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FATALITIES AND INJURIES IN MOTOR VEHICLE BACKING CRASHES

Required Under

The Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU)

**Report to the House Committee on Transportation and Infrastructure and
the Senate Committee on Commerce, Science, and Transportation**

Report to Congress

**National Highway Traffic Safety Administration
U.S. Department of Transportation
Washington, DC 20590**

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16. Abstract <p>The U.S. Congress required the Secretary of Transportation to examine fatalities and injuries in backing crashes in Public Law Number 109-59, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Section 2012 and to transmit a report about such crashes by January 1, 2009. A backover is a crash which occurs when a driver reverses into and injures or kills a nonoccupant such as a pedestrian or a bicyclist. Backovers can occur either on a public roadway or not on a public roadway, i.e., in a driveway or in a parking lot. The former are called traffic backovers and the latter nontraffic backovers. There are also "other backing crashes" that are not backovers, i.e., they do not involve a pedestrian or other nonoccupant, that occur when, for example, a driver backs into a tree or pole or when a driver backs out of a driveway or parking space and is struck by another vehicle. Together, backover crashes and other backing crashes are referred to as backing crashes.</p> <p>The National Highway Traffic Safety Administration's (NHTSA) existing Fatality Analysis Reporting System (FARS) and National Automotive Sampling System - General Estimates System (NASS-GES) already provide information regarding backing crashes that occur on public trafficways. However, data regarding nontraffic backovers (and other backing crashes), those which occur on private roads, driveways, and parking lots, have not routinely been collected by NHTSA. In response to SAFETEA-LU Sections 2012 and 10305 and Section 2(f) of the Cameron Gulbransen Kids Transportation Safety Act of 2007, NHTSA developed the Not in Traffic Surveillance (NiTS) system to collect information about all nontraffic crashes, including nontraffic backover crashes.</p> <p>Combining the 221 NiTS backover fatalities with the annual average of 71 FARS backover fatalities produces an estimate of 292 total annual backover fatalities. The estimate of 292 annual backover fatalities is larger than the estimated 183 fatalities stated in the November 2006 Report to Congress <i>Vehicle Backover Avoidance Technology Study</i>, but NHTSA believes that the new estimate reflects a refinement in the methodology rather than a substantial change in the problem size. The estimated 14,000 NiTS backover injuries when combined with the 4,000 NASS-GES backover injuries produces an estimate of 18,000 total annual backover injuries.</p> <p>Most backover fatalities and injuries involve passenger vehicles. Among cases where the type of the striking vehicle is known, 78 percent of the backover fatalities and 95 percent of the backover injuries involved passenger vehicles. While people of all ages are victims of backovers, this report confirmed that children under 5 years old and adults 70 and older have an elevated risk of being backover victims compared to the rest of the population. Backover fatalities happen in a variety of areas with the most common area being the driveway, closely followed by other residential areas, public roadways, and nonresidential parking lots. Backover injuries tend to happen more frequently in nonresidential parking lots than other areas.</p>					
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Executive Summary

A backover is a crash which occurs when a driver reverses into and injures or kills a nonoccupant such as a pedestrian or a bicyclist. Backovers can occur either on a public roadway or not on a public roadway, i.e., in a driveway or in a parking lot. The former are called traffic backovers and the latter nontraffic backovers. There are also “other backing crashes” that are not backovers, i.e., they do not involve a pedestrian or other nonoccupant, that occur when, for example, a driver backs into a tree or pole or when a driver backs out of a driveway or parking space and is struck by another vehicle. Together, backover crashes and other backing crashes are referred to as backing crashes.

The U.S. Congress required the Secretary of Transportation to examine fatalities and injuries in backing crashes in Public Law Number 109-59, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) Section 2012 and to transmit a report about such crashes by January 1, 2009.

The National Highway Traffic Safety Administration’s (NHTSA) existing Fatality Analysis Reporting System (FARS) and National Automotive Sampling System - General Estimates System (NASS-GES) already provide information regarding backing crashes that occur on public trafficways. However, data regarding nontraffic backovers (and other backing crashes), those which occur on private roads, driveways, and parking lots, have not routinely been collected by NHTSA. In response to SAFETEA-LU Sections 2012 and 10305 and Section 2(f) of the Cameron Gulbransen Kids Transportation Safety Act of 2007, NHTSA developed the Not in Traffic Surveillance (NiTS) system to collect information about all nontraffic crashes, including nontraffic backover crashes. NHTSA did not receive all possible reports through this system but derives a national estimate based upon the sample.

The NiTS system has provided useful information on nontraffic backovers and other backing crashes that were not included in FARS or NASS-GES. The following table summarizes the nontraffic fatalities and injuries from NiTS and traffic fatalities and injuries from FARS and NASS-GES in backover and other backing crashes for all vehicles as well as passenger vehicles. Passenger vehicles, which include cars, pickup trucks, sport utility vehicles, and vans, are broken out separately since crashes involving these vehicles account for the majority of all backing crash fatalities and injuries. The category of all vehicles includes the addition of heavy trucks, buses and motorcycles. Heavy trucks account for about 90 percent of the difference between fatalities involving all vehicles and just passenger vehicles.

<i>Type of Crash</i>	<i>All Vehicles</i>		<i>Passenger Vehicles</i>	
	Fatalities	Injuries	Fatalities	Injuries
<i>Nontraffic (NiTS)*</i>				
Backovers	221	14,000	173	13,000
Other Backing Crashes	82	15,000	77	14,000
<i>Traffic (FARS and NASS-GES)**</i>				
Backovers	71	4,000	55	4,000
Other Backing Crashes	89	15,000	57	12,000

* NiTS 2007

** Average FARS 2002-2006, NASS-GES 2002-2006

Combining the 221 NiTS backover fatalities with the annual average of 71 FARS backover fatalities produces an estimate of 292 total annual backover fatalities. The estimate of 292 annual backover fatalities is larger than the estimated 183 fatalities stated in the November 2006 Report to Congress *Vehicle Backover Avoidance Technology Study*, but NHTSA believes that the new estimate reflects a refinement in the methodology rather than a substantial change in the problem size. The estimated 14,000 NiTS backover injuries when combined with the 4,000 NASS-GES backover injuries produces an estimate of 18,000 total annual backover injuries.

An examination of the nontraffic cases from NiTS and the traffic cases from FARS indicated that the only significant difference between the two groups was the location of the crash. Therefore, the two groups were combined when describing the overall characteristics of the backover problem. The backover injuries from NiTS and NASS-GES were combined for similar reasons to provide an overall picture of injuries. In both cases, NiTS provided information for about 75 percent of the backover fatalities and injuries.

Most backover fatalities and injuries involve passenger vehicles. Among cases where the type of the striking vehicle is known, 78 percent of the backover fatalities and 95 percent of the backover injuries involved passenger vehicles. While people of all ages are victims of backovers, this report confirmed that children under 5 years old and adults 70 and older have an elevated risk of being backover victims compared to the rest of the population. Backover fatalities happen in a variety of areas with the most common area being the driveway, closely followed by other residential areas, public roadways, and nonresidential parking lots. Backover injuries tend to happen more frequently in nonresidential parking lots than other areas.

NHTSA's Special Crash Investigations (SCI) program provided detailed investigations of backover crashes to supplement the information obtained through crash reports. The SCI investigations found that about 40 percent of the nonoccupant victims were related to the driver. The SCI investigations also indicated that more nonoccupants were approaching the backing vehicles from the side rather than being stationary behind the vehicles.

On February 28, 2008, the President signed into law the Cameron Gulbransen Kids Transportation Safety Act of 2007. Section 2(b) of this law requires that within 12 months of the President signing the bill, the Secretary of Transportation must initiate rulemaking to expand the required driver's field-of-view behind vehicles to reduce deaths and injuries from backing crashes, especially crashes involving small children and disabled people. A final rule must be in place no later than 3 years after the President signed the bill unless the Secretary of Transportation extends the deadlines as described in Section 4 of the law.

1. Purpose and Background

A backover is a type of backing crash where a backing vehicle strikes a nonoccupant such as a pedestrian or a bicyclist. The backing vehicle may be a car, a sport utility vehicle, a pickup, a van, a truck or other motor vehicle, and the backover may result in an injury or even a fatality. Backovers may occur in a variety of areas including public roads, parking lots, and driveways. There are also backing crashes that are not backovers such as when a driver backs into a pole or tree or when a driver backs into a roadway and is struck by another vehicle. The purpose of this report is to provide a better understanding of the circumstances surrounding fatalities and injuries that occur in backovers and other backing crashes.

U.S. Congress required the Secretary of Transportation to examine fatalities and injuries in backovers and other backing crashes in Public Law Number 109-59, Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). Section 2012 of SAFETEA-LU states:

(a) IN GENERAL.—Using funds made available to carry out section 403 of title 23, United States Code, for fiscal years 2005 through 2009, the Secretary shall collect data and compile statistics on accidents involving motor vehicles being backed up that result in fatalities and injuries and that occur on public and nonpublic roads and residential and commercial driveways and parking facilities.

(b) REPORT.—Not later than January 1, 2009, the Secretary shall transmit to the Committee on Transportation and Infrastructure of the House of Representatives and the Committee on Commerce, Science, and Transportation of the Senate a report on accidents described in subsection (a), including the data collected and statistics compiled under subsection (a) and any recommendations regarding measures to be taken to reduce the number of such accidents and the resulting fatalities and injuries.

This requirement is related to at least two other sections of SAFETEA-LU: Section 10305, Nontraffic Incident Data Collection and Section 2(f) of the Cameron Gulbransen Kids Transportation Safety Act of 2007. The National Highway Traffic Safety Administration's (NHTSA) existing Fatality Analysis Reporting System (FARS) and National Automotive Sampling System - General Estimates System (NASS-GES) provide information about fatalities and injuries in backovers and other backing crashes that occur on public roads and other portions of the trafficway. However, these systems do not contain information about the remaining fatalities and injuries. In response to these requirements related to information on fatalities and injuries in backovers and other backing crashes occurring on nonpublic roads and in most parts of driveways and parking lots is obtained through NHTSA's Not-in-Traffic Surveillance (NiTS) system. NHTSA designed and implemented the NiTS system to fulfill these requirements of SAFETEA-LU.

