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航空安全調査レポート
AVIATION SAFETY RESEARCH REPORT

RR-2026-001

高速道路・一般道路への航空機緊急着陸に関する安全性実態調査

— 世界の過去事故・搭乗者生存性・地上第三者リスク・二次災害からの検証 —

PEOPLE
SAFETY
EVIDENCE
ANALYSIS
BETTER SKIES

Safety Assessment of Aircraft Emergency Landings on Highways and Public Roads

— An Analysis of Historical Accidents, Occupant Survivability, Third-Party Ground Risk, and Secondary Consequences —

事実から学び
より安全な空の未来を
Learning from Facts
for a Safer Future



Aviation Intelligence Lab
航空インテリジェンスラボ

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1. Executive Summary

[FACTS]

On August 20, 2026, a Beechcraft King Air 200 made an emergency landing on Foothills Boulevard in Prince George, British Columbia, Canada, and collided with four vehicles on the road. The two crew members and six passengers on board were uninjured, while one person on the ground was killed. The Transportation Safety Board of Canada (TSB Canada) investigation into the cause is ongoing, and this report does not analyze the cause of this accident, the pilot's decisions, or the appropriateness of the choice of landing site in any way. This accident is treated solely as the starting point for the question it raises: that even when every aircraft occupant survives, road users can be killed. [1]

For this study, the Lab collected 60 cases of emergency landings and forced landings on roads that occurred worldwide (in the United States, Canada, the United Kingdom, Australia, New Zealand, Japan, and elsewhere) between 1996 and 2026, drawing on official accident investigation materials from the NTSB, TSB Canada, ATSB, TAIC, JTSB, and others. Of these, 30 cases in which a controlled touchdown and landing sequence was completed on the road (Category A) were compiled as the primary statistical sample. [2]

[STATISTICAL FINDINGS]

- Touchdown success rate on the road (within the sample of intentional road attempts): 30/40 = 75.0%
- Aircraft occupant survival rate (Category A, occupants confirmed): 72/72 = 100% (0 fatalities)
- Occupant serious-injury rate: 6/72 = 8.3%; rate of any injury: 17/72 = 23.6%
- Vehicle collision rate during the landing sequence: 17/28 = 60.7% (likely subject to strong upward bias from the search methodology)
- Third-party ground casualty rate: 5/27 = 18.5%, of which fatal accidents: 1/27 = 3.7%
- Fire after touchdown or collision: at least 3/30 = 10.0%

[LAB ANALYSIS]

What these figures show is that a road can become a very good forced-landing surface for aircraft occupants, provided the conditions are right, if evaluated on that basis alone. At the same time, roads simultaneously contain obstacles not normally present on runways — vehicles, wires, signs, streetlights, medians — and ground third parties who have no connection whatsoever to the aircraft's emergency. The figure of a 100% occupant survival rate alone cannot be generalized into the claim that "forced landings on roads are safe."

This report tested two hypotheses the Lab had previously formulated (Source 2: national/regional differences in road environments; Source 3: separating Aircraft Occupant Risk from Third-Party Ground Risk) against this factual survey data. The concern raised in Source 3 — that occupant survival alone cannot be used to evaluate the safety of a road forced landing — was clearly supported by the observed third-party casualty rate of 18.5%. The concern raised in Source 2 — that road environments differ by country and region — does not conflict with the direction of today's data, but because only two domestic Japanese cases exist, a quantitative comparison between Japan and North America/Australia is explicitly treated as "indeterminate."

The final conclusion can be summarized in a single sentence: roads "can, under the right conditions, be a very good landing site for aircraft occupants, but the category of 'road' itself cannot be regarded as a safe landing site, and when overall safety including third parties is considered, it is not necessarily the best option."

2. Introduction

[FACTS]

On August 20, 2026, in Prince George, British Columbia, Canada, a Beechcraft King Air 200 (registration C-GEDV) experienced an engine power anomaly and made an emergency landing, touching down on Foothills Boulevard, a road in a built-up area. The two crew members and six passengers on board were all uninjured. However, the aircraft collided with four vehicles traveling on the road, and one person in a vehicle was killed. A TSB Canada investigation is underway. [1]

This report is not an analysis of the cause of the Prince George accident itself. The pilot survived, and the Lab makes no independent speculation, analysis, or assessment as to why the engine anomaly occurred, why the aircraft could not reach an airport, why the road was chosen, or whether that decision was appropriate. These are matters that should be clarified in the future through TSB Canada's official investigation.

[LAB ANALYSIS]
What this report takes from this accident is a single question: the fact that "even when every aircraft occupant survives, members of the public using the road can be killed" occurred again in reality, in 2026. Taking this question as its starting point, this report examines road forced-landing accidents worldwide over the past 30 years and reconsiders, using statistical data and case histories, whether emergency landings on highways and public roads are truly safe.

3. Purpose of This Study

[LAB ANALYSIS]
This study is not simply asking, "What is the survival rate for road forced landings?" Its central question is: "Is choosing a highway, arterial road, or public road as an emergency landing site safe, not only in terms of Aircraft Occupant Risk, but also Third-Party Ground Risk?"

This question is broken down into the following seven sequential questions for examination.

- Question 1: Looking at past accidents worldwide, what proportion of emergency landings on roads result in a successful touchdown?
- Question 2: What is the survival rate for aircraft occupants?
- Question 3: Even if the touchdown success rate and occupant survival rate are high, can this be generalized to mean "forced landings on roads are safe"?
- Question 4: If all aircraft occupants survive but road users are killed or injured, is it appropriate to evaluate this as a "successful forced landing"?
- Question 5: To what extent do secondary accidents — vehicle collisions, collisions with following vehicles, fires — occur after touchdown on a road?
- Question 6: Can statistics obtained from roads in the United States, Canada, Australia, and elsewhere be applied directly to Japan's road environment?
- Question 7: Should "touchdown success rate on the road" and "safety of the emergency landing as a whole" be evaluated as separate metrics?

