



## ***Transportation Incidents***

### **Key Points**

- This section covers all major transportation modes: aviation, surface (road, rail, and pipeline) and marine. It covers incidents where a vehicle accident is the primary impact.
- Some of Seattle's deadliest disasters were transportation accidents, but all occurred over 50 years ago when transportation systems were much less reliable. They are:
  - The sinking of the Dix off of Alki in 1906 that killed 42 people.
  - The 1943 crash of a B-29 bomber that killed 32 people.
  - Another bomber crash in 1951 that killed 11 people.
- While there have been huge gains in the safety and reliability of transportation systems, these accidents remind us that transportation incidents can be very dangerous. The 1998 shooting of a Metro driver that caused his bus to plunge off the Aurora Bridge was another reminder. Only the driver and the shooter died. It could have been much worse. In 2008 a similar accident was narrowly avoided when a tour bus slid down a snowy Capitol Hill street, crashed through a barrier over I-5 and came to rest with its front third overhanging the freeway.
- Seattle's transportation systems have become busier, more congested, more tightly interdependent and lacking in substantial reserve capacity. Disruptions in one part of the system can produce large consequences far from the site of the disruption and can spread from one transport mode to another.
- **Aviation:** The direct hazard for Seattle is a large aircraft crashing into a crowded part of the city. The odds of such a crash are low. Since 2001, 74 commercial aircraft have crashed during flight in the U.S. despite more than 10 million flights annually<sup>1</sup>. Crashes are most likely to occur near flight corridors within two miles of an airport. Approaches and departures for SeaTac and Boeing Field, the country's busiest general aviation airport, take aircraft over the city.
- **Marine:** Seattle has a large port and ferry system. While incidents in the waters surrounding Seattle could be severe, incidents that directly impact Seattle directly are the greatest hazard. There have been no disastrous marine incidents in the past fifty years, but there have been a number of large ship fires and collisions.
- **Rail:** Seattle has an active rail system that until recently mostly transported freight but now included growing commuter rail and light service. The main hazards are derailments, collisions and tunnel incidents. Seattle has several miles of tracks that are exposed to landslides. A freight train was knocked into Puget Sound in 1997.
- **Motor vehicles:** Several recent bus accidents nationally have resulted in tragic loss of life and focused attention on highway accidents. Seattle has experienced two bus incidents and several tanker truck fires.



- **Pipeline:** A spur of the Olympic/BP pipeline runs from Harbor Island to Renton, mostly along the City Light power transmission right-of-way. This pipeline carries mostly gasoline. Part of the same pipeline exploded in Bellingham killing three children.
- Transportation incidents can cause infrastructure failure. Bridges are especially vulnerable. Barges and ships have collided with several Seattle bridges. The First Avenue South Bridge had to be rebuilt after a strike. Fires can also damage bridges. In 1975, the Alaskan Way Viaduct was damaged in a fuel tanker explosion.

## Context

Transportation systems have been the source of some of the modern era's biggest disasters. The September 11<sup>th</sup> attacks exploited the air transportation system to inflict catastrophic damage on New York and the Washington D.C area. Air, marine and surface systems have all produced high casualty count disasters.

Much of the vulnerability to transportation accidents is built into a community's transportation infrastructure. For complete details on this infrastructure see the Community Profile.

An accident doesn't have to happen in Seattle for it to have a major impact on the community. Anytime a vessel originating here is involved in an accident, many Seattle residents are involved.

### ***Air Transport***

75% of all accidents involve general aviation (private aircraft) and 25% involve commuter, charter and scheduled airlines. The majority of accidents occur immediately after take-off and before landing. The FAA acknowledges this danger and requires airports to create special emergency plans that detail how they would respond to a crash within five miles from their boundaries. Nationally, despite the hundreds of thousands of planes that fly over urban areas, the number of crashes that have killed or injured non-passengers is very small.

### ***Marine Transport***

Maritime accidents include many different mishaps, such as grounding, capsizing, sinking, collision, fire, explosion and chemical spill. Worldwide, some of the worst maritime accidents have involved the sinking of passenger ferries. Many maritime accidents have a hazardous materials linkage. Great environmental damage has occurred as a result of oil spills.