The Section 2012 requirement is also related to the *Vehicle Backover Avoidance Technology Study* required by SAFETEA-LU Section 10304, which NHTSA published in

November 2006. The *Vehicle Backover Avoidance Technology Study*, and the companion reports *Estimation of Backover Fatalities* and *Experimental Evaluation of the Performance of Available Backover Prevention Technologies*, provided NHTSA's best understanding of the extent and nature of the backover safety problem at the time as well as an evaluation of the existing backing aids. These reports also described the difficulty in obtaining information about backovers that occur on nonpublic roads, in driveways, and in parking lots. Since the publication of the *Vehicle Backover Avoidance Technology Study*, NHTSA has released additional research about parking aids and backover prevention including the reports *Experimental Evaluation of the Performance of Available Backover Prevention Technologies for Medium Straight Trucks* and *Use of Advanced In-Vehicle Technology by Young and Older Early Adopters: Survey Results on Sensor-Based Backing Aid Systems and Rear-View Video Cameras*, both published in 2007.

The reports mentioned above were not the first time NHTSA attempted to describe backovers. NHTSA used a variety of data sources to examine backovers in the reports *Data Collection Study: Deaths and Injuries Resulting from Certain Nontraffic and Noncrash Events* published in 2004, *NHTSA Pilot Study: Nontraffic Motor Vehicle Safety Issues* published in 2002, and *Nonoccupant Fatalities Associated with Backing Crashes* published in 1997. In many ways, this current report is an extension and refinement of NHTSA's previous research on backovers. While the previous reports provided useful information about backovers, the data collected about nontraffic crashes as part of the NiTS system enables NHTSA to provide a more refined estimate of the size of the problem as well as a comprehensive examination of backovers as well as other backing crashes.

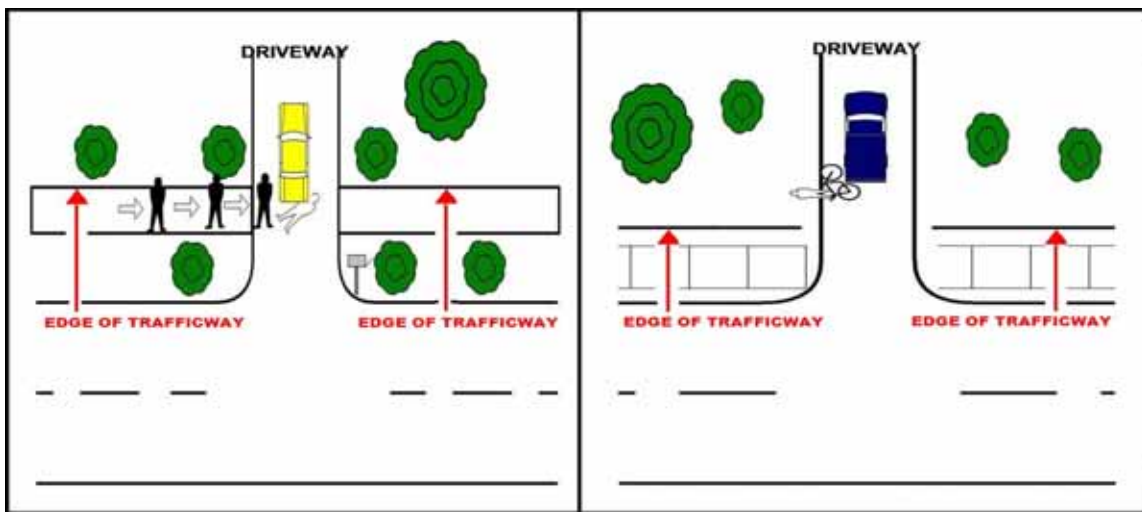
2. Data Sources

NHTSA maintains a variety of databases to provide national counts, as well as detailed information, about motor vehicle crash fatalities and injuries. In turn, these databases rely upon the American National Standards Institute's (ANSI's) D16.1 *Manual on Classification of Motor Vehicle Traffic Accidents* to determine which injuries and fatalities qualify for inclusion. This ANSI standard defines a "motor vehicle accident" as well as motor vehicle accident fatalities and injuries. For example, fatalities that are the result of deliberative intent or natural causes are not classified as motor vehicle accident fatalities. The standard further divides motor vehicle accidents into traffic and nontraffic accidents based upon the location of the crash. The ANSI standard generally classifies crashes that occur on a right-of-way customarily open to the public, such as on a public road, as traffic accidents. The standard also classifies crashes that occur on sidewalks adjacent to public roads, which are part of the right-of-way, as traffic accidents. Crashes that occur on roads not customarily open to the public, in most parts of public parking lots, in private parking facilities, and in residential and commercial driveways are generally nontraffic accidents.

The distinction between traffic and nontraffic accidents is important for understanding the data sources used in this report. Figure 1 shows a traffic backover on the left and a

nontraffic backover on the right. This report uses FARS to obtain information about traffic backovers, such as the one on the left of Figure 1, involving fatalities. FARS contains details regarding all State-reported traffic accidents that involve a fatality within 30 days of the crash. This report uses NASS-GES to obtain information about traffic backovers involving injuries. NASS-GES collects details about State-reportable traffic crashes through a nationally representative sample of police reports and provides sample weights that can be used to produce national estimates. However, a nontraffic crash such as the one on the right of Figure 1 would not be counted in FARS nor in the NASS-GES sample. Therefore, NHTSA needed to develop a method for collecting information about nontraffic crashes.

Figure 1: Traffic Versus Nontraffic Backover



Traffic Backover: Included in FARS and NASS-GES

Nontraffic Backover (private property): Not currently included in FARS or NASS-GES

The method for collecting information about nontraffic crashes is part of NHTSA’s NiTS system. NHTSA considered several methods for collecting information about nontraffic crashes including police reports, trauma registries and hospital records, insurance company data and newspaper stories. After examining the available information, NHTSA determined that police reports were the best method for collecting information about nontraffic crashes for a variety of reasons. The first reason is that NHTSA could use its existing data collection infrastructures to ensure that it did not “double-count” cases that were already collected and to provide national counts using statistically based adjustments. The second reason is that police reports contain the necessary vehicle information for NHTSA to understand nontraffic crashes, such as nontraffic backovers, and to develop appropriate countermeasures. The other sources that NHTSA examined generally did not provide enough information to determine whether the case was traffic or nontraffic, the specific type of motor vehicle involved or even whether the crash involved backing.

The nontraffic crash surveillance was designed to use NHTSA's existing crash data collection infrastructures. To collect information about injuries in nontraffic crashes, NHTSA requested that beginning in 2007 the NASS researchers, who visit the police jurisdictions that provide crash reports to the NASS-GES sample, send all injury cases that did not qualify for NASS-GES to a NHTSA contractor for tracking and cataloguing. The injury crashes that did not qualify for NASS-GES because they were off the trafficway (nontraffic) were then entered into NiTS. To collect information on nontraffic crash fatalities, NHTSA requested that beginning in 2007 the FARS analysts, who collect and enter the fatal traffic crash information into FARS for each State, send all cases that did not qualify for FARS to the NHTSA contractor. Similar to the nontraffic injuries, the crash fatalities that did not qualify for FARS because they were off the trafficway were then entered into NiTS. NHTSA also supplemented the nontraffic crash fatality reports in NiTS with reports of nontraffic crash fatalities submitted by the NASS researchers. All total, NHTSA received information about 455 fatalities and 1,973 injuries in nontraffic crashes that occurred in 2007.

The cases entered into NiTS provide useful information about nontraffic fatalities and injuries. However, NHTSA is aware that NiTS does not have a complete count of all nontraffic crash fatalities. State laws and regulations vary considerably regarding when a report is required for a nontraffic crash fatality, the type of report used to document the crash, and whether the report is sent from the local jurisdiction to the State. Most States require some type of report, but the report is generally kept at the local police jurisdiction and is not sent to the State. Since the FARS analysts work at the State-level, there may be reports of nontraffic crash fatalities of which they are not aware. NHTSA did not receive any reports from eight States, and only received one report from six other States. NHTSA cannot determine if it did not receive any reports from the eight States because there were none or because the State did not have nontraffic fatalities.

Similarly, NHTSA is aware that not all of the NASS-GES sample police jurisdictions were able to provide nontraffic police reports. Over 80 percent of the over 400 NASS-GES sampled police jurisdictions indicated that their officers complete reports for nontraffic crashes involving injury. (Most of the exceptions were State Police, who call in the local police for nontraffic crashes.) However, NHTSA received nontraffic crash reports from only about two-thirds of the sampled police jurisdictions. Some of the practical problems reported by the NASS-GES researchers regarding why they could not obtain nontraffic crash reports included situations where the nontraffic crash reports were stored with general police incident reports including criminal complaints such as robberies and assaults and could not easily be separated, where the nontraffic crash reports were sent to another office or location, and where the researcher could not obtain permission to receive or to look for the nontraffic reports. Because of these limitations, this report derived adjustment factors to account for the incompleteness of the NiTS system.

3. Adjustments for the Nontraffic Fatalities and Injuries

As described in the previous section, the counts of nontraffic backover fatalities and injuries needed to be adjusted due to the incomplete nature of the NiTS system, but the degree of the undercount needed to be determined using additional data sources. The following section describes the derivation of the adjustments for the nontraffic fatalities and injuries.

3.1 Adjustment for the Nontraffic Fatalities

Because NiTS does not have a complete count of nontraffic fatalities, NHTSA estimated the number of nontraffic fatalities using other data sources. In particular, NHTSA obtained two special mortality files, which contain 2003 and 2004 death certificate information, from the National Center for Health Statistic's National Vital Statistics System (NVSS). Unintentional fatalities in transport accidents, which were identified using the World Health Organization's International Classification of Diseases (ICD-10) external causes of mortality, were divided into three categories: road vehicle occupant fatalities, fatalities to nonoccupants in collisions with road vehicles, and fatalities that did not involve a road vehicle. Road vehicles are motor vehicles designed primarily for use on roadways and include cars, pickup trucks, sports utility vehicles, large trucks, buses, and motorcycles. Nonoccupants were defined using ICD-10 codes for pedestrians, which include users of a pedestrian (personal) conveyance, and pedal cyclists. Vehicles that are not road vehicles include vehicles designed primarily for off-road recreational use (such as snowmobiles and dirt bikes), vehicles designed primarily for use on industrial premises (such as forklifts), vehicles designed primarily for use in agriculture (such as tractors and combines), and special construction vehicles (such as graders and backhoe loaders). The vehicles that are not road vehicles also include people riding animals and occupants of animal-drawn (nonmotorized) vehicles.