4. Methodology and Data Limitations

[FACTS]
The study period covers, in principle, January 1996 through August 31, 2026. The scope was fixed-wing aircraft, with a particular focus on the United States, Canada, the United Kingdom, Australia, New Zealand, the EU, and Japan. For the United States, the NTSB's CAROL database and official final and factual reports were the primary

sources. [5] A small number of especially instructive cases outside this period, such as a 1994 Canadian DC-3 accident, were used only as reference examples. [46]

On the definition of a road forced landing: the FAA's Airplane Flying Handbook defines a forced landing as a situation in which an aircraft, unable to continue flight, must land immediately, on or off an airport, and distinguishes it from a precautionary landing. [6] To avoid overlap in the user-specified A–D classification, this report applies the following operational definitions.

Category	Operational Definition	Statistical Treatment
A	The road was intentionally chosen and a controlled touchdown/landing roll was completed on the road (still counted as A even if it subsequently struck a vehicle, sign, etc.)	Primary statistics
B	The road was intended, but before a stable touchdown was achieved the aircraft struck wires, trees, vehicles, etc., or the pilot diverted to another site to avoid traffic	Tabulated separately as a failure to reach the road
C	The aircraft crashed onto a road incidentally, e.g., due to loss of control	Reference only
D	The aircraft crashed beside or near a road with no evidence the road was chosen as the landing surface	Reference only

Keeping this classification separate matters for preserving the meaning of the statistics. For example, in a 2014 Louisiana accident involving a Cessna U206E, the pilot chose a road but, on seeing an approaching vehicle, diverted to land short of it and struck wires the pilot reported not having seen. Counting this as a "successful road landing" would overstate the safety of roads, so this study classifies it as B. [7] Likewise, a 2023 Cessna 310R in Western Australia was aiming for Derby Highway when its right wing struck trees during the final turn and it came to rest at the road's edge; this too is classified as B. [8]

[UNKNOWNS / LIMITATIONS OF THE STUDY]

This sample is not a random sample. NTSB and similar data primarily cover accidents and selected incidents, and reporting obligations and the scope of investigation differ by country. Moreover, because this search used keywords such as "forced landing highway" and "interstate vehicle," accidents involving collisions with vehicles or obstacles are more likely to be found — a methodological bias. Consequently, a figure such as the "60.7% vehicle collision rate" discussed below cannot be reinterpreted as a general probability that "60% of aircraft that land on roads hit a car." Events in which an aircraft landed on a road undamaged and uninjured, and which were never recorded or reported as an accident, are likely not systematically captured by this study.

Regarding aircraft MTOW, wingspan, and approach speed, values differ even within the same type depending on sub-model, modifications, actual weight, flap setting, and so on. Where a figure could not be confirmed from an official accident report or type data, it is treated as "unknown" rather than estimated.

5. Overview of Road Forced-Landing Accidents Worldwide

[FACTS]

Looking at the breakdown of the 30 Category A cases used in the statistics, the United States accounts for the majority, with cases also drawn from Canada, Australia, New Zealand, and Japan. By aircraft type, light single-engine piston aircraft account for the large majority at 25 cases; one twin-engine piston aircraft (Cessna 402A), one single-engine turboprop (Cessna 208B), and one twin-engine turboprop (Cessna 441) are also included. In two cases the powerplant/type could not be sufficiently confirmed from the source material, and there were zero jet aircraft cases.

As representative examples: in Australia, a Cessna 441 landed on the Great Northern Highway with zero injuries

and zero aircraft damage. [3] Likewise, a Cessna 208B landed uninjured on a mine access road while carrying 13 people [30], and a Cirrus SR22 landed on Mitchell Highway with 2 occupants uninjured and only minor additional damage. [35] In the United States, meanwhile, a Cessna 402A struck two school buses after touching down in Van Nuys in 1999, injuring 13 people on the ground [4]; a Piper collided with two vehicles on I-680 in Concord in 2004, seriously injuring one vehicle occupant [18]; and a Lancair IV-P struck a parked vehicle on I-15 in Fallbrook in 2016, killing one person inside it. [29] Domestic Japanese cases include a 2008 accident in which a Cessna TU206F approaching Yao Airport made a forced landing on a city street and was destroyed (the passenger survived with minor injuries) [36], and an accident on Miyako Island in which the left wing struck a tree beside the road, seriously injuring the passenger. [44]

Major Road Forced-Landing Cases (Category A, Included in Statistics)

Date	Country/Location	Aircraft	Road	Main Outcome	Interaction With Road/Third Parties	Source
1996-02-18	NZ, North Shore	Piper PA-32R-300	Public road	5 survived; 1 serious, 4 minor injuries	Forced landing beside the road	[10]
1996-08-20	US, Puyallup	Glasair I-FT	City street	Pilot uninjured; 1 serious injury on ground	Struck 2 vehicles during landing roll	[11]
1996-12-20	US, Lexington	Cessna T210M	Highway	5 survived; 1 minor injury on board	Struck 2 vehicles after touchdown; no injury to vehicle occupants	[12]
1999-06-23	US, Van Nuys	Cessna 402A	City street	Pilot uninjured; 13 minor injuries on ground	Wingtip fuel tank struck 2 school buses after touchdown	[4]
1999-07-24	US, Emeryville	Cessna 172E	I-80	2 uninjured	Hard flare to avoid a car; struck road sign and fence	[13]
1999-11-19	US, Phoenix	Cessna 150K	City street	Pilot uninjured	Struck sign post and embankment during rollout	[14]
2000-05-13	US, Casa Grande	Piper PA-32R	Highway	2 uninjured	Forced landing on highway; aircraft destroyed	[15]
2001-11-10	US, Manvel	Zenith 801	Highway 6	Pilot uninjured	Delayed touchdown for traffic, hard landing near power lines, nose gear collapsed	[16]
2003-06-10	US, Fallon	Piper PA-24-250	Highway	Pilot uninjured	Struck a vehicle and a road sign	[17]
2003-07-26	Canada, Québec	Cessna 172M	Autoroute de la Capitale	Pilot seriously injured	Struck a streetlight, then nosed into the ground	[9]
2004-04-13	US, Concord	Piper PA-28RT	I-680	2 on board uninjured; 1 serious injury on ground	Struck 2 vehicles; fuel tank damaged; fire	[18]
2004-07-10	US, Castaic	Ercoupe 415-C	Interstate	Pilot uninjured	Nosed over after striking a vehicle	[19]
2004-10-02	US, Sedona	WACO YMF	4-lane city street	3 uninjured	Right wing struck a vehicle during landing roll	[20]
2005-04-13	US, Phoenix	Cessna T210M	I-17	Pilot seriously injured	Chose the freeway median; struck a semi-truck	[21]
2005-06-	US, Idaho	Rockwell S-2R	Highway	Pilot and truck driver	Overtook a large	[22]

