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Attributes of Police Vehicle Crashes

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Abstract

While overall on-duty law enforcement deaths has decreased moderately from over 160 in 1980 to a level under 120 per year in the late 2000s, fatalities by motor vehicle collisions have steadily increased. This descriptive analysis examines police vehicle crashes during specific conditions such as emergency response, road surface, lighting, and weather in a large statewide police agency. Police vehicle crashes are most likely to occur on dry roads, in daylight conditions, and in clear weather on weekdays as opposed to weekends. Weather and lighting conditions are not the most frequent factors associated with cruiser crashes in this examination.

Introduction

Police officer deaths from violent criminal attacks are a serious concern for police professionals, and this piece does not seek to trivialize those deaths. What is often unnoticed is that traffic fatalities are one of the leading causes of police officer death and injuries (Mayhew, 2001; Tiesman & Hieck, 2014). While overall on-duty law enforcement deaths has decreased moderately from over 160 in 1980 to a level under 120 per year in the late 2000s, fatalities by motor vehicle collisions have steadily increased (Ashton, 2011; Federal Bureau of Investigation [FBI], 2009; Pinizzotto, Davis, & Miller, 2002). From 1997 to 2010, traffic-related fatalities were the leading cause of law enforcement officer fatalities, according to the National Law Enforcement Officers Memorial Fund (Federal Emergency Management Agency [FEMA], 2014).

Even though police agencies have experienced a substantial number of on-duty deaths and injuries related to vehicle collisions, little is known about the characteristics of these incidents. Police organizations have a vested interest in promoting officer safety, public safety in general, and risk mitigation as part of their management responsibilities. Providing greater insight into law enforcement vehicle collisions can assist police executives with making better strategic decisions regarding training, policy, vehicle design, and deployment decisions.

Data from the National Highway Traffic Safety Administration (NHTSA) Crash Investigation Division found that death of law enforcement officers as a result of motor vehicle crashes has increased by 80% during the last 28 years, while officer deaths from other circumstances has decreased by approximately 50% (Bean & Noh, 2010). The NHTSA found that over half (54%) of officer on-duty deaths between the years 2005 and 2007 were caused by car crashes, making it the leading cause of law enforcement officer deaths.

Another study conducted for the NHTSA examined law enforcement officer fatalities involving police vehicle crashes (Noh, 2011). This examination used NHTSA's Fatality Analysis Reporting System (FARS) to study crashes from 1980 to 2008, with a sample size of 772 crashes. Among the findings at the crash unit of analysis was the fact that

police fatalities were distributed between rural areas at 54% and in areas classified as urban at 46%. The *first harmful event*, defined as the first property damage or injury producing crash event, showed changes over the almost three decades of tracking fatalities. Crashes with motor vehicles "in transport" declined from 60 to 52% from the 1980s to 1990s, then to 48% in the 2000s. Alternatively, fixed object crashes in which police vehicles struck guardrails, barriers, or other objects, increased from 29 to 37 to 41% in each of those three time frames.

The *Orlando Sentinel* newspaper conducted a study in Florida (Ashton, 2012) examining crashes from 2006 to 2010, finding an annual average of 7,400 law enforcement–involved crashes. Police crashes in this state result in 20 fatalities, 2,400 injuries, and $25 million in property damage each year. The *Sentinel* researchers found that 77% of the police-involved crashes happened during routine patrol activities as opposed to actual emergency response or vehicle pursuit situations.

A study by the Centers for Disease Control and Prevention's (CDC) National Institute for Occupational Safety and Health (Tiesman & Hieck, 2014) found that police vehicle crashes occurred during daylight hours (49%), in clear weather (70%), during non-emergency calls (64%), and at speeds lower than 50 mph (79%). Officers responding to the survey reported that 20% had been involved in a motor vehicle collision in the last three years. Interestingly, there were no differences in the reported involvement of cruiser crashes by officers' gender, education, length of shift, or time of shift (nighttime versus daytime). The most common crash types were broadside (31%), rear-end (27%), and single vehicle (20%) collisions.