This study did not use the ICD-10 subdivisions of traffic versus nontraffic for two reasons. First, as discussed in the previous section, the determination of traffic versus nontraffic is complicated and requires knowing details of the crash that generally would not be available to the person completing the death certificate. Second, the ICD-10 coding rules state that all crashes involving a road vehicle without further detail should be assumed to be on the trafficway, which essentially combines traffic fatalities with fatalities of unknown location. Therefore, the ICD-10 codes were used to determine all road vehicle related fatalities without distinction between traffic and nontraffic fatalities.

Most of the major ICD-10 codes could be used to place the fatalities into one of the three categories of road vehicle occupant fatalities, fatalities to nonoccupants in collisions with road vehicles, and fatalities that did not involve a road vehicle. However, two codes required special judgment. One set of cases included occupants killed in crashes where the type of vehicle was unknown. These fatalities accounted for less than 1 percent of the total. In reading the description of these cases, they appeared likely to involve motor vehicles on roadways, and thus they were counted as road vehicle fatalities. The second set of cases that required judgment was the codes involving nonoccupants struck by other or unknown motor vehicles. This group accounted for about 5 percent of the fatalities.

Because ICD-10 placed nonoccupants struck by other and unknown vehicles in the same category, this analysis removed cases where the narrative indicated that the nonoccupant was struck by an all-terrain vehicle (ATV), a snowmobile, a tractor, a combine, a hay spreader, or a forklift. It is assumed that the remaining cases, which frequently stated “pedestrian struck by vehicle,” involved road vehicles. Similarly, the analysis also removed pedal cyclists in other and unknown transport accidents that did not involve another “vehicle” to remove cases where there was no collision or a collision with another pedal cyclist.

One difference between the special mortality file and FARS is the maximum length of time allowed after a crash for a fatality to count as a motor vehicle crash fatality. FARS uses a 30-day fatality counting rule. The World Health Organization, which is responsible for the ICD-10 coding rules, uses a 12-month fatality counting rule. According to the American National Standard’s *Manual on Classification of Motor Vehicle Traffic Accidents, Seventh Edition*, 98 percent of the deaths that occur within 12 months also occur within 30 days. Therefore, the counts of road-vehicle-related fatalities based upon the ICD-10 coding of death certificates must be reduced by 2 percent to be consistent with FARS.

The focus of this study is fatalities involving road vehicles, which include road vehicle occupants and nonoccupants struck by road vehicles. Table 1 compares all road-vehicle-related fatalities from the NVSS special mortality files to the road-vehicle-related traffic fatalities from FARS for 2003 and 2004. As discussed above, the NVSS fatalities were reduced by 2 percent to make the numbers comparable to FARS. The NVSS fatalities were then compared to the FARS fatalities using the ratio of total fatalities to traffic fatalities. The ratio indicates that FARS captures most road vehicle occupant fatalities because the ratio is close to one. Because the only difference between the NVSS and FARS fatalities should be that the NVSS fatalities include nontraffic fatalities, the ratio could also be interpreted as expressing the number of nontraffic fatalities per traffic fatalities. The ratio for road vehicle fatalities indicates that there are, on average, 15 nontraffic road vehicle fatalities for every 1,000 traffic fatalities. The ratio for nonoccupants struck by a road vehicle, however, indicates that there are, on average, 111 nontraffic nonoccupant fatalities for every 1,000 traffic fatalities.

Table 1: Total Versus Traffic Road Vehicle Fatalities

<i>Year</i>	<i>Total (NVSS)</i>	<i>Total Adjusted to 30-Day Rule</i>	<i>Traffic (FARS)</i>	<i>Derived Nontraffic</i>	<i>Ratio of Nontraffic to Traffic</i>
<i>Road Vehicle Occupant</i>					
2003	38,114	37,352	36,847	505	0.014
2004	38,095	37,333	36,748	585	0.016
Average	38,105	37,342	36,798	544	0.015
<i>Nonoccupant Struck by Road Vehicle</i>					
2003	6,185	6,061	5,474	587	0.107
2004	6,223	6,099	5,476	623	0.114
Average	6,204	6,080	5,475	605	0.111

Source: NVSS 2003-2004, FARS 2003-2004

The difference between the ratios for road vehicle occupants and nonoccupants is likely for at least two reasons. First, road vehicles in motion off trafficways would likely be travelling at lower speeds than those on the trafficways, which would decrease the fatality risk for occupants. Second, even though road vehicles in motion off of the trafficways may be travelling at lower speed, there may be more nonoccupants, especially pedestrians, in the nontraffic areas of parking lots and driveways than on trafficways, which would increase the chance of a collision with a nonoccupant and a resulting nonoccupant fatality.

This report uses the results in Table 1 to estimate the number of nontraffic road vehicle fatalities based upon the traffic fatalities in FARS and to compare the estimate to the number of cases received through the NiTS system. As discussed above, NiTS is unlikely to contain all nontraffic fatalities, and this comparison provides an estimate of the degree to which the NiTS case counts must be adjusted to account for the difficulties of collecting data on nontraffic fatalities.

Table 2 summarizes the calculation of the adjustment. The annual average traffic fatalities in Table 2 are from FARS. The expected nontraffic fatalities are based upon the ratios in Table 1. The received nontraffic fatalities are from the NiTS system for 2007. The NiTS system received reports of 455 nontraffic fatalities in 2007. Based upon the comparison of the expected and the actual number of cases, it is estimated that NiTS received reports corresponding to about 34 percent (188 of 552) of the estimated road vehicle occupant nontraffic fatalities and about 43 percent (267 of 620) of the estimated nonoccupant nontraffic fatalities. Therefore, to make national estimates from the NiTS data, the fatalities should be multiplied by the factors in Table 2 to account for the undercount.

Table 2: Expected Nontraffic Fatalities Versus NiTS Fatalities

	<i>Annual Average Traffic (FARS)</i>	<i>Ratio of Nontraffic to Traffic</i>	<i>Expected Nontraffic</i>	<i>Nontraffic Received (NiTS)</i>	<i>Adjustment for Undercount (Expected / Received)</i>
Road Vehicle Occupant	36,814	0.015	552	188	2.9
Nonoccupant Struck by Road Vehicle	5,587	0.111	620	267	2.3

Sources: FARS 2002-2006, NiTS 2007

3.2 Adjustment for the Nontraffic Injuries

The nontraffic injuries also needed to be adjusted for the fact that not all of the sampled NASS-GES police jurisdictions were able to provide reports of nontraffic crash injuries. While the method for adjusting the nontraffic injuries is similar to the fatalities, a different data source was needed to derive an estimate of the total number of crash injuries.

For benchmarking the total number of crash injuries, both traffic and nontraffic, NHTSA turned to its State Data System. The State Data System is a collection of the electronic crash files provided voluntarily by 32 participating States. Several of the participating States provide NHTSA with files that contain nontraffic crashes. After examining the crash files and discussing their contents with the relevant States, NHTSA determined that three of the participating States provided files that had all of the States' police-reported injury crashes regardless of location. These States were Kentucky, Nebraska, and North Carolina. NHTSA used the three most recent years of data in each of these three States to determine the number of (nonfatal) injuries in traffic and nontraffic crashes and to determine the ratio of nontraffic to traffic injuries as the benchmark. Similar to the procedure using death certificate information for fatalities, the ratio was calculated separately for road vehicle occupant injuries and for nonoccupants. Table 3 reports the results for the three States.

Table 3: Traffic Versus Nontraffic Road Vehicle Injuries

<i>Year</i>	<i>Traffic</i>	<i>Nontraffic</i>	<i>Ratio of Nontraffic to Traffic</i>
<i>Road Vehicle Occupant</i>			
Kentucky 2003-2005	43,943	1,043	0.024
North Carolina 2003-2005	128,097	3,488	0.027
Nebraska 2002-2004	21,439	218	0.010
<i>Nonoccupant</i>			
Kentucky 2003-2005	823	277	0.337
North Carolina 2003-2005	2,173	668	0.307
Nebraska 2002-2004	831	144	0.173

Source: State Data System, 2002-2005

The results for road vehicle occupant injuries ranged from 10 nontraffic injuries for every 1,000 traffic injuries in Nebraska to 27 for every 1,000 in North Carolina. The results for nonoccupant injuries ranged from 173 nontraffic for every 1,000 traffic injuries in Nebraska to 337 for every 1,000 in Kentucky. The results were similar for two of the States, but there appear to be fewer nontraffic injuries as a proportion of traffic injuries in Nebraska as opposed to Kentucky or North Carolina. This difference may represent relatively fewer opportunities for nontraffic injuries relatively to traffic injuries, such as relatively fewer large parking lots, or it could represent reporting differences. Because the difference cannot be explained at this time and two of the States were very similar, this analysis used the median ratio from the three States to serve as a benchmark.

The method for determining the adjustment for the undercount of injuries is similar to the approach used for the fatalities. The first step is to determine the estimated number of traffic crash injuries using the weighted NASS-GES data. Given the estimate of traffic crash injuries, the ratio of 0.024 (from Kentucky) is multiplied by the estimate of road vehicle occupant injuries, and the ratio of 0.307 (from North Carolina) is multiplied by the nonoccupants injured by collisions with road vehicles to produce expected nontraffic injuries. As described above, NHTSA received 1,973 cases using the NASS-GES sampling infrastructure, and these cases have their own probability of selection and

corresponding sample weight. Since the NASS-GES researchers were asked to submit all cases that they received that did not qualify for the NASS-GES sample, the sample weight for the NiTS cases was calculated using the probability that the NASS-GES researcher saw a NiTS case. This probability is the product of the probability of selecting the geographic region or PSU, the probability of selecting the police jurisdiction within the PSU, and the probability of selecting a police report from the jurisdiction. These weights produce an estimate of about 31,000 nontraffic injuries. However, as shown in Table 4, this number appears to be an undercount when compared to the estimate based upon the State data benchmarks. It is estimated that NiTS received about 31 percent of the nontraffic occupant injuries and about 35 percent of the nontraffic nonoccupant injuries. Therefore, to make national estimates from the NiTS data, the injuries should be multiplied by the sample weight as well as the undercount adjustment in Table 4.