Date	Country/Location	Aircraft	Road	Main Outcome	Interaction With Road/Third Parties	Source
24				uninjured	truck during landing roll; right wing made contact	
2005-10-26	US, Baker	Cessna 210L	Public road	Initial road landing uneventful	Later refueled and attempted takeoff from the road; struck emergency vehicles and trees	[23]
2008-08-08	Canada, Manitoba	Cessna 207-series	Highway 8	4 on board uninjured; 1 minor injury on ground	Two oncoming vehicles took evasive action; one entered a ditch, injuring its driver	[24]
2011-04-16	US, New Orleans	Piper PA-22/20	Road	Pilot minor injury	Struck a vehicle; driver uninjured	[26]
2011-10-17	US, Watertown	Piper PA-28R-200	Road beside an airport	2 on board and vehicle driver uninjured	Struck a vehicle and a pole	[27]
2015-07-07	Canada, BC	Beechcraft A36	Highway 97	Pilot seriously injured	Struck a truck and a utility pole; fire	[28]
2016-04-02	US, Fallbrook	Lancair IV-P	I-15	2 on board seriously injured; 1 fatality on ground	Struck a parked vehicle on the shoulder	[29]
2016-11-16	Australia, WA	Cessna 208B	Mine access road	All 13 on board uninjured	Recognized 3 vehicles on the road; no contact	[30]
2018-03-02	Australia, WA	Cessna 441	Great Northern Hwy	Zero injuries, zero aircraft damage	No vehicle collision	[3]
2019-07-08	US, Illinois	VariEze	Interstate	Pilot minor injury	Collided with a vehicle	[31]
2021-08-24	US, Del Mar	Piper PA-32-300	I-5	2 on board uninjured; no ground injuries	Struck multiple vehicles after touchdown	[32]
2022-01-31	US, Palm Coast	Cessna 195	I-95	2 on board, minor injuries	Right wing struck a semi-trailer at touchdown; flipped off the road	[33]
2024-10-27	US, Nevada	Badlands Vaquero	Interstate frontage road	Pilot minor injury	Fire continued after landing and egress; most of the aircraft burned	[34]
2025-01-24	Australia, NSW	Cirrus SR22	Mitchell Hwy	2 uninjured, minor additional damage	Successful landing despite reduced visibility from smoke/oil; no vehicle contact	[35]
2008-08-19	Japan, Yao	Cessna TU206F	City street	2 survived; passenger minor injury	Forced landing on a road while approaching Yao Airport; aircraft destroyed	[36]

(In addition, the following are recorded as A-category reference cases not included in the statistics: a 1996 U.S. gear-up road landing [37]; a 1997 wire-strike case in Oregon; a 2006 emergency landing of a Piper PA-34 on Germany's Autobahn A52; a Beagle Auster D5 case in the United Kingdom; and a forced landing on a road under construction in Kanazawa, Japan. Sources for cases directly discussed in this report are listed in the reference list at the end. Full data — including Categories B–D — for all 60 cases, in Excel/CSV form, is retained separately by the Lab as supporting data to Source 1.)

Category B cases, in which the aircraft never reached the road itself, cannot be ignored either. In a 2012 U.S. case, the pilot recognized multiple vehicles just short of a highway and diverted to an adjacent field, where the aircraft flipped over [38]; in the 2014 Louisiana case, the pilot avoided an approaching vehicle by landing short of the road and struck wires that had not been seen. [7] In Canada, a PA-31-350 diverted to an adjacent forest to land after preparing for a highway landing, owing to road traffic. [39] These are accidents in which "an obstacle on the road (a vehicle) caused the road landing itself to be abandoned," and they show that, in assessing the risk of choosing a road, one cannot look only at the Category A cases that successfully touched down.

6. Touchdown Success Rate and Aircraft Occupant Survival Rate

[STATISTICAL FINDINGS]

Metric	Value Within This Sample	Interpretive Note
Touchdown success rate on the road	30/40 = 75.0%	Value within the sample of intentional road attempts (30 A cases + 10 sufficiently classifiable B cases). Not a population success rate
Aircraft occupant survival rate	72/72 = 100%	Among Category A cases, the 29 cases (72 occupants) for which occupant counts could be confirmed
Occupant fatality rate	0/72 = 0%	Category A only. Because Category B cases that failed before reaching the road are excluded, the selection effect is strong
Occupant serious-injury rate	6/72 = 8.3%	Count of occupants explicitly identified as seriously injured
Occupant any-injury rate	17/72 = 23.6%	Serious and minor injuries combined
No casualties	14/27 = 51.9%	Category A cases for which both occupant and ground injury status could be fully confirmed

[LAB ANALYSIS]

The first point to confirm is that a "100% survival rate" is not the same as a "100% uninjured rate." None of the 72 occupants in Category A died, but 6 (8.3%) sustained serious injuries and, including minor injuries, 17 (23.6%) sustained some form of injury. The reality behind "all occupants survived" spans a range from surviving uninjured to surviving with serious injuries.

The single most important point in this result is that "zero occupant fatalities in Category A" and "roads are safe" are not synonymous. Category A by definition covers only events in which a landing sequence was completed on the road; Category B cases in which the aircraft struck wires, trees, vehicles, and so on before reaching the road are tabulated separately. The 100% survival rate for Category A alone is therefore evaluating "conditional survivability after a successful road landing," not "a 100% chance of survival if you choose a road." The pre-arrival accidents such as the 2014 Louisiana Cessna U206E and the 2023 Derby Cessna 310R illustrate this distinction concretely.

