

Emergency Highway Landings in General Aviation and the Possible Role of Media Reports

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- BACKGROUND:** To examine the causes and factors of airplane landings on highways and the dangers to occupants of vehicles on the ground.
- METHODS:** The U.S. National Transportation Safety Board online database provided 133 accidents involving a highway landing dating from 2000 to 2013. Supplemental information was sought in online media archives, which reported on 53 of these accidents. Collisions with highway-related objects, other options for landing, and witness accounts were added categories extracted from the narrative statements and media reports.
- RESULTS:** Highway landings occur mostly due to mechanical failures, ineffective preflight or in-flight planning, and fuel exhaustion, in addition to a lack of alternate landing options for a pilot of a fixed-wing aircraft. Most of the landings ($N = 108$) lead to minor or no injuries at all. A significant proportion of 7 out of 19 collisions with powerlines resulted in a fatality, as opposed to other types of accidents. Collisions with motor vehicles ($N = 29$) caused minor ($N = 23$) and serious ($N = 2$) injuries to people on the ground. Main online media archives covered less than half of all accidents (39.8%).
- DISCUSSION:** While highway landings are not a recommended landing alternative, mitigation strategies should include a focus on avoiding powerlines and vehicles on the ground. Unfortunately, online media archives are not yet a consistent source of information for general aviation accidents.
- KEYWORDS:** in-flight decision-making, motor vehicles, power lines, news archives.

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Media coverage is considered a concern for aviation organizations,⁷ as negative public perception of air safety is seen to be disproportionately affected.² In this study, it is shown that only a subset of general aviation accidents, as opposed to mishaps with airliners, receives media attention. They may include interviews with witnesses and pilots shortly after the accident as well as images or even video footage of the scene. General aviation accident reports are often limited in scope and additional insight may be gleaned by using media reports. This study examines the availability of media reports for a set of general aviation accidents for which media attention is thought to be particularly likely. After an analysis of the reports from the National Transportation Safety Board (NTSB), the availability and possible usage of media information is discussed.

We selected 133 accidents with general aviation airplanes that made an emergency landing on a highway or public road. The public impact of such accidents transcends aviation and makes media reports particularly likely. When airplane pilots need to make an emergency landing and cannot reach an airfield

or appropriate landing area, they may opt for a highway landing. Similar to landings at wrong airports, such a situation may occur in cases of geographic disorientation or being lost.^{1,4} Fuel exhaustion in combination with the absence of suitable other terrain may explain the choice of a highway landing in the case of airplanes. Here we focus on controlled emergency landings on highways or public roads in the United States.

Unlike controlled landings on (air)fields, highway landings pose an immediate threat to people on the ground. Studies of aviation accidents have included people on the ground as part of the accident analysis, but in the case of small aircraft these people were commonly part of the aircraft operation.^{3,6} An

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understanding of the danger of highway landings may inform a pilot's decision to choose a public road or highway. With an average of almost 10 such landings per year that lead to an aviation accident and with the risks for people on the ground, this study analyzes the main causes and factors to better inform the decision of a highway landing.

We contrast accidents leading to fatal injuries with those that only cause damage to the airplane in order to understand the dangers particular to highway landings both for airplane occupants and people on the ground. This study highlights the roles of ground-based vehicles as well as highway-related obstacles such as signposts, while it explores relationships between the characteristics of the aircraft, the pilot, and the causes and contributing factors determined by the National Transportation Safety Board.

METHODS

General aviation accidents from the period 2000 to 2013 and involving an emergency highway landing were extracted from the NTSB online database.⁸ Search words included highway, freeway, turnpike, interstate, and road. The characteristics of each accident were categorized and compared using Pearson's Chi squared analysis to determine the significance of the relationships between factors. Newspaper and broadcast network online archives were searched for reports on general aviation accidents involving an emergency highway landing using the NTSB reports for keywords on location and date.