This type of data has significant importance in conducting risk management by police leaders. Emergency vehicle operators in general and police officers specifically are at greater risk for motor vehicle collisions due to the nature of their mission (NHTSA, 1995; Tiesman & Hieck, 2014). Police officers are four times more likely than a civilian motorist to be involved in a crash (Ford Motor Company, 2002). Officers work on a 24/7 basis, are patrolling during inclement weather, and conduct vehicle patrol for significant amounts of their shift. Police work brings officers into highly traffic-congested areas as well as poorly lit and often less well-maintained roadways. Police vehicle operators also are responsible for observing their patrol surroundings while patrolling as well as listening to radio communications.

There is relatively little research on the attributes associated with law enforcement vehicle accidents (Allard & Prenzler, 2009; Gustafson & Cappitelli, 2010; Lundälv, Philipson, & Sarre, 2010; Mayhew, 2001; Rice & Gustafson, 2012; Tiesman & Hieck, 2014). Factors such as driving during darkness, reduced peripheral vision while speeding, and operating during foul weather have been proposed as causes (Mayhew, 2001; Tiesman & Hieck, 2014; Wehr, Alpert, & Rojek, 2012).

While there is a scarcity of studies that examine police vehicle crash indicators, other emergency vehicle studies help inform this discussion. Ray and Kupas (2007) examined ambulance crashes, determining that there was little difference between urban and rural collisions with regard to time of day, light conditions, and roadway type.

While police vehicle collisions have not been studied in significant detail, other related professions can inform this discussion. The fatality rates for emergency services workers, including police officers, are estimated at 2.5 to 4.8 times the national average compared to all occupations (Savolainen, Dey, Ghosh, Karra, & Lamb, 2009). Some of this can be explained by first responders working in high-risk conditions in terms of the potential for traffic collisions. They are charged with responding to life-threatening events, building alarms, crimes in progress, and, ironically, motor vehicle accidents involving the general

public. The scope of police vehicle crashes is often underestimated in comparison to other line-of-duty incidents that result in emergency personnel injuries and deaths.

Emergency vehicle crashes are a high-risk outcome of work in public safety. Ambulance operators are more frequently involved in motor vehicle collisions in comparison to other professions and fatally crash at twice the national average (Kahn, Pirrello, & Kuhn, 2001; MMWR, 2003; Sterud, Ekeberg, & Hem, 2006). Research has shown that ambulances are most likely to collide during an emergency call in daylight and dry road conditions, often at intersections where they face a red traffic light (Albertsson & Sundstrom, 2011).

Research in the State of Michigan (Savolainen et al., 2009) looked at a number of possible factors that contributed to all emergency vehicle crashes. The most frequent type of crash involves single-vehicle collisions (31.7%), followed by rear-end (21%) and angle (20.1%) collisions.

The State of Missouri examined emergency vehicle crashes as well, finding that of the 1,628 emergency service vehicles involved during the study period, 375 (23.0%) were on an emergency call for service (Emmel, 2004). Of the crashes examined in 2003, 78% involved police vehicles which normally spent more time in traffic than either ambulances or fire apparatus.

The environmental characteristics of police vehicle collisions in Missouri indicate that the first harmful event in 55.3% of the incidents involved one motor vehicle in transport striking another motor vehicle in transport. In another 20.2% of the cases, police vehicles struck a fixed object. Police vehicle crashes occurred on straight roadways in 83.9% of the cases and on level road inclines in 66.9% of the cases. The traffic safety factors related to police vehicle crashes are less well-defined from this review. This present crash analysis hopes to add to the knowledge base regarding police vehicle accidents specifically.

Methodology

This examination was the outgrowth of an intelligence-led policing effort to provide better data to policymakers and police commanders regarding police cruiser crashes. As a result of several high-profile crashes, the police department began to collect crash data and review individual crash investigations as a risk assessment goal.

This paper contains a descriptive analysis of police vehicle crash data to provide a baseline of data about this particular issue. As mentioned, there have been few studies of police vehicle crash attributes; and in this specific organization, this is the first formal analysis of this accident data. This inquiry will probe various crash characteristics in comparison to the previous research as well as provide an avenue to test specific research hypotheses in the future.