On this point, the concern raised in Source 2 (the Lab's prior analysis #1) — that "the outcome of an emergency landing differs greatly from flight to flight" and that "what past statistics yield is a tendency under certain conditions, not a guarantee of survivability for any individual flight" — is consistent with this study's factual data. The very structure in which pre-arrival failures exist separately, behind a seemingly favorable 100% occupant survival figure, is itself a warning against simple generalization.

7. Collisions With Vehicles

[STATISTICAL FINDINGS]

The vehicle collision rate during the landing sequence was 17 of 28 assessable Category A cases, or 60.7%.

However, this figure is likely subject to a strong upward bias. Because keywords such as "highway," "vehicle," and "road" were used when searching accident databases, accidents involving vehicle collisions are more likely to be found and recorded, while events in which an aircraft landed on a road undamaged and uninjured and was not treated as an "accident" are less likely to be captured. Indeed, the Cessna 441 recorded by the ATSB suffered no aircraft damage after landing on the road, but was subject to detailed investigation — and thus included in this sample — because it was a serious incident involving fuel exhaustion during a passenger-carrying flight.

[FACTS]

The following representative cases were confirmed in which a vehicle collision compounded the damage.

- Puyallup (1996): a Glasair I-FT achieved touchdown itself on a city street, but struck two vehicles during the landing roll. The pilot was uninjured, but one vehicle occupant was seriously injured. [11]
- Van Nuys (1999): after a twin-engine Cessna 402A touched down on a city street, its wingtip main fuel tank struck the front of two oncoming school buses. The pilot was uninjured, but 13 people including the bus drivers and children sustained minor injuries. The wingtip fuel tank ruptured. [4]
- Concord (2004): a Piper PA-28RT attempting to land on the eight-lane I-680 had its left wing strike a vehicle, rupturing a fuel tank, and its right wing strike a second vehicle. The two occupants on board were uninjured, but one vehicle occupant was seriously injured, and the aircraft was destroyed in the post-collision fire. [18]
- Highway 8, Canada (2008): there was no direct collision between the aircraft and a vehicle, but two oncoming vehicles that saw a Cessna 207-series aircraft approaching swerved off the road, and one entered a ditch, injuring its driver. [24]
- Fallbrook (2016): a Lancair IV-P made a forced landing on I-15 and struck a parked vehicle on the shoulder. The pilot and passenger survived with serious injuries, but one occupant of the parked vehicle was killed. [29]

[LAB ANALYSIS]

The Van Nuys accident is a textbook example showing that the safety of a road forced landing cannot be assessed merely by asking whether the fuselage fits within the road's width. The possibility that wingtips or wingspan will interfere with traffic is overlooked if only fuselage width is considered. And as the Highway 8 case shows, third-party ground risk arises not only when an aircraft directly strikes a vehicle, but also from the emergency evasive actions of ordinary vehicles themselves.

8. Secondary Accidents Following Touchdown

[STATISTICAL FINDINGS]

- Secondary events broadly defined (further collisions with vehicles/signs, rollover, fire, evasive accidents by road users, etc.): 23/29 = 79.3% (subject to extremely strong upward bias, as this is an accident sample)
- Fire after touchdown or collision: at least 3/30 = 10.0% (Concord, BC A36, Nevada Vaquero)
- Fire during the emergency landing sequence (including in-flight fire): at least 4/30 = 13.3% (adding the 2025 Cirrus in-flight fire to the above)

[FACTS]

Risk does not end the moment the tires touch the road. The Cessna 402A struck a school bus after touchdown [4]; the WACO YMF's right wing made contact with a vehicle during the landing roll [20]; the Rockwell S-2R caught up to and made contact with a large truck during the landing roll [22]; and the Piper PA-32-300 struck multiple vehicles after touching down on I-5. [32] As for fire, at Concord a wing tank was damaged in a vehicle collision and a fire developed [18]; the 2015 British Columbia Beechcraft A36 caught fire after striking a truck and a utility pole [28]; and the 2024 Nevada Badlands Vaquero continued burning even after the pilot landed on a frontage road and egressed, destroying most of the airframe. [34]

On the other hand, some secondary events do not involve the aircraft itself colliding with anything. The injury to the driver on Highway 8 resulted from a vehicle's evasive maneuver [24], and in the 2015 Canadian PA-31-350 case, road traffic itself caused the pilot to abandon the highway as a landing site and divert to a forest. [39]

[LAB ANALYSIS]

When assessing "secondary accidents from road forced landings" from a safety-engineering perspective, therefore, one must consider not only post-touchdown collisions by the aircraft itself, but also the event boundary extending to the sudden intrusion into traffic flow, evasive vehicles, fuel spills and fire, damage to road infrastructure, and rescue operations and road closures. This is consistent with both the perspective raised in Source 2 regarding "secondary accidents after touchdown," and the concern raised in Source 3 that "even if an aircraft successfully touches down on a road and all occupants survive, if it collides with an ordinary vehicle in the process, this should be evaluated cautiously from a safety-engineering standpoint."

9. Third-Party Casualty Risk on the Ground

[STATISTICAL FINDINGS]

- Among the 27 Category A cases for which ground outcomes could be sufficiently confirmed, accidents in which a third party was injured or killed: 5 cases = 18.5%
- Of which fatal accidents: 1 case = 3.7% (Fallbrook, 2016; a value within this sample, not a general fatality rate)

For reference, if the result of the (still under investigation) Prince George accident alone is added to the 30 Category A cases as a sensitivity analysis, ground fatal accidents become 2/31 = 6.5%. However, this is not "the ground fatality rate for road forced landings" but merely a sensitivity analysis on an arbitrarily assembled sample, and should not be treated as a general probability.

[LAB ANALYSIS]

Third parties are subject to a fundamentally different risk structure than aircraft occupants. A third party has not chosen the emergency landing and has no connection to the aircraft's emergency state, yet is drawn into the accident system the instant the road is used as a landing surface. At Van Nuys, 13 people were injured [4]; at Concord, one vehicle occupant was seriously injured [18]; at Puyallup, one vehicle occupant was seriously injured [11]; and at Fallbrook, one vehicle occupant was killed. [29] As at Highway 8, there are also cases in which a driver who never made direct contact with the aircraft was injured while taking evasive action. [24] From this perspective, the "traffic volume" of a road is not simply the density of landing obstacles, but represents the number of non-occupants exposed to risk.