Seattle is surrounded and bisected by water. Much of it is a working waterfront. Seattle is a major maritime center. The Port of Seattle is one of the largest in the U.S. It handles container, bulk cargo (grain) and cruise ship operations. Additionally, Seattle has three heavily used passenger ferry routes, the Ballard Locks that connect Lake Washington to Puget Sound and a large commercial fishing fleet.

### ***Surface Transport***

Accidents on surface streets, highways and railways can cause multiple fatalities, large hazardous materials releases and damage to infrastructure. Nationally, large accidents have involved passenger buses, fuel tankers and rail derailments. In some areas, bad driving conditions have caused car crashes involving hundreds of vehicles.

## History

Seattle's most deadly disasters, aside from the 1919 influenza pandemic, were transportation accidents. The first was the 1906 sinking of a passenger ship off Alki that killed 42 people and the second was the crash of a B-29 bomber during World War II that killed 32 people. While safety standards have vastly improved since both of



these events making the circumstances under which these accidents occurred different from today, they illustrate the potential for high loss of life.

Some transportation accidents could fall under multiple categories. For example, the explosion of a fuel tanker on a bridge could fall under this section, hazardous materials, fires or infrastructure. The focus here is on accidents involving passenger vehicles.

### ***Aviation Overview***

Since the beginning of 2003, the National Transportation Safety Board has recorded 13 accidents or incidents in the Seattle area, none of them fatal. Of these, six involved commercial aircraft. None of the accident reports indicated that aircraft were in danger of striking populated areas. While the Seattle area has not experienced a major crash in decades, there is a span of eight years mid-century when several deadly crashes occurred inside the city limits.

### ***Maritime Overview***

As indicated in the Community Profile, Seattle has an especially large maritime passenger sector. The vast majority of passengers ride the Washington State Ferry, which has a very strong passenger safety record. The ferry system has never had a major accident. Despite this record, there have been 11 serious incidents since 1980. Five were minor collisions or near misses with other vessels. Four were dock ramming and two were groundings.

Seattle has become a major cruise ship terminal. There has never been a major accident involving them in Puget Sound. There have been some cases of Norwalk virus on Seattle based cruise ships.

Seattle is home to a major fishing fleet working the Bering Sea. Fishing is a dangerous business and there have been a number of sinkings, most recently of the Alaska Ranger when five people died.

### ***Rail Overview***

Seattle is a rail terminus for Burlington Northern Santa Fe (BNSF) and Union Pacific. Historically, use of the rail network for passenger service has been limited, but it is increasing. Seattle has an Amtrak station that is seeing increased ridership. Sounder Commuter rail began in 2003. Neither service has had a major accident. As noted in the chapter on landslides, the tracks north of Seattle have been closed due to landslides. In 1997, a freight train was knocked into Puget Sound by a landslide.

### ***Motor Vehicle Overview***

Roadway accidents are a serious cumulative hazard in the Seattle area, but few individual incidents rise to the level of city-wide emergency, however tragic they are for the people involved. Nationally, several recent bus accidents have raised awareness that motor vehicle accidents can cause major incidents. Several bus related incidents have occurred in Seattle. Accidents involving 10s or even 100s of vehicles have occurred in multiple locations, including Western Washington.

### ***Major Accidents***

**Nov. 18, 1906. Maritime.** The passenger ferry Dix sinks two miles off Alki. 42 fatalities<sup>ii</sup>.

**Feb. 18, 1943. Aviation.** A B-29 Superfortress came down short of Boeing Field and struck the Frye slaughterhouse at 2101 Airport Way South. Eleven crew members, two firefighters and nineteen people on the ground were killed<sup>iii</sup>. The crash caused a large fire, cut major cross-town power lines and released enough ammonia from the slaughterhouse to kill one fireman.



**Jul. 19, 1949. Aviation.** A C-46 cargo plane crashed shortly after take-off, cutting power lines over wide areas and striking two buildings in Georgetown. After coming to rest, it caught fire and exploded, setting six houses on fire. Flying debris damaged three other houses. A total of eleven homes were damaged or destroyed. Five people on the ground and two passengers were killed. Thirty-three people were injured.

**Aug. 13, 1951. Aviation.** A B-50 bomber crashed into Sick's Brewing and Malting at 3100 Airport Way and then bounced into the Lester Apartments, destroying one third of the building. The crash killed six people in the plane and five on the ground<sup>iv</sup>. The location was about one mile north of King County International Airport, just north of where the West Seattle Freeway and I-5 join. The site is now occupied by I-5.