This Massachusetts agency operates using a take-home vehicle program which enables officers to respond anywhere in the state but at the same time increases their average daily driving time. Consequently, officers increase their crash risk with sometimes up to two hours of additional commuting time. Unfortunately, the data do not contain variables to measure mileage traveled or average driving time.

As a full-service police agency, the department puts a number of different types of vehicles in service. Not only are marked cruisers used for patrol, the department also supplements them with semi-marked and motor cycle units. In addition, it assigns unmarked vehicles to detectives, police commanders, and officers assigned to administrative and other non-patrol duties. During the study period, there were approximately 1,900 sworn officers in the department.

This data was collected from a dataset established by a large statewide policing organization to track police vehicle crashes involving

their officers and staff. The crashes from October 2009 to December 2011 are catalogued in the dataset for reportable police-involved accidents, which generally involves any crashes with injury and or serious vehicle damage. This dataset does not contain minor collisions that involve police cruisers where damage is below the state reporting threshold, and there are no injuries involved. Several of the incidents involved nonsworn staff such as forensic criminalists or mechanics who operate department vehicles during the course of their employment. Other cases were removed because data on the incident was so incomplete as to make analysis difficult. There were 441 useable crashes recorded in the database during that period. The crash data were extracted from the department's police records system and processed by the researcher into a format that enhanced analysis.

Research Questions

There are a couple of research questions that this paper seeks to answer. As discussed previously, the evidence-based research on police vehicle collisions is sparse; therefore, this analysis has the potential to make significant contributions to police practice. Law enforcement crash investigations collect a variety of information that can assist policymakers in examining the environmental, vehicle and operator dynamics of police-involved collisions. This paper will focus on two major research questions:

Research Question 1: What are some of the common environmental and road conditions that are associated with police vehicle collisions in a large statewide police agency?

Emergency Response

Police vehicle operation is inherently dangerous given the emergency response conditions that officers encounter. A study conducted at the State University of New York–Buffalo (Page, 2007) found that 60% of police crashes transpired during non-emergency situations, which is consistent with the NHTSA study (Bean & Noh, 2010) that found that 58% of fatal crashes occurred during routine driving situations.

In this recent analysis, 81% of the reported 441 crashes occurred in a non-emergency circumstance, similar to findings in another statewide analysis (Emmel, 2004). This illustrates the reality that police officers spend a substantial amount of their shift on random patrol unlike ambulances and fire apparatus that are more likely to be in an emergency response mode. What this highlights for policymakers is that despite media attention to high-speed pursuits and emergency driving situations, the majority of crashes are not due to extreme operating conditions.

Road Surface Conditions

The road surface conditions indicate whether the road where the accident occurred was dry, wet, snow-covered, etc. One study (Savolainen et al., 2009) found that emergency vehicles of all kinds were more likely to crash during dry road conditions accounting for 66% of emergency vehicle collisions. Using a multivariate regression model, the researchers found police vehicles in particular were less frequently involved in crashes during rainy weather conditions, a fact that they attribute to better handling capabilities of police vehicles in comparison to ambulances or fire apparatus. An analysis of police-only crashes also found that dry roads were an attribute of most police cruiser accidents (Emmel, 2004).

In the current study, road conditions were more favorable with 72% of cruiser crashes taking place on dry road surfaces; 16% on wet roads; and only 10.5% arose during snow, ice, or slush conditions. While on its face, this was surprising given that this vehicle fleet operates in harsh winter weather conditions

three to four months of the year, it conforms to other research. A further look into what impact road surface conditions may have had on emergency driving did not yield any differences. Normal police patrol driving crashes happened on dry roads in 71.4% of those cases compared to 73.8% of emergency response events, illustrating very little impact by the type of driving police were performing (Figure 1).

Lighting Conditions

One NHTSA (2008) crash analysis study found that most (71%) traffic accidents involving civilian operators take place in daylight conditions, whereas only 12.8% occur in dark lighting conditions and 10.2% in dark but lighted settings. Emergency vehicles in general and police cruisers in particular tend to drive more often in non-daylight environments. Some analysis has found that emergency vehicle crashes in general are less likely to happen during routine operation but are more likely to occur in emergency response situations under dark lighting conditions (Savolainen et al., 2009). The researchers in the present study examined this question as well.

