

Vehicle Fire Deaths Resulting from Fires Not Caused by Collisions or Overturns: How Do They Differ from Collision Fire Deaths?

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ABSTRACT

The majority of all highway-type vehicle (cars, trucks, vans, buses, camping trailers, etc.) fire deaths result from fires caused by collisions or overturns. However, more than one third of these deaths resulted from fires that did not follow a collision or overturn. Compared to vehicle fire deaths from collisions or overturns, vehicle fire deaths resulting from non-collision, non-overturn fires are less likely to occur on highways or road properties, more likely to originate in the passenger area and more likely to have victims who are under 5 years of age or 65 or older.

INTRODUCTION

During the four-year period of 2002-2005, U.S. fire departments responded to an estimated average of 288,000 fires involving cars, trucks, and other highway-type vehicles per year. These fires caused an average of 470 civilian deaths, 1,440 civilian injuries, and \$1.0 billion in direct property damage per year. The term "civilian" is used to describe all individuals who are not part of the fire department, including police and other emergency personnel. For the remainder of this paper, the term "vehicle fires" will be used to refer to fires involving highway-type vehicles only. These vehicle fires accounted for 18% of all fires and 13% of all fire deaths reported to municipal fire departments during this four-year period.

The statistics in this paper are derived from the detailed information collected in Version 5.0 of the United States Fire Administration's (USFA's) National Fire Incident Reporting System (NFIRS) and the National Fire Protection Association's (NFPA's) annual fire department experience survey. Code 51 for the NFIRS field "Factor Contributing to Ignition" is defined as "Collision, knock down, run over or turnover. Includes automobiles and other vehicles." (1) In this analysis, the term "collision" also includes overturns. The phrase "collision and overturn" is used to remind the reader that

overturns are included. "Non-collision" refers to incidents in which no collision or overturn occurred.

During 2002-2005, collisions or overturns were contributing factors in an estimated annual average of 8,080, or 3%, of the vehicle fires. These fires caused an annual average of 270, or 57%, of the vehicle fire deaths. An average of 200 deaths per year resulted from non-collision vehicle fires. In previous discussions at SAE meetings, questions arose about how and why the non-collision fire deaths occurred. Were these actually coding errors, were they caused by factors completely unrelated to the vehicle, or were there factors that needed industry attention? This paper will focus on the differences in circumstances between the collision and non-collision fire deaths. Examples of non-collision, non-incendiary fatal vehicle fires from 1997-2005 will be provided.

STATISTICAL METHODOLOGY

Fire departments around the country use the NFIRS standardized coding to document their fires. Participation in NFIRS is voluntary at the federal level. Because different states have different reporting requirements ranging from mandatory for all incidents through completely voluntary to not reporting at all, NFIRS alone would yield underestimates of the frequency of fire and associated losses. NFPA's sample-based survey captures summary information about municipal fire department responses, fire casualties, and property damage. Projections based on the results are made by broad incident type on the total number of fires, civilian fire deaths, civilian fire injuries, and direct property damage.

Estimates of specific fire causes and circumstances are derived by dividing the NFPA projections of the total number of fires and losses by the comparable totals in NFIRS and multiplying the NFIRS data by this ratio. In most fields, unknown or missing data are allocated proportionally among incidents with known data. This approach was devised by analysts at the USFA, the U.S.

Consumer Product Safety Commission (CPSC), and the NFPA. (2)

NFIRS 5.0 incorporated many changes in data classification choices and coding structure. The national database includes data collected in older versions of NFIRS. Such data were converted to NFIRS 5.0 before the national file was released. Because some data elements were added, dropped, or modified, the conversion was not exact. This analysis is based on incidents originally collected according to the rules and definitions of NFIRS 5.0. Percentages from NFIRS 5.0 are applied to the NFPA projections for this analysis. Reports from fire departments that provided mutual aid (assistance from outside the local fire department) to these fires were excluded.