Table 4: Expected Nontraffic Injuries Versus NiTS Injuries

	<i>Estimated Annual Average Traffic (GES)</i>	<i>Ratio of Nontraffic to Traffic</i>	<i>Expected Nontraffic</i>	<i>Nontraffic Received (NiTS)</i>	<i>Nontraffic Adjusted for Sample Design</i>	<i>Adjustment for Undercount</i>
Road Vehicle Occupant	2,590,000	0.024	62,000	1,094	19,000	3.3
Nonoccupant Struck by Road Vehicle	110,000	0.307	34,000	879	12,000	2.8

Source: NASS-GES 2002-2006, NiTS 2007

Tables 2 and 4 emphasize the importance of the NiTS system for providing information about crash fatalities and injuries that are not currently included in FARS or NASS-GES. The 2007 NiTS system provided information about an estimated 1172 fatalities in crashes that did not qualify for FARS. The 2007 NiTS system also provided information about an estimated 96,000 injuries in crashes that did not qualify for NASS-GES.

4. Fatalities and Injuries in Backovers and Other Backing Crashes

The following section describes the counts of the fatalities and injuries in nontraffic backovers and other backing crashes provided by NiTS. The section then combines the NiTS fatalities and injuries with annual average from FARS and NASS-GES to produce a total estimate of fatalities and injuries in backovers and other backing crashes.

4.1 Fatalities and Injuries in Nontraffic Backovers and Other Backing Crashes

This report tabulates the backovers and other backing crashes in the NiTS system and then applies the sample weights and adjustment factors previously described to derive an estimate of the number of fatalities and injuries that occur off of the trafficway each year. Table 5 contains the annual estimates by level of injury severity. NiTS provided information about an estimated 221 fatalities and 14,000 injuries in backovers that were not included in FARS or NASS-GES.

Table 5: Fatalities and Injuries in Nontraffic Backing Crashes by Injury Severity

<i>Injury Severity</i>	<i>Backovers</i>		<i>Other Backing Crashes</i>	
	Estimated Total	Sample Count	Estimated Total	Sample Count
<i>Fatalities</i>	221	96	81	28
Incapacitating Injury	3,000	55	2,000	22
Nonincapacitating Injury	6,000	125	2,000	55
Possible Injury	5,000	125	10,000	180
Injured Severity Unknown	1,000	16	1,000	10
<i>Total Injuries</i>	<i>14,000</i>	<i>321</i>	<i>15,000</i>	<i>267</i>

Source: NiTS 2007

Note: Estimates may not add up to totals due to independent rounding.

4.2 Fatalities and Injuries in Traffic Backovers and Other Backing Crashes

This report uses five years of FARS data, from 2002 through 2006, to provide an annual average of fatalities in traffic backovers and other backing crashes. This report uses NASS-GES to obtain information about backovers and other backing crashes involving injuries that occur on the trafficway. The injury counts from NASS-GES include incapacitating injuries, nonincapacitating injuries, possible (minor) injuries and injuries with unknown severity. The NASS-GES sample weights are used to produce national estimates. The report uses NASS-GES from 2002 through 2006 to produce an annual estimated average of injuries in traffic backovers and other backing crashes. Table 6 contains the annual average of traffic backover and other backing crash fatalities and injuries from FARS and NASS-GES.

Table 6: Fatalities and Injuries in Traffic Backing Crashes by Injury Severity

<i>Injury Severity</i>	<i>Backovers</i>		<i>Other Backing Crashes</i>	
	Estimated Annual Average	Sample Count	Estimated Annual Average	Sample Count
<i>Fatalities</i>	72	358	89	447
Incapacitating Injury	*	76	1,000	151
Nonincapacitating Injury	1,000	247	3,000	386
Possible Injury	2,000	54	11,000	570
Injured Severity Unknown	*	7	*	15
<i>Injuries</i>	<i>4,000</i>	<i>384</i>	<i>15,000</i>	<i>1,122</i>

Source: FARS2002-2006, NASS-GES 2002-2006

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

4.3 Total Fatalities and Injuries in Backovers and Other Backing Crashes

An examination of the nontraffic cases from NiTS and the traffic cases from FARS indicated that the only significant difference between the two groups was the location of the crash. Therefore, the two groups were combined when describing the overall characteristics of the backover problem. The backover injuries from NiTS and NASS-GES were combined for similar reasons to provide an overall picture of injuries. The information from NiTS, FARS, and NASS-GES was also used to provide estimates of fatalities and injuries in other backing crashes.

Table 7 contains the estimated totals of backover fatalities and of injuries by the level of injury severity. Overall there are an estimated 292 fatalities in backovers annually. The estimate of 292 annual backover fatalities is larger than the estimated 183 fatalities stated in the November 2006 Report to Congress *Vehicle Backover Avoidance Technology Study* and described in the *Estimation of Backover Fatalities* report, but NHTSA believes that the new estimate reflects a refinement in the methodology rather than a substantial change in the problem size. The traffic backover fatalities in FARS have not shown an increase over time. While there is no way to track the nontraffic backover fatalities over time, there is no reason to expect that the nontraffic fatalities would increase independently of the relatively flat trend in the traffic fatalities.

There are an estimated annual 18,000 injuries in backover crashes. While 7,000 per year are minor injuries, an estimated 3,000 per year are incapacitating injuries. Table 7 also demonstrates the usefulness of NiTS. NiTS provided information for about 75 percent of the total backover fatalities and injuries. NiTS also supplied useful information regarding the 171 fatalities and estimated 30,000 injuries that occur annually in other backing crashes. NiTS provided information for about 50 percent of the total fatalities and injuries in other backing crashes.

Table 7: Fatalities and Injuries in All Backovers and Other Backing Crashes

<i>Injury Severity</i>	<i>Backovers</i>		<i>Other Backing Crashes</i>	
	Estimated Total	Sample Count	Estimated Total	Sample Count
<i>Fatalities</i>	292	716	171	894
<i>Incapacitating Injury</i>	3,000	131	3,000	173
<i>Nonincapacitating Injury</i>	7,000	372	5,000	441
<i>Possible Injury</i>	7,000	179	20,000	750
<i>Injured Severity Unknown</i>	1,000	23	2,000	25
<i>Total Injuries</i>	18,000	705	30,000	1,389

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: Estimates may not add up to totals due to independent rounding.

5. Circumstances Surrounding Backovers and Other Backing Crashes

The previous section provided annual estimates of the number of fatalities and injuries in all backovers regardless of location. The estimates included backovers on public roads, driveways, parking lots, private roads and other locations. The estimates were produced using predominately police reports and were then adjusted for incomplete coverage to produce national estimates. The NiTS system provided information about nontraffic backovers that are not included in FARS and NASS-GES. Because it was determined that the nontraffic backover fatalities from NiTS and the traffic backover fatalities from FARS did not differ substantially except in terms of location, the two groups were combined when describing the overall characteristics of the backover problem. The backover injuries from NiTS and NASS-GES were combined for similar reasons to provide an overall picture of injuries. In both cases, the NiTS system provided valuable information for about 75 percent of the backover fatalities and injuries, which would have been missed in an examination of just FARS and NASS-GES. This section uses the details contained in these data files to provide a better understanding of the circumstances surrounding backover and other backing crashes. This section focuses on backover injuries and fatalities and then briefly examines the injuries and fatalities in other backing crashes.

5.1 Circumstances Surrounding Backovers

This section provides more detail regarding the circumstances surrounding the estimated 292 backover fatalities and 18,000 backover injuries that occur each year. This section provides information about the backing vehicles involved, the age and sex of the victim, the type of nonoccupant, the age and sex of the driver, and the location of the backover.

Table 8 provides details regarding the type of vehicles involved in backovers by injury severity. Table 8 indicates that 78 percent (215 / 275) of the backover fatalities involving vehicles with known body types were passenger vehicles, which include cars, pickups, utility vehicles, and vans. This estimate is very close to the finding in the *Estimation of Backover Fatalities* report that 76 percent of the fatalities involved passenger vehicles (p. 10). Likewise, an estimated 94 percent (16,000 / 17,000) of the backover injuries involving vehicles with a known body type were passenger vehicles. Heavy trucks accounted for an estimated 56 fatalities and about 1,000 incapacitating injuries a year. The other and multiple vehicle category includes mostly buses and cases involving more than one backing vehicle. Many of the fatalities and injuries with unknown backing vehicle types occur in hit-and-run crashes.

Table 8: Fatalities and Injuries in Backover Crashes by Vehicle Type and Severity

<i>Backing Vehicle Type</i>	<i>Fatalities</i>	<i>Injuries (A, B, C, and unknown severity)</i>		<i>Incapacitating Injuries (A)</i>		<i>Non-incapacitating Injuries (B)</i>		<i>Possible Injuries (C)</i>	
		<i>Estimated Total</i>	<i>Sample Count</i>	<i>Estimated Total</i>	<i>Sample Count</i>	<i>Estimated Total</i>	<i>Sample Count</i>	<i>Estimated Total</i>	<i>Sample Count</i>
Car	56	9,000	341	1,000	63	3,000	184	3,000	82
Light Truck or Van (LTV)	159	7,000	267	1,000	47	3,000	147	3,000	64
Heavy Truck	56	1,000	41	1,000	14	*	15	*	11
Other/Multiple Vehicle	4	*	4	*	1	*	3	0	0
Unknown	17	1,000	52	*	6	*	23	1,000	22
<i>Total</i>	<i>292</i>	<i>18,000</i>	<i>705</i>	<i>3,000</i>	<i>131</i>	<i>7,000</i>	<i>372</i>	<i>7,000</i>	<i>179</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500, estimates may not add up to totals due to independent rounding.

Most tables in this report give information about all backing vehicles as well as the subset of backing passenger vehicles. Table 8, however, demonstrates that the type of backing vehicle is unknown for a small portion of backover fatalities and injuries, which could include some passenger vehicles. Therefore the estimates of passenger vehicle backing crash fatalities and injuries are adjusted to account for the unknown backing vehicle types. The estimates for passenger vehicle backover fatalities are multiplied by a factor of 292/275 (all backover fatalities over backover fatalities with known vehicle types). Passenger vehicle backover injuries were adjusted in a similar manner.