Based upon this sample, 59.2% or 261 of the crashes occurred during daylight conditions, while only about 18% happened under dark, unlighted conditions. When compared to all emergency vehicle crashes reported in a previous analysis (Savolainen et al., 2009), daylight accidents were reported in 50.6% of those incidents, which is consistent with our findings. Alternatively, unlike the Michigan findings, under emergency response conditions, Massachusetts cruiser crashes during daylight still accounted for cumulatively 56% of those high-risk events. Neither routine patrol nor emergency driving was affected by lighting conditions in this department (Figure 2).

Weather Conditions

Weather conditions are a significant factor that affects motor vehicle crashes. Rain and snow conditions often create more hazardous driving situations, at least where the general

Figure 1. Types of Road Surface Conditions Involved in Police Vehicle Crashes by Percentage

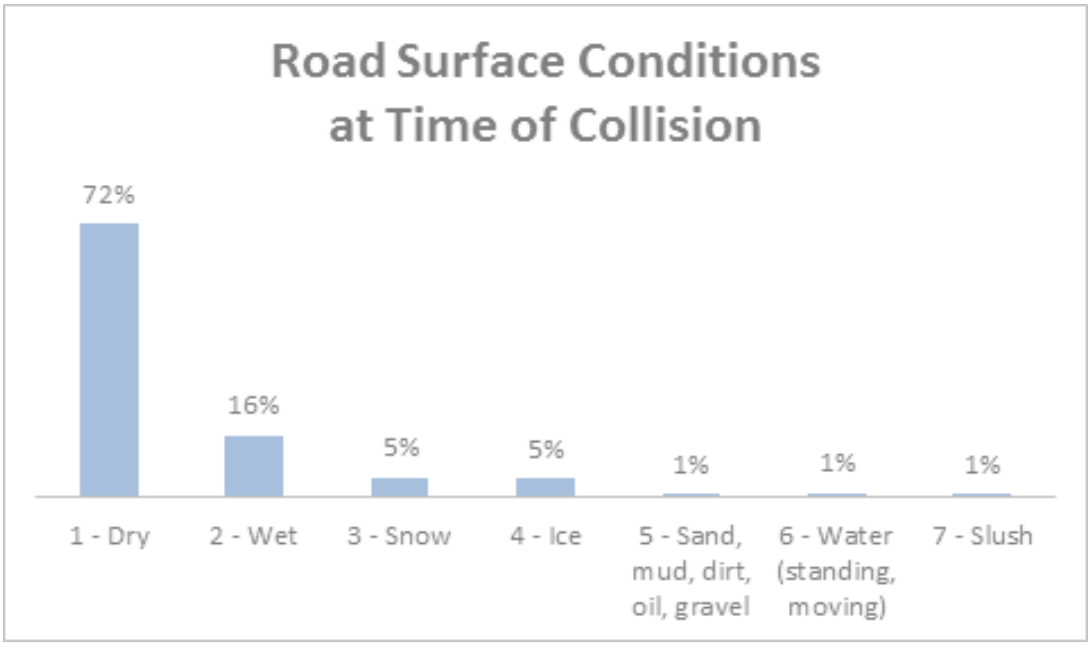
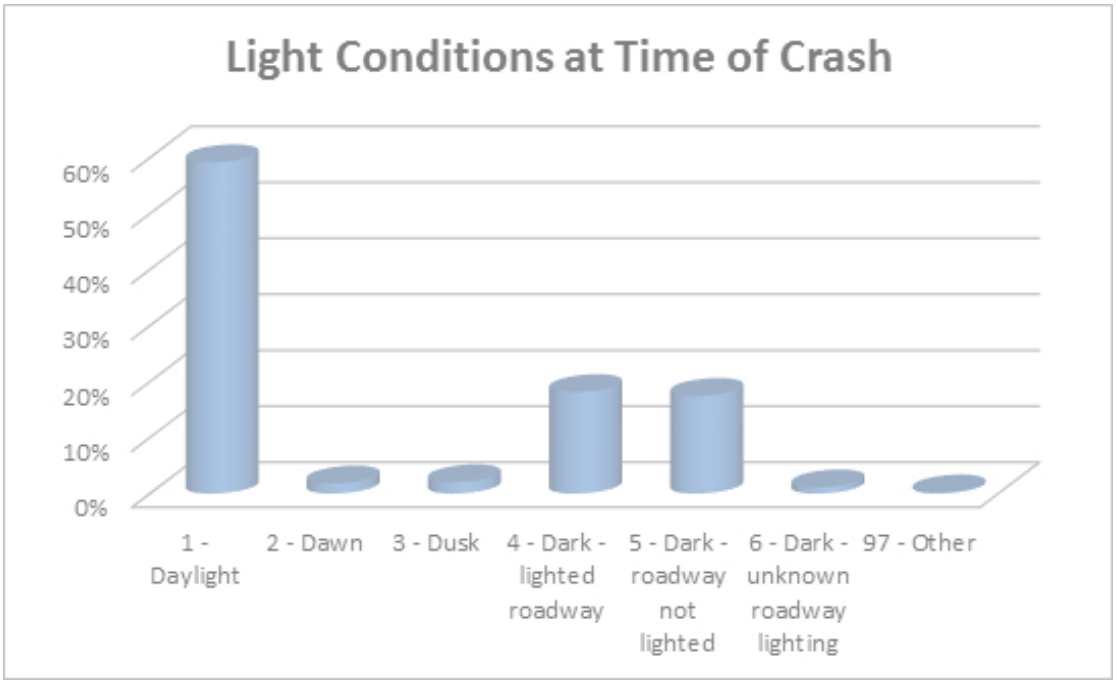