This analysis strongly supports the concern raised in Source 3 (the Lab's prior analysis #2) — that Aircraft Occupant Risk and Third-Party Ground Risk should be evaluated separately. The fact that, behind a 100% occupant survival rate, third-party ground casualties occur at a non-trivial rate concretely underscores the danger of treating the two under a single metric.

10. Aircraft Size, Performance, and Road Landings

[STATISTICAL FINDINGS]

By aircraft type, the 30 core cases comprise 25 light single-engine piston aircraft; one twin-engine piston aircraft (Cessna 402A); one single-engine turboprop (Cessna 208B); one twin-engine turboprop (Cessna 441); two cases in which the powerplant or type could not be sufficiently confirmed from the source material; and zero jet aircraft. This composition itself matters: it is not possible to statistically assert that "ground fatality rates rise as aircraft get

larger," extending even to King Air-class or jet aircraft.

[LAB ANALYSIS]

If anything, the small number of larger-aircraft cases point in both directions. The Cessna 441, after both engines failed, descended safely onto the Great Northern Highway with neither injuries nor aircraft damage. [3] The Cessna 208B also landed safely on an unpaved road while carrying 13 people. [30] On the other hand, the twin-engine Cessna 402A struck two school buses with its wingtip fuel tanks, injuring 13 people on the ground [4], and the King Air 200 involved in the still-under-investigation Prince George accident collided with four vehicles and caused a ground fatality. [1] The observed accident count therefore cannot demonstrate a monotonic relationship in which "larger aircraft = higher accident rate."

At the same time, physical accident potential cannot ignore size and speed. Kinetic energy is given by $E = 1/2\ mv^2$: for the same collision conditions, an increase in mass increases collision energy proportionally, while an increase in speed increases it with the square. Furthermore, contact with road users often begins at the wingtip rather than the fuselage; the Cessna 402A, WACO YMF, Rockwell S-2R, and Cessna 195 accidents all in fact involved wing/wingtip contact with a vehicle as part of the accident sequence. [4][20][22][33] Treating a Cessna 172-class aircraft and a King Air-class aircraft together as "small aircraft landing on the same road" is therefore not sound from a safety-engineering standpoint.

This analysis is consistent with the concern raised in Source 2 that "differences in aircraft type, weight, wingspan, speed, and so on should be considered." However, this sample does not contain enough data to statistically assert that "ground risk rises as the aircraft gets larger." This point is appropriately treated as falling within the "partially supported" category.

11. Hazards Specific to Roads

Vehicles, Oncoming Traffic, and Traffic Volume

This is the road-specific factor that appeared most frequently. Effects were confirmed not only in the form of direct collisions with vehicles, but also delayed touchdowns, diversion to another landing surface, and ordinary vehicles swerving into ditches. The Zenith 801 on Highway 6 delayed its touchdown because of traffic and approached wires further along as a result. [16] The 2014 Cessna U206E saw an approaching vehicle, abandoned the road, and struck wires short of it. [7] The 2015 Canadian PA-31-350 likewise abandoned a highway because of traffic. [39]

Wires and Utility Poles

The FAA’s Airplane Flying Handbook cautions pilots crossing a road on approach to keep in mind that "power lines and telephone lines parallel most highways and even many rural unpaved roads." [6] In actual accidents, in one U.S. case the aircraft struck power lines and knocked down two poles during final approach [40], and the pilot in the 2014 Louisiana case reported not having seen the wires that were struck. [7] On Highway 117 in Canada, a cable over a road made contact with a helicopter making an emergency landing, which crashed onto the road, rolled over, and caught fire, killing two people (this is not included in the fixed-wing statistics, but serves as a reference case illustrating the danger of linear obstacles crossing above roads). [41]

Streetlights, Traffic Signals, and Signs

A Cessna 172M in Québec struck a streetlight while making a forced landing on the Autoroute de la Capitale. [9] A Cessna 172E struck a road sign with its right wing on I-80, and a Cessna 150K struck a sign post on a city

street. [13][14] In a 2025 NTSB case, the aircraft struck three vehicles and a metal traffic-signal pole during the landing roll on a service road. [42]

Medians, Road Width, and Wingtip Clearance

The I-680 accident shows that even on an eight-lane road, the left and right wings can each strike a separate vehicle. [18] In the I-17 accident, the pilot tried to use the freeway's grass median and struck a semi-truck. [21] In other words, "more lanes" does not mean "enough width for an aircraft." Where vehicles are present, the instantaneously available clearance shrinks substantially.

Roadside Trees

In one U.S. case, the pilot chose an open unpaved road, but during the landing roll the road passed through a section flanked by trees, and both wings struck them. [43] In the Miyako Island case in Japan as well, the left wing struck a tree beside the road during a forced landing, and the aircraft came down to the ground, seriously injuring the passenger. [44]

Human Factors: "A Road Looks Like a Runway"

[UNKNOWN]

No quantitative research — for example, on the probability that a road is systematically mistaken for a runway from the air — could be found in the FAA, TSB, ATSB, and other materials examined for this study. A figure of this kind cannot therefore be produced.

[LAB ANALYSIS]

However, a recurring pattern emerges from the accident record: the road surface itself is readily recognized from a distance, while the small obstacles that determine its actual usability — wires, signs, streetlights, moving vehicles — tend to be recognized late. This is a Human Factors inference drawn from this study. The Cessna U206E pilot was able to recognize and choose the road, yet did not see the wires leading to it. [7] The Cessna 172E pilot was able to choose I-80, but, concerned about a collision with a car, pulled the nose up at the last moment and struck a road sign. [13] By contrast, the Cessna 208B pilot recognized three vehicles on the road at low altitude and was able to flash the landing light at around 100 ft to warn them. [30] The visibility of the road surface itself, and the visibility of whether the road constitutes a safe, obstacle-free zone for the aircraft, are two separate questions.