Table 9 provides more detail regarding the type of passenger vehicles involved in backover fatalities and injuries. The table indicates that all major passenger vehicle types (cars, utility vehicles, pickups, and vans) are involved in backover fatalities and injuries. However, understanding the association between vehicle type and backover crashes may indicate the vehicle types most likely to benefit from countermeasures capable of preventing these incidents. In particular, some vehicles may have a greater risk of being in backing crashes than other vehicles.

Table 9: Passenger Vehicle Backover Fatalities and Injuries by Vehicle Type

<i>Backing Vehicle Type</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>	<i>Percent of Vehicles in Non-Backing Traffic Injury Crashes</i>
Car	59	26%	9,000	54%	341	62%
Utility Vehicle	68	30%	3,000	20%	107	14%
Van	29	13%	1,000	6%	68	8%
Pickup	72	31%	3,000	18%	79	15%
Other Light Vehicle	0	0%	*	2%	13	1%
<i>Passenger Vehicles</i>	<i>228</i>	<i>100%</i>	<i>17,000</i>	<i>100%</i>	<i>608</i>	<i>100%</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500, estimates may not add up to totals due to independent rounding.

Various measures can be used to compare the relative risk of involvement in a backover crash. One method to control for other possible factors, such as geography and miles driven, that might affect the involvement rates of different vehicle types in backing crashes is to use non-backing crashes as an exposure measure. The *Vehicle Backover Avoidance Technology Study* used the proportion of vehicles in fatal traffic crashes because the analysis concentrated on FARS fatalities. This study uses the proportion of traffic injury crashes for each vehicle type for comparison. The use of the injury threshold, instead of either all police-reported crashes or solely fatal crashes, captures the propensity for a vehicle to be involved in a crash that is severe enough to produce an injury but not as relatively infrequent as a fatal crash.

Overall, the results indicate that pickups and utility vehicles are overrepresented in backover fatalities and injuries when compared to non-backing traffic injury crashes. The difference is particularly pronounced for backover fatalities because utility vehicles and pickups are involved in an estimated 61 percent of the fatalities but are only involved in an estimated 29 percent of non-backing traffic injury crashes. The finding that cars experienced a lower relative risk of backover crash involvement than utility vehicles and pickups is consistent with the results in the *Vehicle Backover Avoidance Technology Study* (p. 21). Vans appear to be overrepresented in fatal backover crashes but not in the injury crashes. This result may have occurred because vans are a relatively small portion of the passenger vehicle fleet and the estimates may be less robust.

Other issues that frequently arise in the study of backovers are the age and sex of the victims. According to the *Vehicle Backover Avoidance Study*, “While people of all ages are the victims of backover crashes, children under 5 years old have the highest involvement in these crashes... Older pedestrians also have an elevated risk.” (p. 12). The *Estimation of Backover Fatalities* report found that 38 percent of all backover

fatalities, and 47 percent of passenger vehicle backover fatalities, involved victims younger than 5 years old. This report confirms these previous findings.

Table 10 contains the age of the backover victim for fatalities and injuries and for all backovers as well as backovers involving passenger vehicles. Table 10 also contains the proportion of the U.S. population in each age category from the U.S. Census Bureau's Population Estimates Program for comparison. Similar to previous findings, backover fatalities disproportionately affect children under 5 years old and adults 70 or older. When restricted to backover fatalities involving passenger vehicles, children under 5 account for 44 percent of the fatalities, and adults 70 and older account for 33 percent. The difference in the results between all backovers and passenger vehicle backovers occurs because large truck backovers, which are excluded from the passenger vehicle calculations, tend to affect adults of working age. The proportion of backover injuries by age group is more similar to the proportion of the population than for backover fatalities. However, while children under 5 years old appear to be slightly overrepresented in backover injuries compared to the population, adults 70 and older appear to be greatly overrepresented. One reason for the relatively large proportion of injuries in backover crashes among older adults may be that low-speed backovers involving younger nonoccupants may not result in an injury while the same backover involving an older nonoccupant may result in a fall and a broken bone.

Table 10: All Backover Fatalities and Injuries by Age of Victim

<i>Age of Victim</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>	<i>Percent of Population</i>
<i>All Vehicles</i>						
Under 5	103	35%	2,000	8%	37	7%
5-10	13	4%	*	3%	33	7%
10-19	4	1%	2,000	12%	75	14%
20-59	69	24%	9,000	48%	383	55%
60-69	28	9%	2,000	8%	54	8%
70+	76	26%	3,000	18%	107	9%
Unknown			*	2%	16	
<i>Total</i>	<i>292</i>	<i>100%</i>	<i>18,000</i>	<i>100%</i>	<i>705</i>	<i>100%</i>
<i>Passenger Vehicles</i>						
Under 5	100	44%	2,000	9%	35	7%
5-10	10	4%	1,000	3%	30	7%
10-19	1	1%	2,000	12%	71	14%
20-59	29	13%	8,000	46%	319	55%
60-69	15	6%	1,000	8%	46	8%
70+	74	33%	3,000	19%	95	9%
Unknown			*	2%	12	
<i>Total</i>	<i>228</i>	<i>100%</i>	<i>17,000</i>	<i>100%</i>	<i>608</i>	<i>100%</i>

Source: US Census Bureau, Population Estimates Program, 2007 Population Estimates; FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

The proportion of backover fatalities by sex indicates that there are slightly more males (55 percent) among all backover fatalities and slightly more females (53 percent) when restricted to passenger vehicle backover fatalities. Similar to the change in the age pattern, this difference is the result of excluding backovers involving heavy trucks. Backover injuries are almost equally divided among males and females. Almost all of the backover victims were pedestrians. Pedestrians comprised an estimated 96 percent of the fatalities and 95 percent of the injuries. The remaining backover victims were mainly bicyclists.

Additional issues that arise are the age and sex of the drivers in backover crashes. The *Vehicle Backover Avoidance Technology Study* notes that males in their 20s and 30s have the greatest risk of a backover crash when compared to the proportion of licensed drivers (p. 14). However, this group may also be more likely to be involved in all types of crashes. Therefore, the comparison group used in this report is the percent of drivers in non-backing traffic injury crashes, which was the same group used to compare involvement by passenger vehicle body type in Table 9.

Table 11 describes backover fatalities and injuries by the age of the drivers for all vehicles and passenger vehicles. For the most part, the distribution of backover fatalities and injuries by the age of the drivers is similar to the distribution of the age of drivers in non-backing traffic injury crashes. One exception is that drivers 70 and older account for a much larger proportion of the backover fatalities and injuries than their proportion of all non-backing traffic injury crashes. For drivers with known age in passenger vehicle backovers, drivers 70 and older account for 12 percent (11 of 93) of the fatalities and 16 percent (14 of 89) of the injuries compared to 5 percent (5 of 95) the drivers in all non-backing traffic injury crashes.

Table 11: All Backover Fatalities and Injuries by Age of Driver

<i>Age of Driver</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>	<i>Percent of Drivers in Non-Backing Traffic Injury Crashes</i>
<i>All Vehicles</i>						
Under 20	22	8%	2,000	9%	63	12%
20-29	61	21%	3,000	19%	118	24%
30-39	65	22%	2,000	14%	110	18%
40-49	40	14%	3,000	14%	121	17%
50-59	32	11%	3,000	14%	81	11%
60-69	20	7%	1,000	4%	36	6%
70+	25	8%	2,000	13%	56	5%
Unknown	28	9%	2,000	13%	120	7%
<i>Total</i>	<i>292</i>	<i>100%</i>	<i>18,000</i>	<i>100%</i>	<i>705</i>	<i>100%</i>
<i>Passenger Vehicles</i>						
Under 20	24	10%	2,000	10%	63	13%
20-29	55	24%	3,000	20%	111	25%
30-39	48	21%	2,000	14%	95	18%
40-49	27	12%	3,000	15%	107	17%
50-59	20	9%	2,000	13%	65	11%
60-69	13	6%	1,000	3%	30	6%
70+	26	11%	2,000	14%	54	5%
Unknown	16	7%	2,000	11%	83	5%
<i>Total</i>	<i>228</i>	<i>100%</i>	<i>17,000</i>	<i>100%</i>	<i>608</i>	<i>100%</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: Estimates may not add up to totals due to independent rounding.

Table 12 provides the breakdown by the sex of the drivers involved in backover fatalities and injuries. Most of the drivers associated with backover fatalities and injuries are male. Males also comprise a larger portion of the drivers involved in backover fatalities and injuries than their proportion of all non-backing injury crashes, which suggests that male drivers are overrepresented in backover crashes.

Table 12: All Backover Fatalities and Injuries by Sex of Driver

<i>Sex of Driver</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>	<i>Percent of Drivers in Non-Backing Injury Traffic Crashes</i>
<i>All Vehicles</i>						
Male	196	67%	11,000	59%	403	54%
Female	85	29%	6,000	34%	233	41%
Unknown	11	4%	1,000	7%	69	5%
<i>Total</i>	<i>292</i>	<i>100%</i>	<i>18,000</i>	<i>100%</i>	<i>705</i>	<i>100%</i>
<i>Passenger Vehicles</i>						
Male	141	62%	10,000	58%	341	53%
Female	82	36%	6,000	37%	225	44%
Unknown	6	3%	1,000	6%	42	3%
<i>Total</i>	<i>228</i>	<i>100%</i>	<i>17,000</i>	<i>100%</i>	<i>608</i>	<i>100%</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: *Estimates may not add up to totals due to independent rounding.

A final area of interest about backover fatalities and injuries is the location of the crash. Among traffic crashes, they may either occur on roadways or off roadways, such as on the shoulders or on sidewalks adjacent to the roadways. Table 13, which provides details regarding the location of the backover fatalities and injuries, indicates that 24 percent of the fatalities and 20 percent of the injuries occurred in trafficways. Among the traffic backovers, most of them occurred on the roadway. The nontraffic backover fatalities, which comprise 76 percent of the backover fatalities, occur in a variety of areas. Driveways are the most common area for nontraffic backovers to occur. Driveways are also the most common area for a passenger vehicle backover to occur. Another common location for a backover fatality is an “other residential area” category, which are predominately residential parking lots at apartments and town homes with small numbers of residential garages and yards. A third location of interest is “nonresidential parking lots,” which are mostly large parking facilities for commercial businesses such as shopping centers, grocery stores, and discount stores. For backover injuries the most common area, which are the locations for a little over half of the backover injuries, are nonresidential parking lots. The locations for all vehicle backovers versus passenger vehicle backovers are similar.