Figure 2. Percentage of Crashes by the Light Conditions at the Time of Collision



driving public is concerned (Eisenberg & Warner, 2005). The NHTSA (2008) reports that, nationally, for the general public, only 9.3% of traffic crashes occur in rainy conditions, with another 2.7% taking place in snowy weather. Over 91% of these collisions occurred during clear/cloudy weather.

The NHTSA also studied the crash environment for police officers involved in fatal crashes to determine any trends in weather conditions (Bean & Noh, 2010). Their assessment of weather at the time of the crash found that 83% occurred in clear/cloudy weather conditions whereas only 12% happened in rain and 2% in snow.

In our analysis, most police vehicle crashes occurred in clear weather conditions representing 251 cases or 57% of the crashes investigated here. Another 22% of the crashes occurred in cloudy conditions. Based upon this result, similar to crashes by the general public, inclement weather had a less important role, with about 16% occurring during rain, snow, sleet, or foggy conditions.

When we segregated emergency response-only accidents, 61.7% took place in clear weather, which were virtually the same proportions for non–emergency crashes at 60%. Inclement weather brings reduced visibility, less stable road surface conditions, and less care and caution from other drivers, which could exacerbate the potential for cruiser crashes. While we would have anticipated that high-risk emergency response driving combined with poor weather would have impacted crash prevalence, in this sample, they were similar in proportion.

Day of the Week

Some of the previous research (Noh, 2011) did not examine crashes by day of the week, which can often be an indicator of traffic volume or divergent calls for services such as more disturbances or alcohol-related crashes during weekends. The Michigan emergency

vehicle and the Missouri police crash studies (Emmel, 2004; Savolainen et al., 2009) did find that crashes were distributed evenly across days of the week.

In this sample, weekend crashes averaged about 35.5 (8%) accidents on Saturday or Sunday, while the daily average on Mondays through Fridays averaged over twice as many at 74 (16.78%) each weekday. In total, weekday collisions accounted for 83.9% of the total, indicating that high volume traffic days and higher staffing levels are likely factors in police cruiser crashes. Despite police agencies working 24/7, many have higher staffing during normal work weekdays, increasing exposure.