A search in the <https://www.nhtsa.gov/research-data> special crash investigations did not lead to a match as only a select number of motor vehicle accidents are in this system. No vehicles involved with our selection of aircraft accidents included a fatality of a vehicle occupant and only a few had serious or minor injury, often a requirement for inclusion in this database. In addition, different reporting systems for the Department of Motor Vehicles (DMV) in each state made any systematic comparison of motor vehicle accident reports and aircraft accident reports problematic. For instance, the state of Oregon requires an accident report filed with the DMV only if there is substantial damage of the vehicle and/or serious injury involved.⁵

RESULTS

In the period 2000 to 2013, a total of 133 accidents were reported by the NTSB in which the pilot intended to make an emergency landing on a public road or highway. In less than half of the accidents ($N = 53$) was a media report found for the accident.

Online media sources affiliated with newspapers ($N = 43$), such as the Chicago Tribune, New York Times, and the Concord Monitor, published 51 stories on 34 of the accidents. In our dataset, single newspapers rarely reported on more than one highway landing between 2000 and 2013, with four published accident reports for one newspaper as a maximum. Online sources affiliated with news broadcasts such as FOX, NBC,

ABC, and their affiliates contributed 35 stories on 24 accidents, of which 19 were accidents different from those reported in the newspapers. A single news network, excluding its local affiliates, did not report on more than three accidents for the studied time period. Both online archives of broadcasting networks and newspapers reported on a total of 53 different accidents. Online sources affiliated with newspapers and online sources affiliated with television broadcasts overlapped in covering the accidents. Half (50%) of the fatal accidents were reported in the news media archives and almost half (48.2%) of the accidents involving a collision with a vehicle on the ground were reported as well. For these fatal accidents, newspaper and television sources reported 15 stories between them for 14 total accidents. For accidents involving vehicles, news sources reported 23 news stories about 14 out of 29 total accidents.

Not all media sources are archived online to allow for historical searches. General aviation accidents appear only occasionally in the news so that those news sources with accessible archives do not provide reports for all accidents. The reports that were accessed did not contradict those from the NTSB in any significant way. Instead, they included, for instance, the public reaction after the accident had occurred. They did not provide generalizable data for accident analysis.

The main causes for attempting a highway landing were related to mechanical failures ($N = 45$), fuel exhaustion ($N = 25$), or preflight or in-flight planning ($N = 16$). There were 22 accidents where the primary cause of the accident remained undetermined.

There were only fixed-wing aircraft in the dataset, of which four aircraft were homebuilt. In total, 17 aircraft were destroyed, while all other aircraft in this dataset suffered substantial damage. Fatalities were reported for 14 accidents with a total of 21 people killed. Out of 17 accidents with a destroyed aircraft, 9 also included a fatality, which is significantly more than for substantially damaged airplanes ($\chi^2 = 37.2, P < 0.01$). The largest part of the data set, 108 accidents, reported minor or no injuries for the occupants, while 11 featured serious injuries. There were 7 accidents that included injuries to people on the ground, with 2 having serious injuries and 22 having minor injuries. Two of these seven accidents reported fatalities in the airplane and two others noted serious injuries to occupants of the airplane.

There were 4 fatal accidents that occurred at night and 10 during the daytime, which suggests a significantly higher proportion of fatal accidents at night ($\chi^2 = 3.779, P = 0.0519$). In total, 112 accidents occurred during daylight conditions; 1 was at dawn and 3 were at dusk, while 17 happened at night.