DATA INCLUDED - Only fires involving highway-type vehicles were included in this analysis. Vehicles that burned in a structure fire were omitted from the statistical analysis but may be included in the narratives. By definition, fire deaths include only deaths in which the fire contributed to the fatality. Trauma deaths due to vehicle collisions with fire but unrelated to the fire itself are not included in this definition. The directions for recording civilian deaths in the NFIRS 5.0 coding manual state that only fire-related civilian deaths should be entered in the civilian death field. The same section includes a reminder that the emergency medical service (EMS) civilian deaths are not entered in this field. (1)

As mentioned, codes from NFIRS 5.0 codes were used in the data queries. The initial query identified highway-type vehicle fires by querying for fires reported in 2002-2005 with incident type codes 130-139 (all categories of mobile properties or vehicles excluding those used as a structure) and mobile property type codes 10-29 (passenger and freight road vehicles). The specific mobile property types involved in these vehicle fire deaths are shown later in the paper.

The four-year raw totals included 417,106 such vehicle fires and 947 civilian deaths. Code 51 in the field “Factor Contributing to Ignition” captures collisions and overturns. Raw four-year totals for collisions (including overturns) were 4,774 fires and 243 associated deaths. Raw totals for other known contributing factors excluding collisions and overturns were 165,162 fires and 184 civilian deaths. The factor contributing to ignition was coded as either none or undetermined, or not reported at all, in the remaining 247,170 fires and 520 deaths. Up to two factors contributing to ignition may be reported. In 926 fires, undetermined was entered along with a valid factor. Percentages are calculated as the number of mentions divided by the number of incidents. Consequently, totals can exceed 100%.

The 60% of fires and 55% of deaths in which the factor contributing to ignition was coded as none or undetermined, or left completely blank, were allocated proportionally among known data to produce the estimated averages shown in the introduction.

Throughout this analysis, percentages are based on known data.

Subsequent queries were run against 2002-2005 data for the two groups of fires from a) collisions and overturns, and b) all other known factors contributing to ignition, excluding collisions or overturns.

“Unclassified” is a valid choice for most fields in NFIRS. Many sub-categories within a field also include an “unclassified” choice. “Unclassified” should be used when none of the available code choices describe the situation encountered. When used in a sub-category, it may truly mean unclassified, or it may mean that insufficient information was available to make a more precise choice.