Collisions at Work Zones

Over the last five years, there were 4,400 deaths at construction zones and 200,000 people injured (Federal Highway Administration [FHWA], 2014). There were 579 work zone traffic fatalities in 2013 alone (The National Work Zone Safety Information Clearinghouse, 2015), outlining a clear problem for construction workers and the police officers assigned to these zones. Officers in this agency under examination work a significant amount of time at work zones as a means of earning additional income. These construction details are assigned across the department to all sworn officers, some of whom may work an additional 40 hours weekly, increasing their exposure to accidents.

Despite that potential exposure, only 13% or 57 of the cases that could be identified were classified as happening at a work zone. This is important because a great deal of attention has been focused across this jurisdiction as a result of several officer fatalities that have taken place at construction sites over the last five years. This does not represent a majority of crash conditions in this analysis, however.

Policymakers and police professionals need to gain a greater understanding of the conditions that are factors related to police vehicle accidents. This section served as an exploratory analysis of environmental conditions common to cruiser crashes. The next section will highlight any trends in the types of collisions and attributes of those crashes that may inform policy.

Research Question 2: What types of collisions involving police vehicles are most prevalent?

Different studies categorize the types of vehicle crashes in slightly different ways depending on the source of the accident data. Some, like the NHTSA fatalities study (Noh, 2011), use something called roadway function class which defines road types by interstate, arterial, collector, or local road. Other studies use the common definitions incorporated into their state accident reporting formats. Unfortunately, this current dataset is based upon investigation reports that do not use these roadway breakdowns.

This examination of Massachusetts police vehicle crashes uses two primary data elements to categorize crash characteristics: (1) the manner of collision and (2) the first harmful event. The *manner of collision* compares crashes according to single vehicle versus angle, rear-end, and head-on collisions, etc. The *first harmful event* or first property damage or injury resulting from the crash uses classifications similar to the definition in the NHTSA FARS coding. The Massachusetts reporting system uses the following categories: motor vehicle in traffic, parked motor vehicle, and a series of crashes with fixed objects or animals etc.; whereas the FARS classes are limited to five general categories—(1) non-collision, (2) collision with motor vehicle in traffic, (3) collision with object not fixed, (4) collision with fixed object, and (5) unknown—in addition to a number of subcategories in each class.

In their study of manner of collisions for Michigan emergency vehicles, Savolainen et al.

(2009) cite evidence that angle, rear end, and sideswipe crashes were more frequent than head-on. They also found that across all categories of emergency vehicles, single vehicle crashes occurred in 32% of those cases.

Noh's (2011) research on police fatalities discovered that motor vehicle in-transport collisions, those that concerned police vehicles crashing with other vehicles, were primarily characterized by angle crashes (55%) and head-on crashes (27%), and, somewhat surprisingly, less by rear-end crashes (13%). With regard to vehicle behavior just before the collision, the NHTSA report delineated that 61% of police vehicles were driving straight ahead as opposed to only 19% that were maneuvering on a curved portion of the road.

In Massachusetts, the most frequent accidents were rear-end collisions which took place in 165 of 441 or 37% of the cases. The second most frequent type was angle collisions (27%) followed by single vehicle crashes (17%) (Figure 3). Comparably, a previous study (Savolainen et al., 2009) found that rear-end, angle, and side-swipe crashes happened most frequently across all emergency vehicles. Rear-end and angle accidents are the more frequently cited manner of collision, which may indicate less police operator error.

The first harmful event in this analysis of over 400 police cruiser accidents was most frequently a motor vehicle in traffic at 332 incidents or 75% of the total crashes reported (Figure 4). Comparatively, the Michigan emergency vehicle analysis (Savolainen et al., 2009) found that 44% involved vehicles in transport (i.e., a vehicle operating in traffic) and another 42% struck an object off the road, while Missouri found the level at 55.3% for police cruisers (Emmel, 2004). Noh (2011) reported that specific police officer deaths occurred most often in collisions with motor vehicles in-transport (53%) or in fixed object crashes (36%).