A significant proportion of 7 out of 19 collisions with powerlines resulted in a fatality, as opposed to other types of accidents ($\chi^2 = 16.3, P < 0.01$). In 29 cases, the airplane collided with a road sign, which resulted in serious injuries in only 1 accident. Only collisions with vehicles ($N = 29$) included any injuries with people on the ground. Four occupants of the aircraft died and three had serious injuries in six separate collisions with a vehicle. Yet, out of a total of 29 collisions with vehicles, 25 individuals on the ground received either minor or serious ($N = 2$) injuries. In one case, 7 vehicles were hit during

1 accident with 12 people injured on the ground. In another collision, three vehicles were impacted, fatally injuring the pilot and causing one minor and one serious injury on the ground. One nighttime accident was reported where a plane hit a vehicle. In 11 cases, the NTSB report specifically mentions a wing colliding with a vehicle. In two cases, it was mentioned that the plane also took off from the highway. In one case, this occurred because the authorities did not find a tow large enough, while in another case, a vehicle was hit during takeoff at a speed of 70 mph. Also mentioned in online news media sources were 14 accidents that included collisions with vehicles, which is not significantly higher ($P > 0.05$) than the reporting of other highway landing accidents.

Strategies mentioned to evade collisions included flying with traffic at the same speed and landing between cars; in other cases, the plane swerved off the road to avoid oncoming traffic. It is not consistently mentioned in the NTSB or in media reports whether planes landed with or against traffic, but several times it is mentioned that the airplane and car traffic came from opposite directions.

In 30 cases, the pilot reported that an attempt was made to land at a nearby airport, but that either mechanical problems or limited visibility prevented the pilot from doing so. Few other alternative landing spaces were available with those reported, including other highways ($N = 1$), desert terrain, a field or a cropduster airstrip ($N = 4$), and rooftops and city suburbs ($N = 2$), suggesting that in most cases no appropriate alternatives were available.

The average age of the pilots was 52, with the youngest pilot at 20 yr of age and the oldest pilot at 90 yr of age. They had an average number of flight hours of 3664, ranging from 74 to 33,268, with 3 cases not reported. There were 14 pilots with less than 200 h and 17 pilots with 10,000 or more hours. Less experienced pilots in the dataset (< 1500 h) were not associated significantly with fatal accidents ($P > 0.05$) and pilots without a commercial private license or an airline transport license were also not significantly associated with more fatalities. Of all pilots, 20 had an airline transport license, 36 a commercial license, 74 a private pilot license, 2 a student license, and one pilot was reported with no license. Pilots with an airline transport or commercial license were not significantly associated with fatal accidents ($P > 0.05$). Only 3 female pilots were recorded, with 7 not specified and 123 male pilots. No women were involved in fatal accidents.

DISCUSSION

Highway landings are attempted when the pilot has no other option to land, most often because of a mechanical failure or fuel exhaustion. Only pilots of fixed-wing aircraft are reported to choose highways, as other types of aircraft, such as hot-air balloons and helicopters, commonly do not require elongated paved surfaces for an emergency landing. Injuries on the ground occur only when airplanes collide with vehicles. Fatalities, which were only found among occupants of the aircraft,

were significantly more common when airplanes hit wires or transmission lines during the landing or when landings were attempted at night. While highway landings are not a recommended landing alternative based on these findings, mitigation strategies should include a focus on avoiding powerlines and vehicles on the ground.

It is shown that accidents with vehicles constitute the main danger for injuries to people on the ground, while collisions with road signs rarely lead to injuries even to aircraft occupants. Although it seems that landing in the direction of traffic is to be preferred, data on this is not sufficient and pilots do not necessarily have a choice.

Media reports are not a consistent source of information for general aviation accidents since they do not always report such accidents and since not all media sources are archived and accessible online. Even in the case of highway landings and, more specifically, those that involved collisions with cars, general aviation accidents were featured in publicly accessible online news media in less than half of the cases. It highlights a disparity between the particularly extensive media attention for accidents and incidents involving airliners and the limited attention paid to general aviation, where cumulatively more accidents and more fatalities occur on a yearly basis. Media reports may become more consistently available in future years when local, regional, and national news sources have a stronger online presence. Still, general aviation accident analysis commonly includes multiple years, in which case the availability of archived news material may remain problematic.

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