Table 13: All Backover Fatalities and Injuries by Location

<i>Location</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>
<i>All Vehicles</i>					
<i>Traffic Crashes</i>					
Roadway	48	16%	3,000	15%	275
Off-Roadway	22	8%	1,000	5%	102
Unknown Location	1	0%	*	0%	7
<i>Nontraffic Crashes</i>					
Driveway	69	24%	2,000	12%	38
Other Residential	44	15%	1,000	8%	29
Nonresidential Parking Lot	48	17%	9,000	52%	210
Other Commercial	28	9%	1,000	6%	35
Other Locations	23	8%	*	2%	7
Unknown Location	9	3%	*	0%	2
<i>All Crashes</i>	<i>292</i>	<i>100%</i>	<i>18,000</i>	<i>100%</i>	<i>705</i>
<i>Passenger Vehicles</i>					
<i>Traffic Crashes</i>					
Roadway	34	15%	3,000	15%	234
Off-Roadway	20	9%	1,000	4%	76
Unknown Location	1	0%	*	0%	6
<i>Nontraffic Crashes</i>					
Driveway	63	28%	2,000	13%	37
Other Residential	46	20%	1,000	7%	27
Nonresidential Parking Lot	34	15%	9,000	51%	188
Other Commercial	10	4%	1,000	7%	33
Other Locations	10	4%	*	3%	5
Unknown Location	10	4%	*	0%	2
<i>All Crashes</i>	<i>228</i>	<i>100%</i>	<i>17,000</i>	<i>100%</i>	<i>608</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

5.2 Circumstances Surrounding Other Backing Crashes

Other backing crashes may involve a single backing vehicle, a two-vehicle collision where one vehicle was backing, or more complicated scenarios involving many vehicles. This section describes the circumstances surrounding those other backing crashes. Similar to the information presented for backovers, the nontraffic and traffic fatalities and injuries in other backing crashes have been combined to examine the overall problem since there did not appear to be substantial differences between the two groups. NiTS provided information for about 50 percent of the total fatalities and injuries in other backing crashes, which would have been missed in an analysis using only FARS and NASS-GES.

Table 14 contains the counts of the fatalities and injuries in other backing crashes by the backing vehicle's body type. An estimated 77 percent of the fatalities and 87 percent of the injuries involve backing passenger vehicles. About two-thirds of the injuries (20,000 of 30,000) are possible (minor) injuries, the lowest level of injury severity. However, an estimated 3,000 incapacitating injuries occur each year in crashes involving backing vehicles that are not backovers.

Similar to the backovers, the backing vehicle type is not known for some of the other backing crashes. Counts involving passenger vehicles in other backing crashes were adjusted to account for fatalities and injuries involving backing vehicles of unknown type. The fatalities involving backing passenger vehicles were adjusted by a factor of 171/167 (all other backing fatalities over other backing fatalities with a known vehicle type) to account for the unknown type of backing vehicles. Passenger vehicle injuries were adjusted in a similar manner.

Table 14: Fatalities and Injuries in Other Backing Crashes by Vehicle Type and Severity

Backing Vehicle Type	Fatalities	Injuries (A, B, C, and unknown severity)		Incapacitating Injuries (A)		Non-incapacitating Injuries (B)		Possible Injuries (C)	
		Estimated Total	Sample Count	Estimated Total	Sample Count	Estimated Total	Sample Count	Estimated Total	Sample Count
Car	57	12,000	517	*	58	2,000	174	10,000	278
Light Truck or Van (LTV)	74	13,000	486	2,000	67	2,000	175	8,000	231
Heavy Truck	30	2,000	313	*	44	*	73	1,000	192
Other/Multiple Vehicle	6	2,000	48	*	3	*	10	1,000	34
Unknown	4	*	25	*	1	*	9	0	15
<i>Total</i>	<i>171</i>	<i>30,000</i>	<i>1,389</i>	<i>3,000</i>	<i>173</i>	<i>5,000</i>	<i>441</i>	<i>20,000</i>	<i>750</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500, estimates may not add up to totals due to independent rounding.

Table 15 provides details regarding the passenger vehicles involved in backing crashes other than backovers. The table also contains the percentages of these vehicles in non-backing traffic injury crashes as a comparison group to account for exposure. Similar to backovers, it appears that pickup trucks are overrepresented in other backing crash fatalities and injuries.

Table 15: Other Backing Crash Fatalities and Injuries by Passenger Vehicle Type

<i>Backing Vehicle Type</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>	<i>Percent of Vehicles in Non-Backing Traffic Injury Crashes</i>
Car	59	44%	13,000	48%	517	62%
Utility Vehicle	17	13%	5,000	21%	190	14%
Van	8	6%	2,000	7%	93	8%
Pickup	50	37%	6,000	23%	192	15%
Other Light Vehicle	0	0%	*	0%	11	1%
<i>Passenger Vehicles</i>	<i>134</i>	<i>100%</i>	<i>26,000</i>	<i>100%</i>	<i>1,003</i>	<i>100%</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

Table 16 contains the details of crash scenarios involving fatalities and injuries in backing crashes other than backovers. Among the other backing crashes, 60 percent of the fatalities and 20 percent of the injuries occur in single-vehicle crashes. The most common single-vehicle scenario for fatalities and injuries involves backing into a fixed object such as a tree or a pole. Additional common fatalities among the other single-vehicle backing crashes include rollovers, drivers or passengers who are run over by their own backing vehicles while falling or jumping from the vehicle and immersion when a person backs into a body of water. Many of the other single-vehicle backing injuries occur when drivers back into parked motor vehicles.

About 36 percent of the fatalities and 76 percent of the injuries in other backing crashes involve two vehicles. This scenario usually occurs when the most harmful event is a collision between a backing vehicle and another vehicle in transport. For example, a vehicle backs from a driveway into the road and is struck by another vehicle travelling on the roadway. Most of the fatalities and injuries in this crash scenario affect the driver of the non-backing vehicle, which is likely due to the forward travelling vehicle moving a higher rate of speed than the backing vehicle and thus experiencing a greater change in velocity. The remaining crashes involve three or more vehicles where at least one was backing at the time of the crash.

Table 16: Other Backing Crash Fatalities and Injuries by Crash Scenario

<i>Scenario</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>
<i>All Vehicles</i>					
Single Vehicle Noncollisions					
Rollover	21	12%	1,000	3%	31
Falls From Vehicle/Run Over by Own Vehicle	31	18%	*	1%	16
Immersion	10	6%	0	0%	0
Single-Vehicle Collisions					
Fixed Object	33	20%	2,000	7%	72
Parked Vehicle	3	2%	1,000	5%	59
Other Single-Vehicle Crashes	5	3%	1,000	4%	45
Two-Vehicle Crashes					
Occupant of Backing Vehicle	21	13%	8,000	25%	329
Occupant of Other Vehicle	40	23%	15,000	51%	762
Nonoccupant	2	1%	*	0%	3
Three-or-More-Vehicle Crashes					
Occupant of Backing Vehicle	2	1%	*	2%	14
Occupant of Other Vehicle	4	2%	*	2%	57
Nonoccupant	0	0%	*	0%	1
<i>Total</i>	171	100%	30,000	100%	1,389
<i>Passenger Vehicles</i>					
Single-Vehicle Noncollisions					
Rollover	17	13%	1,000	3%	19
Falls From Vehicle/Run Over by Own Vehicle	25	19%	*	2%	15
Immersion	11	8%	0	0%	0
Single-Vehicle Collisions					
Fixed Object	34	26%	2,000	8%	67
Parked Vehicle	3	2%	1,000	5%	52
Other Single-Vehicle Crashes	4	3%	1,000	4%	39
Two-Vehicle Crashes					
Occupant of Backing Vehicle	20	15%	6,000	22%	276
Occupant of Other Vehicle	13	10%	14,000	52%	484
Nonoccupant	1	1%	*	0%	1
Three-or-More-Vehicle Crashes					
Occupant of Backing Vehicle	2	1%	*	2%	14
Occupant of Other Vehicle	2	2%	*	2%	36
<i>Total</i>	134	100%	26,000	100%	1,003

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

A final area of interest is where the backing crash fatalities and injuries other than backovers occur. Table 19 contains the details for all backing vehicles and for backing passenger vehicles. Overall, slightly more than half of the other backing crash fatalities

(52 percent) and almost half of the injuries (49 percent) occur on trafficways. However a relatively large proportion of the other backing fatalities also happened in “other locations,” which tend to be private roads, and in other residential areas, which tend to be residential parking areas around apartments and townhouses. Similar to backovers, a relatively large portion of the other backing crash injuries occur in nonresidential, mainly commercial, parking lots.

Table 17: Other Backing Crash Fatalities and Injuries by Location

<i>Location</i>	<i>Fatalities</i>	<i>Percent of Fatalities</i>	<i>Estimated Injuries</i>	<i>Estimated Percent of Injuries</i>	<i>Sample Count of Injuries</i>
<i>All Vehicles</i>					
<i>Traffic Crash</i>					
Roadway	72	42%	13,000	44%	995
Off-Roadway	17	10%	2,000	5%	123
Unknown Location	0	0%	*	0%	4
<i>Nontraffic Crash</i>					
Driveway	3	2%	1,000	3%	10
Other Residential	26	15%	1,000	5%	23
Nonresidential Parking Lot	3	2%	11,000	37%	209
Other Commercial	9	5%	*	1%	12
Other Locations	41	24%	1,000	5%	13
<i>All Crashes</i>	<i>171</i>	<i>100%</i>	<i>30,000</i>	<i>100%</i>	<i>1,389</i>
<i>Passenger Vehicles</i>					
<i>Traffic Crash</i>					
Roadway	42	31%	11,000	44%	661
Off-Roadway	15	11%	1,000	5%	99
Unknown Location	0	0%	*	0%	3
<i>Nontraffic Crash</i>					
Driveway	3	2%	1,000	3%	9
Other Residential	27	20%	1,000	5%	21
Nonresidential Parking Lot	3	2%	9,000	36%	186
Other Commercial	9	7%	*	2%	12
Other Locations	36	27%	1,000	5%	12
<i>All Crashes</i>	<i>134</i>	<i>100%</i>	<i>26,000</i>	<i>100%</i>	<i>1,003</i>

Source: FARS 2002-2006, NASS-GES 2002-2006, NiTS 2007

Note: * indicates estimate less than 500; estimates may not add up to totals due to independent rounding.