The discrepancy between these two studies and the current examination can be explained

Figure 3. Percentage of Police Crashes by Manner of Collision Type

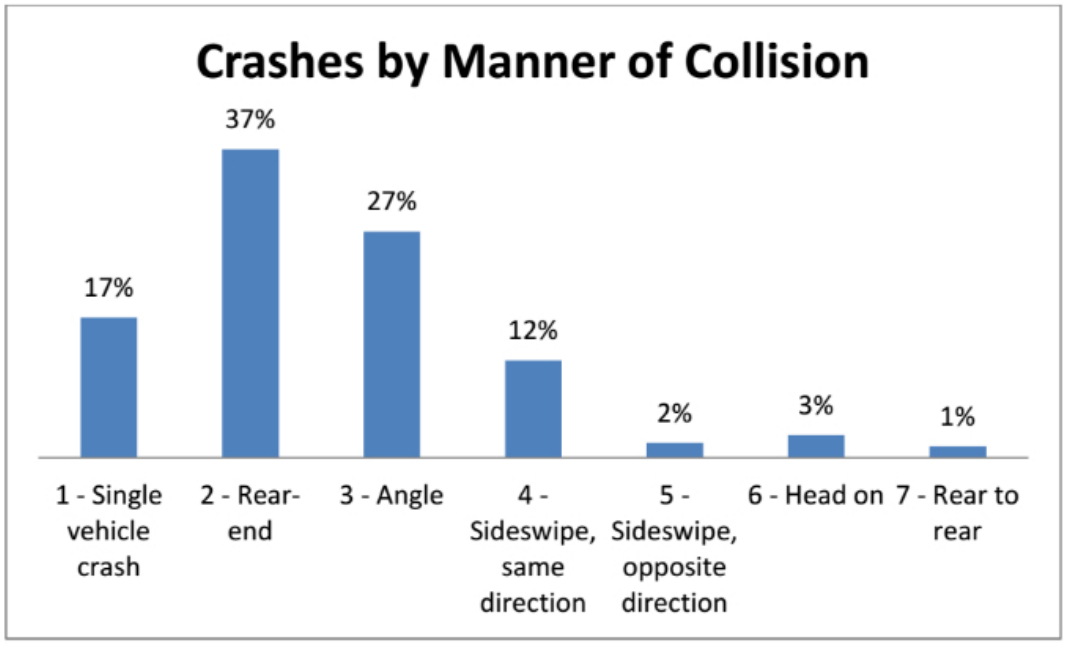
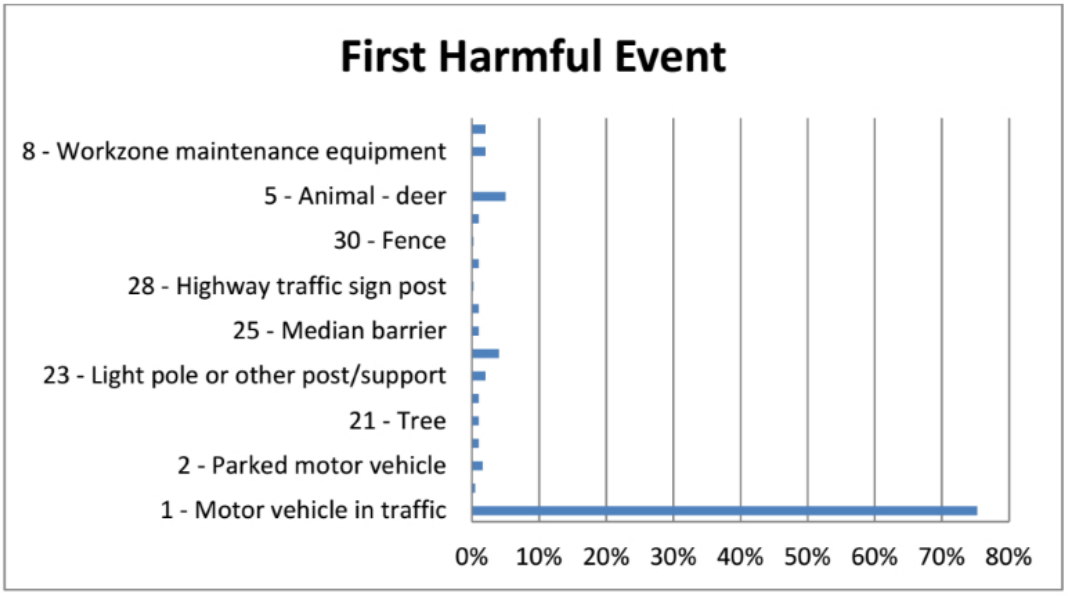