FACTORS CONTRIBUTING TO IGNITION IN VEHICLE FIRE DEATHS

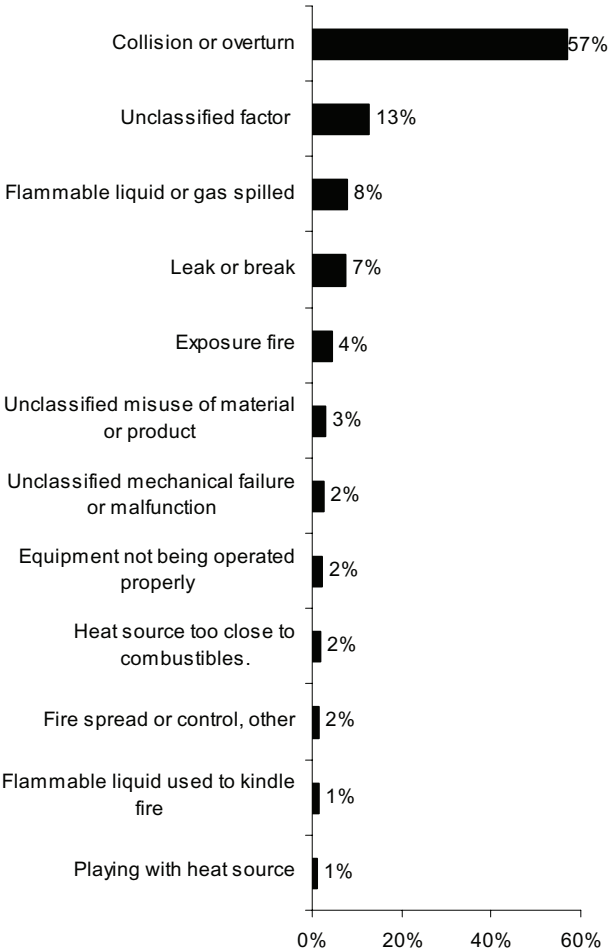


Figure 1. 2002-2005 Vehicle Fire Deaths by Factor Contributing to Ignition

Figure 1 shows the factors contributing to ignition for these vehicle fire deaths. Spilled flammable or combustible liquid or gas was a factor in 8%, leaks or breaks in 7%, and 4% were caused by exposure to other

fires. The rest of the paper will examine differences in other causal factors between the 57% of vehicle fire deaths caused by fires due to collisions or overturns and the vehicle fire deaths due to other factors.

DIFFERENCES IN WHERE AND HOW THE FIRES OCCURRED

Figure 2 shows that almost two-thirds (63%) of the fire deaths resulting from collisions or overturns occurred on highways or divided highways compared to less than half (45%) of the deaths resulting from non-collision fires. One-fifth (21%) of the non-collision vehicle fire deaths occurred on properties that were specifically identified as something other than public roads compared to only 3% of the collision or overturn fire deaths. As the narratives illustrate, some non-collision deaths occurred in vehicles used for shelter, some while cargo was being unloaded, and some when a vehicle was stuck in a parking area. None of the fatal vehicle fire property uses were unknown.

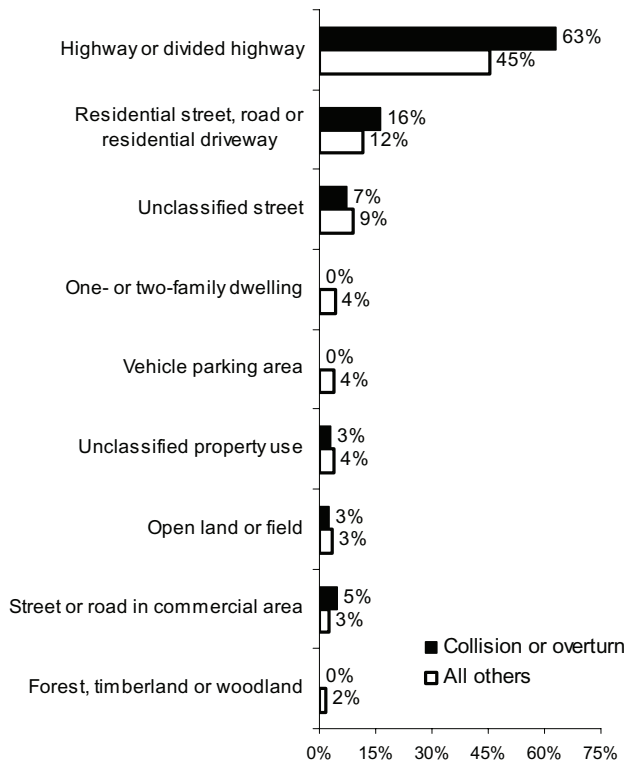


Figure 2. 2002-2005 Vehicle Fire Deaths by Factor Contributing to Ignition and Leading Property Uses

Figure 3 shows that the majority of deaths in both groups resulted from unintentional fires. The entries shown in Figure 3 represent the choices shown in the NFIRS 5.0 field for “cause.”

Twelve percent of the non-collision vehicle fire deaths resulted from fires that were intentionally set compared to only 1% of the deaths from collisions or overturns. Equipment or heat source failures caused 7% of the deaths from fires after collisions or overturns and 10% of the non-collision vehicle fire deaths. These statistics were based on the 87% of non-collision deaths and 82% of collision or overturn deaths with known causes entered in the cause field.

