collection process.

**Table 5-6. Total Fatalities by Trafficway as Shown in MCMIS**

| Road Trafficway | Number | % |
|---|---|---|
| Not Physically Divided (Two-way Trafficway) | 38 | 50% |
| Divided Highway, Median Strip, w/o Traffic Barrier | 18 | 24% |
| Divided Highway, Median Strip with Traffic Barrier | 6 | 8% |
| Blank | 14 | 18% |
| **Total Fatalities** | **76** | |

**Table 5-7. Total Fatalities by Trafficway in the Enhanced Database**

| Traffic Way Configurations for Fatal Accidents | Number | % |
|---|---|---|
| Not Physically Divided (Two-way Trafficway) | 47 | 60% |
| Divided Highway, Median Strip, w/o Traffic Barrier | 23 | 30% |
| Divided Highway, Median Strip with Traffic Barrier | 8 | 10% |
| **Total** | **78** | |

**Table 5-8. Total Fatalities by Road Type in the Enhanced Database**

| Road Type for Fatal Accidents | Number | % |
|---|---|---|
| County Road | 8 | 10% |
| Interstate | 18 | 23% |
| Municipality | 3 | 4% |
| Other | 2 | 3% |
| State Highway | 34 | 44% |
| U.S. Highway | 13 | 17% |
| **Total** | **78** | |

## 5.4 Association of Causes with First Harmful Event

The enhanced database enables the user to analyze a wider scope of data and develop answers to questions concerning causation. As shown in Table 5-9, each of 9 first harmful events is assigned one of 18 causes. In assigning a first harmful event, the focus was on the package. Thus, if the vehicle ran off the road and collided with a fixed object, the first harmful event was the collision. If the truck ran off the road and the accident description in the PAR gave no indication of a *collision with a fixed object* or a *rollover*, then the first harmful event was *ran off the road*. This was done as an alternative to an event sequence as used in MCMIS. Subsequent analyses might show an advantage of retaining the event sequences in the enhanced database.

**Table 5-9. Distribution of Causes and First Harmful Events**

| Cause\Event | Collision with Fixed Object | Collision with Animal, Pedestrian or Pedicycle | Collision with Moving Motor Vehicle | Downhill Runaway | Explosion or Fire | Jackknife | Loss or Cargo or Cargo Shift | Rollover | Ran Off Road |
|---|---|---|---|---|---|---|---|---|---|
| Loss of Control – too rapid maneuver | 2 | 1 | 2 | | | 1 | | 4 | |
| Loss of Control – vehicle dynamics | | | | | | | | 3 | |
| Loss of Control – excess speed | 4 | | 1 | | | 2 | 2 | 25 | 2 |
| Loss of Control – poor conditions | 1 | | | 3 | | 1 | | 2 | 2 |
| Loss of Control – human error | 1 | 2 | 3 | | | 1 | | | |
| Driver Fell Asleep | 3 | | | | | | | 3 | 2 |
| Driver Incapacitated | 1 | | | | | | | | |
| Loss of Control - inattention | 3 | | | | | 1 | 2 | 16 | 8 |
| Ran off Road | 3 | | | | | | 1 | 8 | |
| Human Error – driver other vehicle | | 3 | 44 | | | | | | |
| Improper Lane Shift or Turn | | 1 | 8 | | | | | | |
| Mechanical Failure - Brakes | | | 1 | | | | | 2 | 1 |
| Mechanical Failure – vehicle separation | | | | | | | | | 1 |
| Mechanical Failure - Fire | | | | | 2 | | | | |
| Mechanical Failure – other vehicle | | | 1 | | | | | | |
| Unable to avoid accident | | | 13 | | | 1 | | 3 | |
| Load Shift | | | | | | | | 3 | |
| Unknown | | | | | 1 | | | | |

Each of the causes is believed to be the causal factor that was the immediate precursor to the accident sequence. This should not be considered the root cause of the accident. Based on the event description in the PAR, the immediate cursor for several accidents was *driver fell asleep*. The root cause would identify why the *driver fell asleep*. The identification of root causes is beyond the scope of this project. Many of the causes listed begin with the statement *loss of control* followed by a sub-category. While some of the reasons for the *loss of control* were human caused, some were associated with weather conditions or the mechanical dynamics of the vehicle. For this reason, simply listing *loss of control* as a cause was not considered sufficient. There are many blanks in Table 5-9. This was primarily due to the limited data sample. Because of the accident screening method, it would be incorrect to conclude from this table that rollovers were more common that collisions with fixed objects because, although all rollover accidents were selected for analysis, not all collisions with fixed objects were selected.

Figure 5-2 shows a graph of the 18 cause categories after they have been grouped into seven broader categories. Four categories (*driver fell asleep; driver intoxicated; loss of control – driver inattentive; and unable to avoid accident)* were combined into a broader category (*driver inattentive/incapacitated).* Similarly, all the remaining *loss of control* categories were placed in a category entitled, *error in judgment-HM driver.* All the other categories have a closer correspondence with those shown in Table 5-9 (e.g., all the *mechanical* causes are grouped into one broader category called *mechanical failure – HM vehicle* in the figure.