Figure 4. The Percentage of Police Vehicle Crashes by the First Harmful Event that Occurred During the Incident



by a couple of factors: (1) the current analysis involves only police as opposed to all emergency vehicles whose driving patterns are quite different from law enforcement driving; and (2) this specific police agency has a high proportion of patrol cars that are dedicated to state and interstate highways, reducing the possibility of striking objects and parked motor vehicles.

Vehicle Actions Prior to Crash

Observing the police vehicle actions prior to the accident reveals that over 39% were traveling straight ahead and about 34% were slowing or stopped. Other research (Savolainen et al., 2009) has found that police vehicles are more likely than fire or other emergency vehicles to be struck while slowing or stopped. Comparatively, Noh (2011) found that police vehicles going straight ahead accounted for over 60% of police fatalities, whereas only 2.3% involved a vehicle stopped in traffic. Differences between serious and fatal police cruiser crashes may be explained by the types of roadways and environmental conditions of the event. Some of the more common crash indicators for emergency vehicles in general, such as turning or overtaking a vehicle, did not factor into the cruiser crashes in Massachusetts.

Traffic Controls

The presence of traffic control devices such as stop lights or warning signs may provide more context on the accident circumstances. Unlike most agencies that spend a significant amount of patrol time in highly congested communities, this agency has a high percentage of officers responsible for interstate and state highways, though there was not a roadway class variable in the data. This would explain why 317 of the 441 crashes in this sample (72%) reported no traffic control devices present. Crashes at stop signs or other traffic signals cumulatively accounted for only 19% of incidents.

Summary

The purpose of this descriptive analysis was to provide an assessment of some of the

environmental, crash, and officer attributes associated with police vehicle collisions. It used police crash investigation reports derived from a large statewide agency. It first examined some of the common crash environment and road conditions identified in cruiser crashes. Police officers, particularly officers in this department, spend a considerable amount of time in their vehicles on routine patrol. Police vehicle crashes are most likely to occur on dry roads, in daylight conditions, in clear weather, and on weekdays as opposed to weekends. Poor weather and lighting conditions do not appear to be major factors in cruiser crashes. Officers were more likely to crash during a day shift work schedule. Eight out of 10 of the crashes involving police cruisers happened during routine rather than emergency response situations. Approximately 13% of these crashes occurred in a construction work zone. While emergency driver training and work zone safety are important elements of risk reduction, it seems that there are other factors involved.

The next research question explored the types of collisions most frequently occurring in relation to police vehicles. With respect to the attributes of the crash incident, most of the 441 (37%) accidents involved a rear-end impact with the police vehicle, but over a quarter were angle collisions, and less than 17% were single-vehicle crashes. Three quarters of these accidents were motor vehicles in traffic collisions as opposed to parked vehicles or collisions with fixed objects.

Additionally, 72% of the accidents occurred in conditions where no traffic controls were present; however, almost 20% did transpire at stop signs or other traffic controls. This result matches the nature of this statewide police agency, which has primary jurisdiction on interstate highways where no traffic controls are present, yet also patrols state highway and smaller municipal roadways in urban, suburban, and rural areas.

Taken from a set of incidents involving one police agency in Massachusetts, this analysis provides a snapshot of the attributes associated with police vehicle crashes. Because few police agency-specific studies have been conducted, this current examination adds to the policy-relevant knowledge regarding police-involved collisions. Replication of this type of analysis in a large set of agencies would be a timely research agenda given that motor vehicle crashes have surpassed violent criminal attacks as the leading cause of police fatalities.

This paper serves as a starting point for continued research into police vehicle collisions that can guide risk assessment activities within the profession. It can lead police executives to make more informed decisions about driver training, patrol policy, as well as vehicle and equipment selection. This line of research can arguably reduce the reliance on intuition and anecdotal information that has often influenced law enforcement policy. Refining risk assessment on this issue will have significant public policy benefits.

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