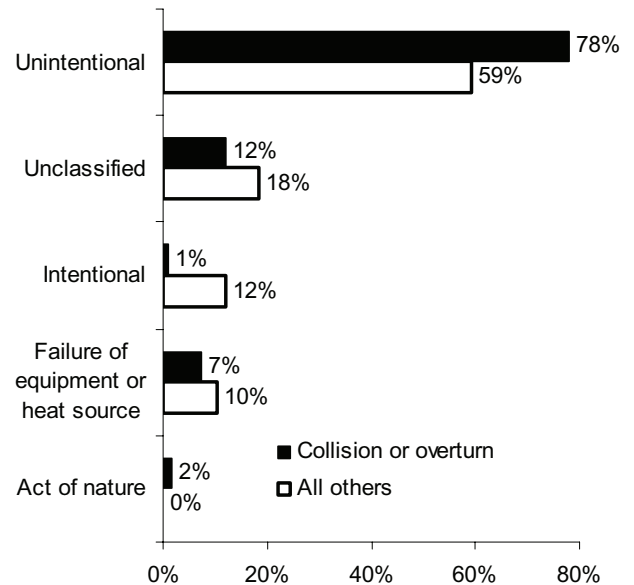


Figure 3. 2002-2005 Vehicle Fire Deaths by Factor Contributing to Ignition and Cause of Fire

Figure 4 shows that 42% of the collision or overturn fire deaths resulted from fires that started in the engine area, running gear, or wheel area. This was the leading area of origin for both collision and non-collision fire deaths. Thirty-two percent of the non-collision fire deaths resulted from fires originating in these areas. (In NFIRS, “engine area, running gear or wheel area” is one choice and cannot be broken down further.)

Larger differences were seen in the frequency of deaths from fires originating in the passenger area. Twenty-six percent of the non-collision deaths resulted from fires starting in this area compared to only 7% of the collision or overturn fire deaths. Twenty-six percent of the collision or overturn deaths resulted from fires that started in the fuel tank or fuel line compared to only 17% of the remainder. These statistics were based on the 87% of non-collision deaths and 85% of collision or overturn deaths with known area of origin.

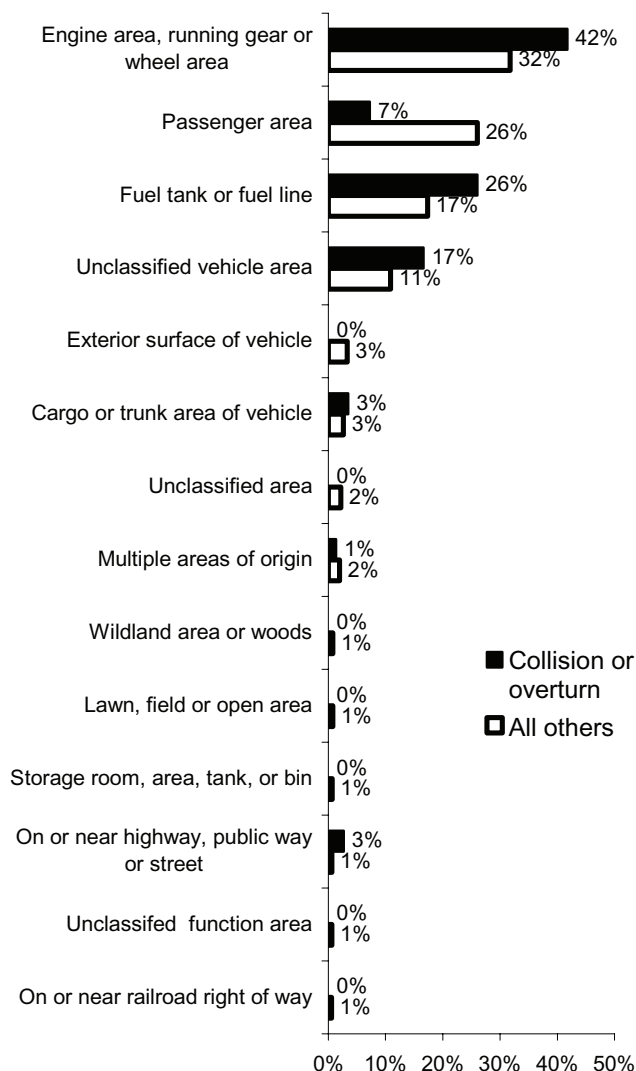


Figure 4. Vehicle Fire Deaths by Factor Contributing to Ignition and Area of Origin