**August, 1996. Motor Vehicle.** A 42-vehicle accident that caused one fatality and 23 injuries closed I-5 southbound for four hours<sup>v</sup>.

**Nov. 27, 1998. Motor Vehicle.** A passenger on a Metro bus shot and killed the driver as the bus was heading south on the Aurora Bridge. The bus crashed off the bridge, struck an apartment building and then the ground 50 feet below. The shooter, driver and one passenger died, plus 32 passengers were injured.

**Jan. 31, 2000. Aviation.** Alaska Airlines Flight 261 crashes into the Pacific in route from Puerto Vallarta, Mexico to Seattle. All 83 passengers and five crewmembers died. Although the crash did not occur in Seattle, it had a big impact because Alaska Airlines is headquartered near Seattle and many of the passengers were from Seattle.

Since 1951 there have been no major crashes within Seattle, but there have been a few significant incidents.

- October 18, 1984, Air Force Two and a private aircraft nearly collided eight miles from Boeing Field. The pilot of Air Force Two had to take evasive action to avoid a collision.
- December 19, 1984, only two months after the Air Force Two incident, a DeHavilland DHC-3 helicopter crash-landed on an athletic field and slid into a nearby street.
- October 10, 2001. A mechanical problem forced an emergency landing of Alaska Airlines flight 497. The accident occurred in California, but the plane was bound for Seattle.
- March 14, 2003. A commercial airliner landed on a SeaTac taxiway.
- May 8, 2003. A Seattle-based tour boat sinks in British Columbia. There were no casualties.
- Dec. 19, 2008. A chartered bus slipped down a steep and snowy street, plowed through a barrier and teetered over I-5 near downtown Seattle. This was a near tragedy. No casualties resulted.

There have been several accidents in other parts of the county involving large commercial aircraft coming in populated areas, but such accidents are rare. Aviation safety systems have vastly improved since mid-century. In Seattle's case, the changes probably have a lot to do with shifting major commercial operations to SeaTac and aircraft production to other locations.