12. Regional and National Differences in Road Environments

[LAB ANALYSIS (VERIFYING SOURCE 2)]

Source 2 put forward the hypothesis that in the United States, Canada, Australia, and elsewhere, long straight roads are common, along with stretches of relatively low population density and traffic volume, whereas in Japan's urban areas and arterial roads, traffic density is high, following distances between vehicles are short, and obstacles such as road signs, traffic signals, streetlights, pedestrian overpasses, wires, and medians are numerous — and that it is therefore inappropriate to apply overseas success rates directly to Japan's road environment.

The factual data collected for this study does not contain data quantitatively comparing the road environments of Japan, the U.S., Canada, and Australia in a way that could directly test this hypothesis. The great majority of the 30-case sample are cases from the United States, Canada, and Australia; domestic Japanese cases are limited to Yao (2008) and Miyako Island — two cases. In the Yao accident, the aircraft was destroyed in a forced landing on a city street; in the Miyako Island accident, the passenger was seriously injured when the wing struck a tree beside the road. In both cases, obstacles around the road — structures in a built-up area, and a roadside tree — were

directly implicated in the accident's outcome, and this does not conflict, in direction, with Source 2's concern that "Japan's road environment has many obstacles." However, because the base is only two cases, it cannot be statistically concluded from this that "Japan's road environment is less favorable for road forced landings than North America or Australia."

On the other hand, the fact that the undamaged, uninjured successes of the Cessna 441 and Cessna 208B both occurred on low-traffic Australian roads (the Great Northern Highway and a mine access road) is consistent with the direction of Source 2's hypothesis that "vehicle spacing is wide, and space for an aircraft to enter may be available." Likewise, the fact that accidents on high-traffic U.S. arterial roads such as I-680 (eight lanes) and I-17 (freeway median) involved vehicle collisions points the same way.

The assessment from this study is therefore as follows. As a qualitative concern — that one should look not at whether a road exists, but at whether space exists on that road for an aircraft to safely enter, touch down, and stop — Source 2's hypothesis does not conflict with today's data and is partially supported. However, as to the quantitative proposition that "Japan's road environment is less favorable for road forced landings than North America's or Australia's," this cannot be determined from the sample confirmed in this study. This is a limitation of the data stemming from the extremely small number of domestic Japanese cases.

13. Aircraft Occupant Risk and Third-Party Ground Risk

[FACTS / STATISTICAL FINDINGS]

No statistical material was found sufficient to rank roads, farmland, grassland, vacant lots, riverbeds, and open water against a single fatality rate to determine which is "safest," because selection bias is extremely strong. Altitude, remaining airspeed, aircraft type, landing gear, terrain, vegetation, wind, traffic, fire, and the candidate sites available to the pilot all affect the outcome simultaneously, and the probability of being investigated and reported itself differs between an undamaged forced landing and a serious accident.

Landing Surface	Potential Occupant-Side Advantages	Main Occupant Risks	Third-Party Risks
Highway	Long, hard, level surface; may allow rolling and braking on wheels	Vehicles, wires, signs, poles, medians, wingtip interference	Can be high; directly exposes drivers and pedestrians
Public road	May be easy to find nearby	Narrow width, streetlights, wires, buildings, curves	Risk to residential areas, vehicles, pedestrians
Farmland/grassland	Often fewer third parties	Soft ground, ditches, furrows, crops, fences, overturning	Generally can be lower than road traffic, but farm workers etc. may be present
Vacant lot	Possible avoidance of traffic	Area and ground condition unknown	Depends on surroundings
Riverbed	May be open and long	Rocks, embankments, trees, waterways, ground condition	Traffic risk usually low
Open water	Avoids ground vehicles and buildings	Impact on ditching, capsizing, egress, drowning, cold water	Relatively low apart from vessels etc.

The FAA explains that survivability in a forced landing on water also depends on how well-practiced the occupants are in emergency procedures and on the effectiveness of water-survival equipment. [45] Absolute rankings such as "water is safer than roads" or "farmland is always safer" are therefore also not supported. Soft terrain, too, is not necessarily dangerous in every respect: in the 1994 out-of-period Canadian DC-3 accident, dense vegetation and trees are recorded as having progressively absorbed forward energy, preserving the cabin structure, which is cited as an explanation for survivability (2 survived, with 1 serious and 1 minor injury). [46] Conversely, there are also cases where soft ground causes the nose gear to dig in and the aircraft to flip over. [47]

Aircraft Occupant Risk

Looking at occupants alone, there are genuinely rational conditions under which a road is advantageous. In this sample, none of the 72 confirmed occupants in Category A died. In particular, the Cessna 441's highway landing — a twin-engine turboprop carrying roughly ten people — resulted in zero injuries and zero damage [3], consistent with the idea that a road can be effective for occupant protection if the aircraft can maintain attitude and decelerate on a long, relatively level surface without major destruction of the cabin. However, the picture worsens once Category B cases — failures during the final approach to the road — are included. [8] "Survivability after touchdown on a road" and "the probability of choosing a road and safely reaching that point" should therefore be evaluated separately.

Third-Party Ground Risk

Third parties are subject to a risk structure different from that of aircraft occupants. A third party has not chosen the accident and has no connection to the aircraft's emergency state, yet is suddenly drawn into the accident system once the road is used as a landing surface. From this perspective, a road's "traffic volume" is not merely the density of landing obstacles, but represents the number of non-occupants exposed to risk itself.

14. Third-Party Protection Under ICAO and Aviation Law

[LAB ANALYSIS (VERIFYING SOURCE 3)]

Source 3 pointed out that while the survival of aircraft occupants is naturally the pilot-in-command's foremost concern in an emergency, from the standpoint of aviation safety, the interior of the aircraft is not the only thing that must be protected. Article 75 of Japan's Civil Aeronautics Act provides that, when an aircraft faces imminent danger, the pilot-in-command must take all necessary measures not only to rescue passengers, but also to "prevent danger to persons or property on the ground or on the water." A comparable basic principle exists in ICAO's international framework for aircraft operations: that an aircraft must not be operated in a manner that endangers the life or property of others.