Although many of the heat source statistics are similar, Figure 5 shows a greater variety for deaths from fires that did not originate with collisions or overturns. Leading heat sources in both scenarios were from the operating vehicles themselves. Heat source statistics were based on the 64% of non-collision deaths and 59% of collision or overturn deaths that resulted from fires with known heat sources.

Figure 6 shows that the leading item first ignited in vehicle fires that result in death was some type of flammable or combustible liquid or gas from the engine or burner. This was the item first ignited in more than half (54%) of the collision or overturn deaths and more than one-quarter (29%) of the other vehicle fire deaths. Overall, an estimated annual average of 210, or 79%, of the collision or overturn fire deaths and 140, or 70%, of the remaining deaths resulted from fires in which the item first ignited was some kind of flammable or combustible liquid or gas, piping, or filter.

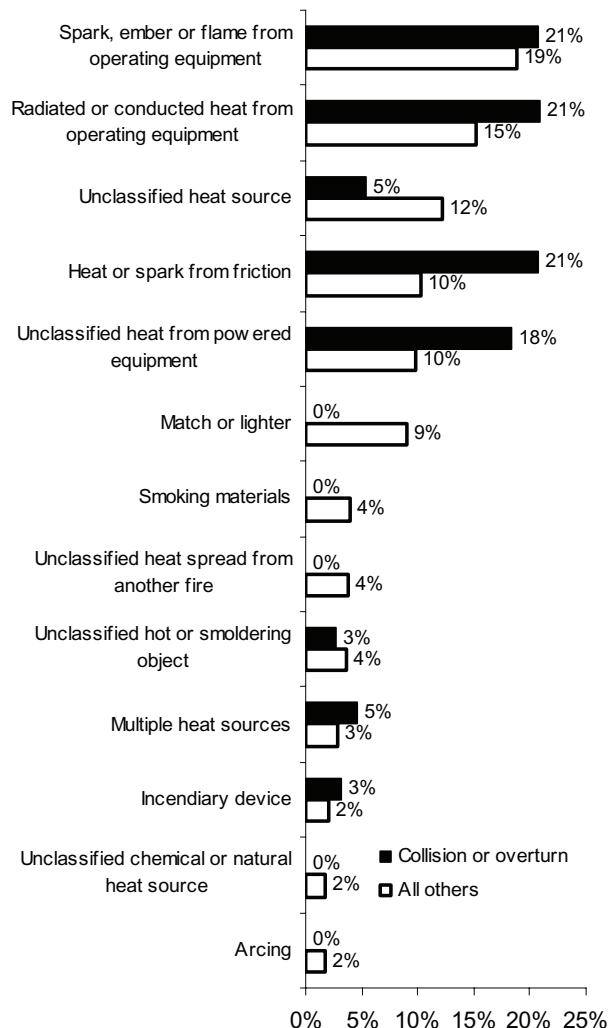


Figure 5. 2002-2005 Vehicle Fire Deaths by Factor Contributing to Ignition and Leading Heat Sources

A few of the items shown require further explanation. The NFIRS coding manual provides some additional detail. (2) When a liquid or gas is described as “in or from,” the “from” refers to “escaping from.” Accelerants are included in the category of uncontained flammable liquid or gas. Some instances of spilled fuel may be recorded here.

The full definition of “Flammable liquid or gas escaping from container or pipe” continues with “Excludes engines, burners, and their fuel systems.”

The full definition of “Flammable liquid or gas in or from final container or pipe” continues with “before engine or burner.” Includes piping between the engine and the burner.”

As with other casual factors, non-collision vehicle fire deaths resulted from fires originating with a wider variety