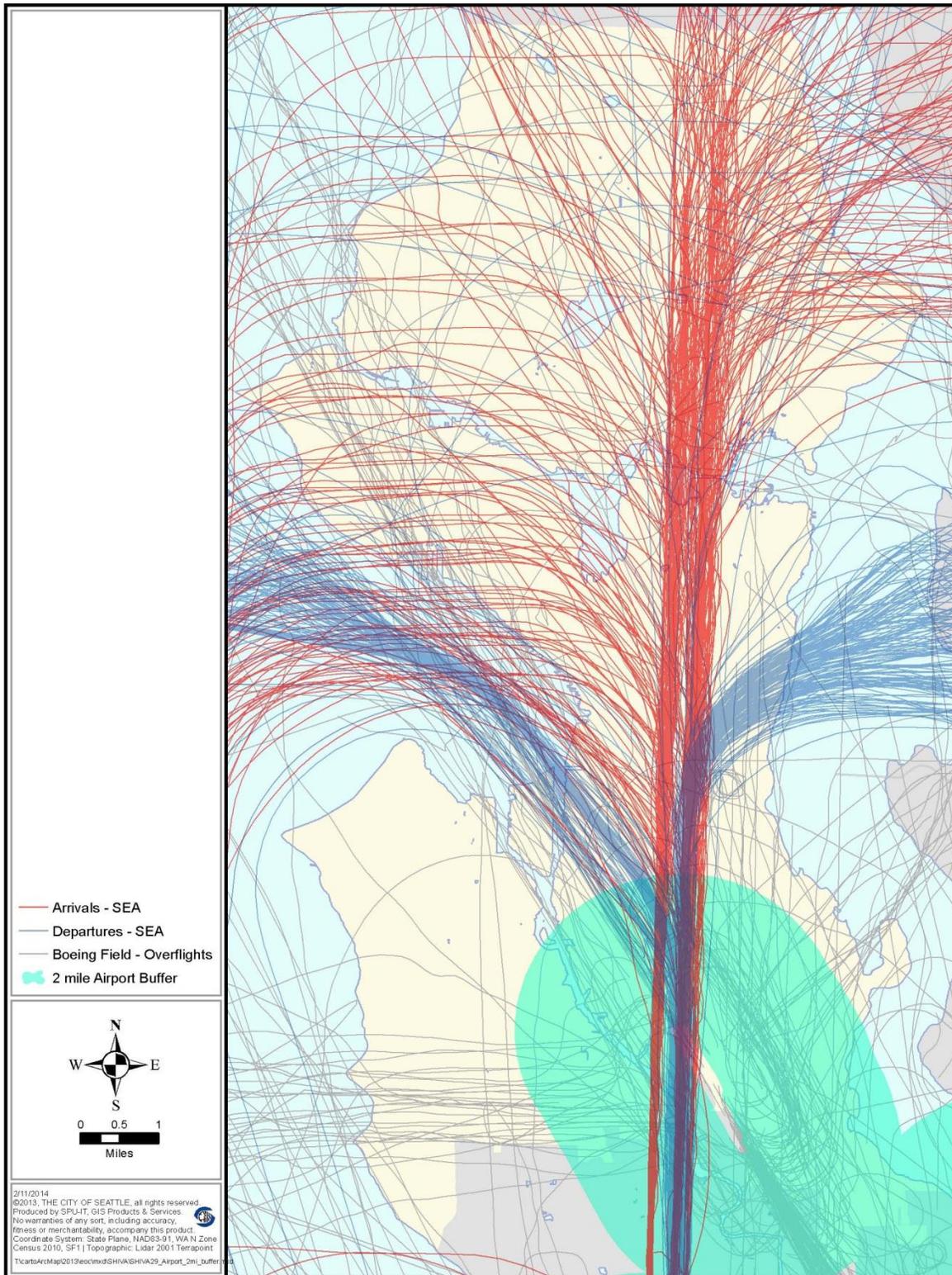
## Likelihood of Future Occurrence

Trends in transportation safety have long been pulling in two directions. On one hand, the rate and severity of accidents has been decreasing dramatically. On the other hand, the use of all transportation modes has been increasing. So far, the pull of the safety improvements that decrease the rate of accidents has been dominant. At some point, the saturation of transportation networks or other factors may reverse this trend, but there is no clear indication that that Seattle is reaching this point. Seattle will probably experience another major accident, but this probability seems to be holding steady or decreasing.



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Seattle Hazard Identification and Vulnerability Analysis

Figure 1. Flight Corridors and Areas within Two Miles of Airports.





## Vulnerability

Transportation accidents present two sets of vulnerability. The first is to the vessels and vehicles themselves and the people in them. The second is to everything and everyone around them. People in transit are in an inherently vulnerable position. They are densely packed into vehicles or vessels and then moved at high speed across often an environment in which they could not long survive without help. Naturally, when things go wrong many passengers get hurt.

As large vehicles and vessels move about, often containing hazardous materials, they are liable to affect people and the built environment around them. Areas near aircraft flight paths, highways and the shoreline are more likely to be affected by an accident than other areas. Urban areas like Seattle are inherently vulnerable due to high population density and the cost and complexity of the built environment through which transportation systems run.

### ***Areas More Prone to Aviation Accidents***

The areas that are most likely to be hit are the ones under or close to the flight paths, especially if they are within five-miles of an airport. [Figure 1](#) shows the area within five miles of both airports. Only Seattle's most southern sections—White Center, South Park, Dunlop, and Rainier Beach—are within five miles of SeaTac, but many planes take flight paths over the southern half of the city. King County International Airport is in the city itself. Planes often approach for landing from the north, over the Duwamish Valley and Georgetown, flying quite low as they near the landing area.

Seattle is also indirectly vulnerable to accidents that disrupt transportation networks. Most of these slowdowns or outages are temporary, but they can be an inconvenience to travelers and an economic burden.

## Consequences

Transportation accidents are a classic case of a hazard with a huge number of low-impact events and a tiny number of high-impact events. Every year more than 40,000 people die in transportation accidents in the United States. The vast majority of these are the result of traffic accidents. Of the traffic deaths, most occur on highways and rural roads. While individual accidents are not large incidents, they have a large cumulative impact. The long-term trend has been down. Many programs and regulations have been established to improve safety and the means to handle the most frequent incidents fall well within the scope of daily operations of local government.