6. Detailed Investigations of Backovers

In addition to collecting police-reported backovers through NHTSA's data collection infrastructure, NHTSA's Special Crash Investigations (SCI) program is currently collecting detailed data on backover events. SCI was created to examine the safety impact of rapidly changing technologies and to provide NHTSA with early detection of alleged or potential vehicle defects. SCI began investigating cases for the NiTS system in October 2006. The SCI NiTS program encompasses several different types of qualifying events including backovers, power window strangulations, hyper- and hypothermia events, trunk entrapments, rollaways, and carbon monoxide poisonings. SCI receives notification of potential NiTS cases from several different sources including media reports, police and rescue personnel, contacts within NHTSA, reports from the general public, as well as notifications from the NASS. As of July 1, 2008, SCI had received a total of 446 NiTS notifications from a combination of all sources. Of these, 69 became NiTS cases which included 52 backovers, 9 hyperthermia cases, 4 trunk entrapments, 3 power window strangulations, and 1 rollaway.

This report addresses the SCI's NiTS backover investigations. For the purpose of the SCI cases, an eligible backover was defined as a light passenger vehicle where the back plane strikes or passes over a person who is either positioned to the rear of the vehicle or is approaching from the side. SCI primarily focuses on cases involving children; however, it investigates some cases involving adults.

The majority of notifications received do not meet the criteria for case assignment. Typically the reasons for not pursuing further include:

- the reported crash configuration is outside of the scope of the program,
- minor incidents with no fatal or seriously injured persons, or
- incidents where cooperation can not be established with the involved parties.

As an example, many backover incidents are determined to be side or frontal impacts, which exclude them from the program.

SCI on-site backover investigations are comprised of an inspection of the vehicle and scene as well as interviewing the involved parties when possible. Other backover cases are investigated remotely and are based on an examination of police-provided reports and photos as well as interviews with the involved parties. SCI also conducts a case vehicle visibility study to determine the vehicle's blind zones and also to determine at what distance behind the vehicle the occupant would have come into view of the driver.

SCI collects detailed information on the scene, vehicle, driver, nonoccupant, and back up or parking aids if the vehicle is so equipped. Information collected at the scene includes ambient conditions, sightline obstructions, crash location, speed, grade, distance to impact, and distance to final rest. Vehicle information collected consists of glazing status, clarity and obstructions, tire data, seat and head restraint types and adjustments. Standard measurements of the exterior of the vehicle are also taken such as clearance

height of the back of the vehicle and undercarriage, and locations of any sensors or cameras if equipped. If the subject vehicle is equipped with a back up or parking aid such as a backup sensor or rear-mounted camera, detailed information is collected. These data include type, location, functionality, and the driver's stated reaction to any warning based upon interviews.

The driver's age, sex, height, weight, vision deficiencies, and relationship (if any) to the struck nonoccupant is captured on the Driver Form. Driver actions such as approach to the vehicle, purpose of backing, pre-impact actions, avoidance actions, sightline obstructions, and impairment are also collected. Information captured related to the nonoccupant include age, sex, height, weight, medical outcome, and any impairment. The nonoccupants' actions collected include attitude, motion, approach to the vehicle, avoidance actions, and any distractions. SCI also collected data on the clothing the nonoccupant was wearing at the time including, type, color, fabric, texture, and weight.

6.1 Overview of SCI Backover Investigations

About 63 percent (33 of 52) of the backover cases occurred in single-family residential areas. The remaining 19 cases took place in either commercial, multifamily, rural areas, or were unknown. Slightly less than one-half (25 of 52) of backover incidents were located in driveways, and 12 occurred in parking lots. Another eight occurred on sidewalks, streets, and roadsides. The location in the remaining seven cases, which were either remote or incomplete investigations, was unknown.

The 52 backing vehicles were comprised of 17 passenger cars, 21 sport utility vehicles, and 14 pickup trucks. Only 4 of the cases (8 percent) contained vehicles equipped with a backup or parking aid. In 35 percent (18) of the backover cases, the driver was related to the struck nonoccupant. In 50 percent (26) of the cases, there was no relationship between the driver and nonoccupant. The relationship between the driver and nonoccupant was unknown in 15 percent (8) of the cases. Based upon the cases where it was known whether the struck nonoccupant was related to the driver, these results indicate that an estimated 40 percent (35 of 85) of the nonoccupant backover victims were related to the driver.

As indicated previously, the focus of the backover case assignment was primarily children; thus 88 percent of the backovers (46 of 52) involved children who were struck by vehicles. Adults were generally excluded from the study unless they were seriously injured or killed or if the backing vehicles were equipped with backing or parking aids. A total of 6 cases were initiated involving struck adults. Of the 52 backover cases, exactly half (26) involved fatally injured nonoccupants.

The 52 backover crashes involved 54 nonoccupant victims, since two of the backing vehicles each struck two nonoccupants. About 90 percent (48 of 54) of the victims were children. They ranged in age from less than 1 year old up to 13 years old. A breakdown of the victim's path of travel prior to being struck is as follows: 24 were approaching from the right or left of the vehicle, 19 were stationary behind the vehicle, 10 were unknown, and one was "other."

The struck nonoccupants' pre-impact attitude and motion were also collected by SCI. About 40 percent (21 of 54) of the nonoccupants were standing before they were struck. In many of the cases (19) the pre-impact attitude of the nonoccupant is not known. The remaining 14 nonoccupants were either on bikes, bending at the waist, kneeling, laying on the ground, or had fallen to the ground before being struck. In a majority (28 of 54) of the backover cases, the pre-impact motion of the nonoccupants is not known. Six of the nonoccupants were stationary, and 5 were walking before impact. Five were falling/stumbling/rising, 4 were on bikes or scooters and 3 were running or jogging. The remaining 3 nonoccupants were either riding a toy truck, skipping/hopping/jumping, or engaged in "other" motion. Two examples of on-site SCI backover investigations are included below.

6.2 SCI Backover Investigation Example #1

Example 1 involves a 2007 Chrysler 300C that backed over an 18-month-old female causing fatal injury. The driver (victim's mother) was backing the vehicle out of a garage and down a long driveway directly to the right of the residence. The 18-month-old child exited the house and entered the driveway in the path of the backing vehicle.

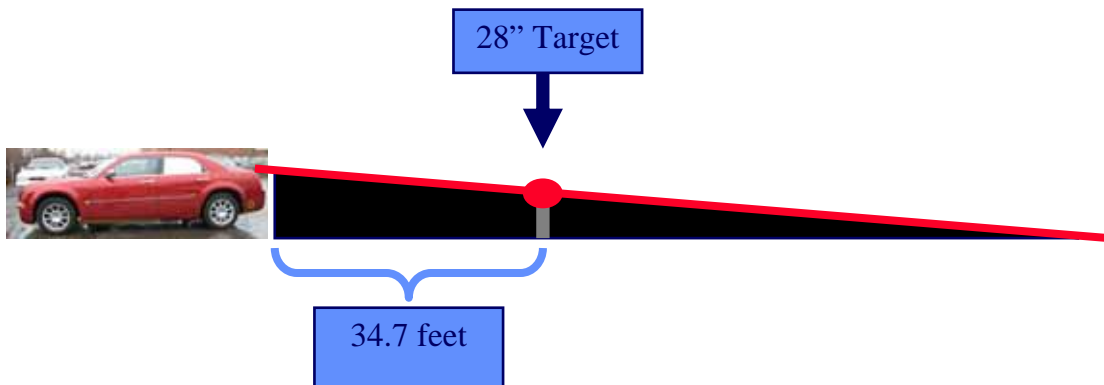


The left rear bumper of the Chrysler struck the child and knocked her to the ground. First the left rear tire ran over the child, and then the left front tire also ran the child over. The driver was completely unaware the impact had occurred. The child expired 4 hours post crash. The autopsy indicated a liver laceration as the cause of death.



A visibility study was conducted on the case vehicle and it was determined that the driver was unable to see the top of a standard 28 inch target until it had been placed 34.7 feet behind the vehicle. The struck child was 24 inches tall.

Figure 2: SCI Backover Example 1



Note: Graphic not to scale.

6.3 SCI Backover Investigation Example #2

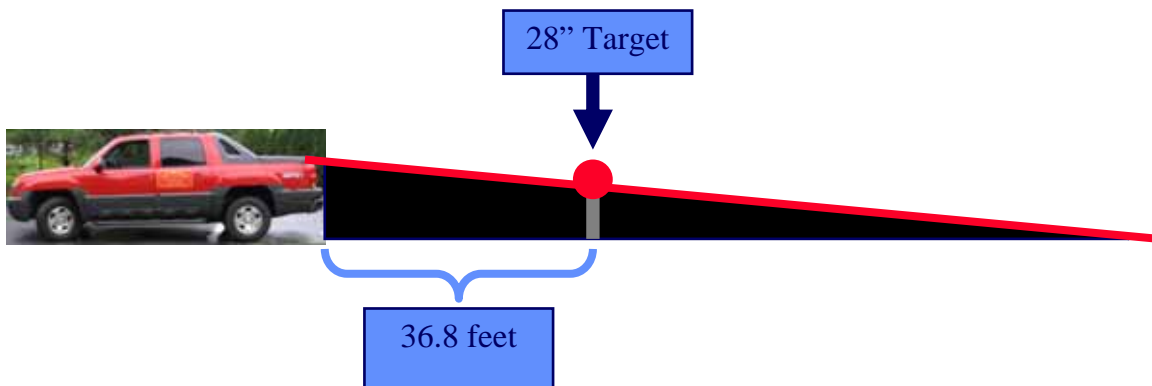
Example 2 involves a 2003 Chevrolet Avalanche that backed over a 6-year-old male causing serious non-fatal injury. The driver (unrelated to victim) had stopped the vehicle at the end of a private road to retrieve mail and a refuse container. He then drove forward into a common area before putting the vehicle in reverse and backing into his driveway. While this was occurring, the 6-year-old was riding a bike behind the vehicle and lost control of the bike and fell to the ground behind the Chevrolet.