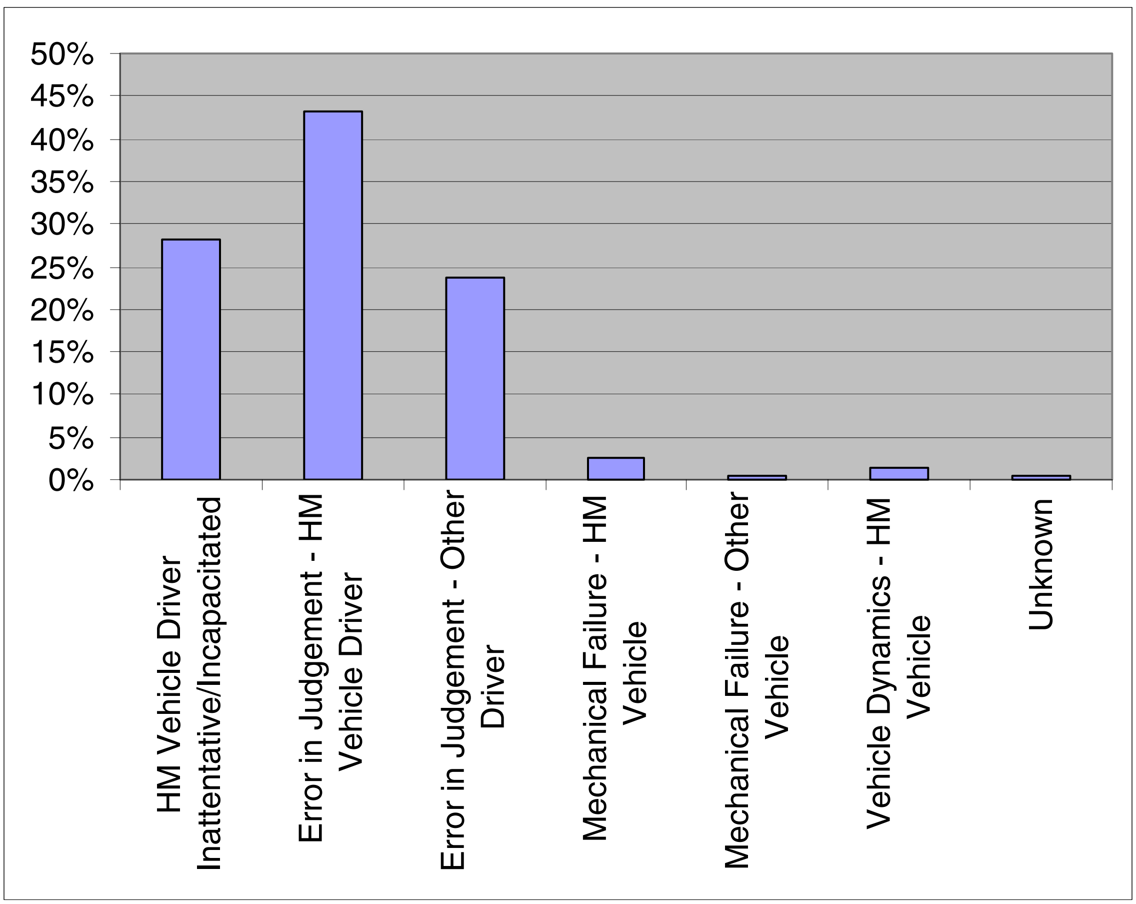


**Figure 5-2. Distribution of Causes and First Harmful Events**

Rollovers are a first harmful event that often lead to serious consequences. This is especially true for cargo tanks. The Serious HM Crash Database permits the reviewer to tabulate the number of rollovers as the first harmful event. When first harmful event is linked to cause, the cause for rollovers can be examined. In the Phase I sample, the number of rollovers represents 34% of the total. When a query is run that links rollover with cause, 11 distinct causes are identified (see Table 5-10). 32% are attributed to excessive speed on a curve or turn and 23% to loss of control related to driver inattention, with only 8% precipitated by a load shift or truck trailer dynamics. Brake failure was identified as a cause in only 3% of the crashes where rollover was the first harmful event.

## 5.5 Rollover Driver Fatalities

A total of 17 HM truck drivers died in the crashes when driver fatalities are queried in the Serious HM Crash Database. Of the 17 HM truck drivers that died, 15 were killed in rollovers, approximately 88% of the total fatalities. This value is higher than the results found in other studies. TIFA commonly finds that about 60% of the all truck driver fatalities occur in rollover accidents. More data is needed to see if more truck drivers are killed in rollovers in vehicles carrying HM than in vehicles not carrying HM.

Rollover is not always the first harmful event in a truck accident. Table 5-10 lists a breakout of possible causes for the accidents in which rollover is the first harmful event.

**Table 5-10. Rollover Causes**

| First Harmful Event | Cause of Crash | Number of Crashes | % Of Total |
|---|---|---|---|
| Overturn (Rollover) | Driver fell asleep | 3 | 4% |
| Overturn (Rollover) | Excess speed for road conditions | 3 | 4% |
| Overturn (Rollover) | Excess speed on curve/turn | 22 | 32% |
| Overturn (Rollover) | Load shift | 3 | 4% |
| Overturn (Rollover) | Loss of control - driver inattention | 16 | 23% |
| Overturn (Rollover) | Loss of control - too rapid maneuver | 4 | 6% |
| Overturn (Rollover) | Loss of control - truck trailer dynamics | 3 | 4% |
| Overturn (Rollover) | Loss of control- poor conditions | 2 | 3% |
| Overturn (Rollover) | Mechanical Failure – brakes | 2 | 3% |
| Overturn (Rollover) | Ran off road | 8 | 12% |
| Overturn (Rollover) | Unable to stop for traffic ahead | 3 | 4% |
| **Total** | | **69** | |

Of note is what is not present in the list; the driver of the other vehicle was not identified as the cause of any accidents in which rollover was the first harmful event. Most were attributable to errors in judgment on the part of the truck driver. Excess speed was a factor in over a third of the accidents, the majority being on curves or turns. If driver inattention and ran off road, a form of driver inattention, are added to the excess speed causes, almost three quarters of the causes have been identified. These conclusions are based on 69 HM accidents, a relatively small sample. The most important finding is that without obtaining the PARs for these 69 accidents, such analyses cannot be performed.