This legal principle is itself widely known as a matter of Japanese statutory law and general international aviation principles, and the Deep Research sample the Lab assembled for Source 1 (consisting mainly of accident investigation reports and NTSB/TSB/ATSB and similar databases) does not include an article-by-article examination of ICAO provisions or Article 75 of the Civil Aeronautics Act. What Source 1 directly corroborates for this study is, strictly, the factual reality that "survival of onboard occupants" and "death or injury of third parties on the ground" are observed as independent variables from accident to accident. That is: at Fallbrook (2016), the two occupants on board survived with serious injuries, while one person in a parked vehicle on the shoulder was killed. At Prince George (under investigation), likewise, the eight people on board were uninjured, while one person was killed in a collision with a vehicle on the ground.

This reality is, as a result, consistent with the legal and safety-engineering concern presented in Source 3, that "aircraft occupant survival does not equal a safe emergency landing." The framework of Article 75 of the Civil Aeronautics Act, which obliges the pilot-in-command to both rescue passengers and prevent danger to third parties on the ground in parallel, points in the same direction as the factual tendency shown by today's data, that "occupant survival rate and third-party ground harm are separate metrics." However, it should be noted explicitly that this legal framing itself has not been verified at the primary-source level by the Deep Research sample in Source 1; it is an explanation based on the Lab's general legal knowledge. Using this provision in the context of assigning pilot responsibility for the Canadian King Air accident is not the purpose of this report. The purpose of this chapter is to explain the principle that, even in an emergency, the scope of aviation-safety evaluation is not

limited to the interior of the aircraft.

15. Is "Touchdown Success" the Same as "A Safe Emergency Landing"?

[FACTS]

The ATSB explicitly describes the Cessna 441 and Cirrus SR22 cases as a "successful forced landing." Neither involved any injuries, and the Cessna 441 case involved no aircraft damage at all. [3][35] In this usage, "successful" is a reasonable description centered on the aircraft and its occupants.

[LAB ANALYSIS]

However, once the boundary of safety-engineering evaluation is widened from "the aircraft alone" to "the aircraft plus the road traffic system," the definition of "success" must also change. This report holds that the following two-axis evaluation is appropriate.

- Landing success: the airframe reaches and touches down in a controlled state on the intended road surface, and the occupants survive
- System-level safe outcome: in addition to landing success, there are no third-party deaths or serious injuries, no major vehicle collision, and no major secondary disaster such as fire or fuel spill

Applying this distinction, the 2016 Fallbrook accident can be described as one in which "the aircraft occupants survived and a forced landing on the road was achieved," but it cannot be evaluated as "a safe emergency landing at the system level," because it involved a third-party fatality. [29] Likewise, evaluating only the outcomes confirmed to date for the Prince George accident, the Aircraft Occupant Outcome — eight people uninjured on board — is favorable, but because it comes with a Third-Party Outcome of one fatality on the ground, it cannot be described as "no harm resulting from the emergency landing overall." This is a purely outcome-based evaluation, separate from any judgment about the cause of the accident or the appropriateness of the decisions made. [1]

This two-axis evaluation framework concretely substantiates, using actual accident data, the concern raised by both Source 2 and Source 3 that "the touchdown success rate alone should not be the measure" and that "occupant survival alone is insufficient to fully evaluate the safety of a road forced landing."

16. Aviation Intelligence Lab Analysis — Testing the Hypotheses

The hypotheses the Lab put forward in advance in Source 2 and Source 3 are tested here against the Deep Research findings in Source 1. The Lab’s hypotheses are not treated as unconditionally correct, and where the data does not support them, this is stated explicitly.

Hypothesis 1: Under the right conditions, a road forced landing can lead to a high survival rate for aircraft occupants

[Supported] A 100% survival rate among the 72 occupants in the 30 Category A cases clearly supports this hypothesis. The Cessna 441, Cessna 208B, and Cirrus SR22 cases each concretely demonstrate the effectiveness of a road when conditions are favorable.

Hypothesis 2: However, a high success rate in the past does not guarantee success on any individual future flight

[Supported] The existence of Category B cases that failed before reaching the road (the 2014 Louisiana Cessna U206E, the 2023 Cessna 310R, and others), together with the fact that conditions — altitude, speed, aircraft

weight, wingspan, nature of the failure, weather, traffic volume, and so on — differ substantially from accident to accident, itself corroborates this hypothesis. The 100% survival rate for Category A alone is a conditional figure that applies "after" a successful road landing, not a figure guaranteeing success in advance.

Hypothesis 3: The safety of a road forced landing varies with country, region, road, and traffic environment

[Partially supported] The contrast between undamaged, successful cases on low-traffic Australian roads and vehicle-collision cases on high-traffic U.S. arterial roads is consistent with the direction of this hypothesis. However, because domestic Japanese cases number only two, no quantitative conclusion about Japan's road environment can be drawn.

Hypothesis 4: The aircraft occupant survival rate alone is insufficient to fully evaluate the safety of a road forced landing

[Supported] Alongside a 100% occupant survival rate, a third-party ground casualty rate of 18.5% (of which 3.7% were fatal accidents) was observed. The very fact that these two metrics exist simultaneously, yet independently, demonstrates the limits of evaluation on a single metric.

Hypothesis 5: Third-party ground risk and secondary accidents must be included in the evaluation

[Supported] Multiple cases, including Van Nuys, Concord, and Fallbrook, record injuries from post-touchdown vehicle collisions, fires, and evasive actions; an evaluation that excludes these does not reflect the reality of road forced landings.

Hypothesis 6: "Touchdown success on the road" and "success of the emergency landing as a whole" should be distinguished

[Supported] Both the Fallbrook and Prince George cases most clearly demonstrate the need for this distinction. The term "successful forced landing," as used by the ATSB, must also be interpreted with the understanding that it is an aircraft- and occupant-centered evaluation.

Hypothesis 7: The safety of road forced landings may be better evaluated as "conditional safety" than as a single "safety rate"

[Supported] Multiple metrics — a 75.0% touchdown success rate, a 100% occupant survival rate, a 60.7% vehicle collision rate, and an 18.5% third-party casualty rate — are each calculated under different populations and conditions, and cannot be integrated into a single "safety rate." It is appropriate to understand the safety of road forced landings as a conditional object of evaluation that varies with factors such as aircraft type, road environment, traffic volume, and obstacles.