The driver reported that he checked his mirrors and initiated his backing maneuver into the driveway. The child was located approximately 12 feet behind the centerline of the vehicle and could not be seen by the driver. While the child was on the ground, still straddling the fallen bike, he was run over by the rear overhang and undercarriage of the vehicle. The child was wearing a bicycle helmet which was fractured during the event. The victim sustained a skull fracture, orbital fracture, and facial abrasions. He was hospitalized but survived the incident.

A visibility study was conducted on the case vehicle and it was determined that the driver was unable to see the top of a standard 28 inch target until it had reached 36.8 feet behind the vehicle. The struck child was lying on his side and well below the 28-inch test height.

Figure 3: SCI Backover Example 2



Note: Graphic not to scale.

The 52 NiTS backover cases assigned as of July 1, 2008, have been published to the Internet and can be found at: <http://www-nass.nhtsa.dot.gov/BIN/logon.exe/airmislogon>. A complete listing of the cases appears in the Appendix to this report.

7. Conclusions

Data regarding traffic backovers, which occur on public roadways, on the shoulders, and other parts of the public right-of-way, have been provided in previous reports using NHTSA's existing FARS and NASS-GES. Data regarding nontraffic backovers, including those that occur on nonpublic roads, in driveways, and in parking facilities, have not routinely been collected by NHTSA. In response to SAFETEA-LU Sections 2012 and 10305 and Section 2(f) of the Cameron Gulbransen Kids Transportation Safety Act of 2007, NHTSA developed the NiTS system to collect information about all nontraffic crashes, including nontraffic backovers.

NHTSA determined that police reports were the best source of information about nontraffic crashes. However, NHTSA is aware that it did not receive all possible reports from the States and local police jurisdictions. Most of the NASS-GES sampled police jurisdictions (over 80 percent) complete police reports if a person is injured in a motor vehicle crash regardless of location. NHTSA was not able to obtain all these reports in part due to variation in procedures for handling nontraffic crash reports across States and local jurisdictions such as the type of report used to document the crash, differences in

the physical location and filing system for nontraffic versus traffic crashes and whether the nontraffic report was sent from the local jurisdiction to the State. For nontraffic injuries, NHTSA estimates that it received police reports for 31 percent of the road vehicle occupant injuries and 35 percent of the nonoccupant injuries. For the nontraffic fatalities, NHTSA estimates that it received reports for 34 percent of the road vehicle occupant deaths and 43 percent of the nonoccupant deaths. The final counts in this report were adjusted based upon these estimates.

Using NiTS, NHTSA estimates that 221 nontraffic backover fatalities occur each year that are not counted in FARS. NHTSA also used NiTS to estimate that 14,000 nontraffic backover injuries occur each year that are not counted in NASS-GES. However, an examination of the nontraffic cases from NiTS and the traffic cases from FARS indicated that the only significant difference between the two groups was the location of the crash. Therefore, the two groups were combined when describing the overall characteristics of the backover problem. The backover injuries from NiTS and NASS-GES were combined for similar reasons to provide an overall picture of injuries. In both cases, NiTS provided information for about 75 percent of the backover fatalities and injuries.

Backovers account for an estimated 292 (63 percent) of the fatalities and 18,000 (38 percent) of the injuries in backing crashes. Most backover fatalities and injuries involve passenger vehicles. Among the cases where the vehicle type of the striking vehicle is known, 228 (78 percent) of the backover fatalities and 17,000 (95 percent) of the backover injuries involved passenger vehicles. Pickup trucks and utility vehicles are overrepresented in backover fatalities and injuries when compared to non-backing traffic injury crashes. In fact, utility vehicles and pickups are involved in an estimated 61 percent (140 of 228) of backover fatalities involving passenger vehicles even though they only account for 29 percent of vehicles in non-backing traffic injury crashes.

While people of all ages are victims of backovers, this report confirmed that children under 5 years old and adults 70 and older have an elevated risk of being backover victims compared to their proportion of the population. An estimated 44 percent of the backover fatalities involving passenger vehicles were children under the age of 5. An estimated 19 percent of the backover injuries were adults 70 and older. For the most part, the distribution of backover fatalities and injuries by the age of the driver was similar to the distribution of the age of drivers in non-backing traffic injury crashes. One exception is that drivers 70 and older account for a much larger proportion of the backover fatalities and injuries than their proportion of all non-backing traffic injury crashes. Backover fatalities happen in a variety of areas with the most common area being a driveway, closely followed by other residential areas, public roadways, and nonresidential parking lots. Backover injuries tend to happen in nonresidential parking lots such as shopping centers.

NHTSA's SCI program provided detailed investigations of backover crashes to supplement the information obtained through crash reports. The SCI investigations found that about 40 percent of the nonoccupant victims were related to the driver. The SCI

investigations also indicated that more nonoccupants were approaching the backing vehicle from the side rather than being stationary behind the vehicle.

Other backing crash scenarios account for an estimated 171 fatalities (37 percent) and 30,000 injuries (62 percent) per year. Among the other backing crashes, 60 percent of the fatalities and 20 percent of the injuries occur in single-vehicle crashes. The most common single-vehicle scenario for fatalities and injuries involves backing into a fixed object such as a tree or a pole. The bulk of the injuries (80 percent) and a sizeable proportion of the fatalities (40 percent) in other backing crashes occur in collisions between backing vehicles and other motor vehicles in transport. About two-thirds of the injuries (15,000 of 23,000) and of the fatalities (44 of 67) involving backing vehicles and other motor vehicle in transports occur in the other vehicles, not the backing vehicles.

On February 28, 2008, the President signed into law the Cameron Gulbransen Kids Transportation Safety Act of 2007. Section 2(b) of this law requires that within 12 months of the President signing the bill, the Secretary of Transportation must initiate rulemaking to expand the required driver's field-of-view behind vehicles to reduce deaths and injuries from backing crashes, especially crashes involving small children and disabled people. A final rule must be in place no later than 3 years after the President signed the bill unless the Secretary of Transportation extends the deadlines as described in Section 4 of the law.

Appendix: Special Crash Investigation (SCI) Backover Case Listing

Count	Case Number	Date Assigned	Count	Case Number	Date Assigned
1	CA06024	10/12/2006	27	DS07030	7/17/2007
2	CA06028	11/3/2006	28	CA07024	7/20/2007
3	DS06032	12/21/2006	29	IN07023	7/20/2007
4	DS07002	1/4/2007	30	IN07024	7/20/2007
5	CA07002	1/12/2007	31	IN07025	7/20/2007
6	CA07004	1/27/2007	32	IN07026	7/20/2007
7	IN07003	2/1/2007	33	CA07025	7/27/2007
8	IN07004	2/1/2007	34	IN07027	8/13/2007
9	CA07009	2/28/2007	35	DS07034	8/15/2007
10	DS07008	3/2/2007	36	IN07028	8/17/2007
11	IN07009	3/16/2007	37	IN07029	8/23/2007
12	DS07013	4/5/2007	38	IN07030	9/10/2007
13	IN07010	4/6/2007	39	IN07031	9/25/2007
14	IN07011	4/17/2007	40	DS07037	9/25/2007
15	IN07012	4/19/2007	41	CA07034	10/19/2007
16	IN07013	4/24/2007	42	IN07034	10/22/2007
17	CA07014	4/25/2007	43	DS07040	10/30/2007
18	DS07019	5/8/2007	44	DS07045	11/27/2007
19	DS07020	5/8/2007	45	CA07036	12/17/2007
20	DS07021	5/8/2007	46	IN08001	1/10/2008
21	IN07014	5/10/2007	47	IN08002	1/10/2008
22	DS07023	5/22/2007	48	DS08006	2/26/2008
23	IN07018	6/20/2007	49	CA08015	4/9/2008
24	IN07019	6/27/2007	50	DS07024	5/22/2008
25	CA07022	7/11/2007	51	IN08023	6/17/2008
26	CA07023	7/13/2007	52	IN08025	6/19/2008

References

- Jenness, J. W., Lerner N. D., Mazor S., Osberg J. S., and B. C. Tefft. "Use of Advanced In-Vehicle Technology by Young and Older Early Adopters: Survey Results on Sensor-Based Backing Aid Systems and Rear-View Video Cameras." August 2007. Washington, DC: National Highway Traffic Safety Administration. Available at <http://www.nhtsa.gov/staticfiles/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2007/DOT-HS-810-828rev.pdf>
- Mazzae, E. and R. Garrott. "Experimental Evaluation of the Performance of Available Backover Prevention Technologies for Medium Straight Trucks." November 2007. Washington, DC: National Highway Traffic Safety Administration. Available at <http://www.nhtsa.gov/staticfiles/DOT/NHTSA/NRD/Multimedia/PDFs/Crash%20Avoidance/2007/DOT-HS-810-865.pdf>
- National Safety Council. "American National Standard Manual on Classification of Motor Vehicle Traffic Accidents." 7th ed. 2007. Itasca, IL: National Safety Council. Available at http://downloads.nsc.org/pdf/D16.1_Classification_Manual.pdf
- NHTSA. "Data Collection Study Deaths and Injuries Resulting From Certain Nontraffic and Non-Crash Events." May 2004. Washington, DC: National Highway Traffic Safety Administration. Available at <http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=0900006480329d5f>
- NHTSA. "Estimation of Backover Fatalities." September 2006. Washington, DC: National Highway Traffic Safety Administration. Available at <http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=09000064802ace37>
- NHTSA. "Experimental Evaluation of the Performance of Available Backover Prevention Technologies." November 2006. Washington, DC: National Highway Traffic Safety Administration. Available at <http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=09000064802ace3a>
- NHTSA. "NHTSA Pilot Study: Nontraffic Motor Vehicle Safety Issues." Washington, DC: National Highway Traffic Safety Administration, May 2002. Available at <http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=0900006480329d5e>

NHTSA. "Report to Congress: Vehicle Backover Avoidance Technology Study."
November 2006. Washington, DC: National Highway Traffic Safety
Administration. Available at
[http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail
&o=09000064802ace39](http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=09000064802ace39)

NHTSA. "Research Note: Nonoccupant Fatalities Associated with Backing Crashes."
February 1997. Washington, DC: National Highway Traffic Safety
Administration. Available at
[http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail
&o=0900006480341cb6](http://www.regulations.gov/fdmspublic/component/main?main=DocumentDetail&o=0900006480341cb6)

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