17. Limitations of the Study Data

[UNKNOWNS / LIMITATIONS]

- Accident-database inclusion criteria and reporting systems differ by country; data such as the NTSB's is centered mainly on accidents and selected incidents.
- More severe accidents are more likely to be captured in reporting and investigation records, a reporting bias that likely makes minor cases — landings on roads with no damage or injury — harder to capture.

- Because search terms such as "forced landing highway" and "interstate vehicle" were used, there is a methodological bias toward finding accidents involving collisions with vehicles or obstacles. In particular, the 60.7% vehicle collision rate is likely strongly affected by this upward bias.
- The sample size is limited to 30 cases (core statistics), and the composition of aircraft types is heavily skewed toward light single-engine piston aircraft (25/30). There are zero jet aircraft cases.
- Domestic Japanese cases number only two, which is insufficient to draw quantitative conclusions about Japan's road environment.
- No common-population data, corrected for selection bias to a degree that would allow a rigorous fatality-rate comparison between roads and other landing sites (farmland, water, etc.), could be confirmed in this study.
- There are inherent limits to extrapolating from past accident tendencies to any individual future accident.

18. Conclusion — Are Emergency Landings on Roads Really Safe?

The answer to the final question — "are highways and public roads really a safe place for an emergency landing?" — is as follows.

> ***Under the right conditions, a road can be a very good landing site for aircraft occupants, but the category of "road" itself cannot be regarded as a safe landing site, and it is not necessarily the best option when overall safety, including third parties, is considered.***

This conclusion rests on four points. First, cases genuinely exist in which a road functioned as an excellent forced-landing surface. The Cessna 441, Cessna 208B, and Cirrus SR22 all made controlled landings on roads and caused no occupant injuries. [3][30][35]

Second, hazards specific to roads differ qualitatively from those of a runway. Cars move; wires are thin and can be recognized late; streetlights, signs, and signal poles exist beside the road and overhead; and the width of a road is not an obstacle-free width relative to wingspan. The FAA explicitly warns of power and telephone lines near roads, and actual accidents show repeated collisions with wires that were not seen, road signs, streetlights, utility poles, and traffic-signal poles. [6]

Third, third-party risk has, in reality, developed into fatal accidents. At Fallbrook in 2016, the two people on board survived while one person inside a parked vehicle was killed. [29] At Prince George in 2026 too, regardless of the analysis of cause or judgment, the currently confirmed outcome is "eight people on board uninjured, one fatality on the ground." [1]

Fourth, road traffic is not merely "an obstacle after touchdown," but a dynamic hazard that destabilizes the very choice of landing site. Cases have been confirmed in which a pilot, on seeing a car on a highway, abandoned the road and landed on different terrain, flipping over; struck wires that had not been seen; and diverted to a forest.

For aviation safety, therefore, rather than ranking landing sites merely by the label "road" versus "field," it is more appropriate to evaluate available length, effective width, traffic volume and direction, overhead wires, poles and signs, road infrastructure, surrounding population, approach direction, escape routes after stopping, and third-party exposure in case of fire, together as a single risk set.

The most cautious and practical statement supported by this study is the following.

> ***A road is not "a substitute runway." Depending on conditions it can share some of a runway's advantages, but it is an emergency landing surface burdened with traffic and road infrastructure that a runway would not normally have.***

19. Implications for Aviation Safety

If safety is defined solely in terms of Aircraft Occupant Risk, the track record of roads looks quite favorable. But once Third-Party Ground Risk is brought within the safety boundary, the hypothesis that "paved surfaces are the safest because they are paved" is not supported. There are certainly cases in which a road is the best option. But "being a road" in itself is not a guarantee of safety; it is the road environment at that particular moment — including its traffic and obstacles — that determines safety.

As to the question raised at the outset of this report — whether the mere fact that "the aircraft made it down onto the road safely" is enough to call that emergency landing "safe" or "successful" — the conclusion this study reaches is that road forced landings need to be reconsidered by expanding the safety evaluation from an aircraft-centered view to a comprehensive one that includes aircraft occupants, third parties on the ground, and secondary accidents. "Touchdown success on the road," "aircraft occupant survival," "harm to third parties on the ground," and "secondary accidents" should each be evaluated as separate metrics, and overall safety judged on that basis.

To reiterate: this report is not an analysis of the cause of the 2026 Prince George King Air accident itself. That accident awaits the results of TSB Canada's official investigation, and this report does not aim to evaluate the cause of the accident or the pilot's decisions while that investigation is ongoing.

20. References and Sources

This report used, as its primary source of facts and data, Source 1 (Aviation Intelligence Lab Deep Research: A Factual Study of the Safety and Secondary Consequences of Aircraft Emergency Landings on Highways and Public Roads), which is based on primary and official accident-investigation materials including the NTSB, TSB Canada, ATSB, TAIC, JTSB, and FAA. Bracketed numbers [n] in the body text correspond to the numbers in the reference list below. Among all 60 cases, source URLs for reference cases not included in the statistics, and for some cases not directly cited in this text, are recorded in the detailed data (Excel/CSV) of Source 1.

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[3] ATSB | AO-2018-019 investigation report (Cessna 441, Great Northern Highway) https://www.atsb.gov.au/investigations/ao-2018-019

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[14] NTSB | Accident report (Phoenix, Cessna 150K, 1999) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/47792/pdf

[15] NTSB | Accident report (Casa Grande, Piper PA-32R, 2000) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/49191/pdf

[16] NTSB | Accident report (Manvel, Zenith 801, Highway 6, 2001) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/53770/pdf

[17] NTSB | Accident report (Fallon, Piper PA-24-250, 2003) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/57191/pdf

[18] NTSB | Accident report (Concord, Piper PA-28RT, I-680, 2004) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/59075/pdf

[19] NTSB | Accident report (Castaic, Ercoupe 415-C, 2004) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/59623/pdf

[20] NTSB | Accident report (Sedona, WACO YMF, 2004) https://data.ntsb.gov/carol-repgen/api/Aviation/ReportMain/GenerateNewestReport/60277/pdf

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In preparing this report, no URL, report title, accident number, statistic, or citation was created that is not found in Source 1. Figures and facts that could not be confirmed are explicitly marked as "unknown" in the body text.