Occasionally larger incidents occur that have a bigger, more lasting impact on the community and challenge the response capabilities of local government. Outlined below are characteristics of what we can expect from the "most likely" large incident and what we can expect from the "maximum credible" scenario.

In a hazard like transportation incidents where there are so many incidents, the most likely scenario is one that just exceeds the normal response capabilities of local government. This is in contrast to incidents like earthquakes in which individual incidents have a higher probability of being high impact. The 1998 Metro bus incident was a good example of an incident that nearly exceeded normal response capability. It drew large amounts of resources from the police and fire departments. Special lighting was needed to search for survivors after nightfall.

The most likely scenario would present a slightly higher level of impact. Despite the different transportation modes that might be involved, there are some similarities in impacts.



1. There is high likelihood of fatalities. This is in contrast to other hazards in which the “most likely” scenario involves a lot more property damage.
2. The geographic scope would be limited to the immediate scene of the incident with a strong possibility that transportation routes through the impacted area would be blocked. Infrastructure outages are also possible.
3. The duration of the incident would be limited. It would be likely that rescue and recovery operations could be completed in less than a few days. Transportation and infrastructure outages would also be restored in a similar amount of time.
4. Neighboring buildings and the people in them will probably be affected to some degree, but the majority of the casualties will be among those on the vehicle or vessel.
5. Maritime accidents tend to involve more property damage, especially when ships collide with bridges and other infrastructure.
6. There is a high likelihood of secondary hazards, especially fires and hazardous material spills. Transportation incidents can also be secondary hazards themselves.

Overall, the most likely major transportation incident will be short, but intense. Unless there is major infrastructure damage (i.e., to a bridge) the recovery will probably fairly quick and complete.

**Most Likely Scenario**

A bus crashes off of Aurora Bridge into a Fremont apartment building causing 15 fatalities and 34 serious injuries. The bus knocks over telephone landlines and blocks an arterial.

Category	Impacts 1 = low 5 = high	Narrative
Frequency	5	Major transportation accidents are one of the most common large scale emergencies faced in Seattle. The type of accident envisioned here is estimated to occur about once every ten years. Past accidents have not resulted in high casualties but a number of past accidents could have easily been much worse.
Geographic Scope	1	The bus heavily damages a mixed use apartment / retail building in Fremont. The bus comes to rest on an arterial.
Duration	1	The accident occurs mid-day. It takes emergency crews the rest of the day and into the night to stabilize the scene, look for survivors in the apartment and conclude an investigation
Health Effects, Deaths and Injuries	3	15 people are killed including passengers, pedestrians and building residents. Many more are injured.
Displaced Households and Suffering	2	The crash damages an apartment building. Its residents need to be sheltered.
Economy	1	Businesses in the immediate area are affected, but the larger economy does not suffer.
Environment	1	The crash spills gasoline but does not do major damage to the environment.
Structures	2	1 apartment building is severely damaged and is red tagged.



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Seattle Hazard Identification and Vulnerability Analysis

Category	Impacts 1 = low 5 = high	Narrative
Transportation	2	The accident investigation blocks SR 99 and surface streets in Fremont for a day.
Critical Services and Utilities	1	No critical services are impacted by the incident. The crash damages power lines causing a local outage. Telephone landlines also go down in the area.
Confidence in Government	1	Local government is able to conclude its investigation quickly. The public perceives its response as measured and competent.
Cascading Effects	2	The accident causes a minor secondary incident, a local and short term power outage.

**Maximum Credible Scenario**

A large passenger aircraft crashes into Beacon Hill around 7:00 AM. Debris is strewn over multiple blocks. Electrical and gas lines are severed. Fires have started. Debris is blocking I-5. It is not known if the cause is terrorism related.

Category	Impacts 1 = low 5 = high	Narrative
Frequency	2	Seattle has experienced three significant aircraft crashes into residential areas with resulting casualties on the ground. All three occurred before 1951. Since then aviation's safety has dramatically improved, but crashes like American Airlines Flight 587 that went down in Queens on November 12, 2001 still occur.
Geographic Scope	3	The aircraft impacted two blocks on Beacon Hill but an additional four blocks are damaged from aircraft debris. Smaller debris is found up to 1/2 mile away. An engine and part of the wing fell onto I-5.
Duration	2	Stabilizing the incident, rescuing survivors and putting out fires takes 24 hours.
Health Effects, Deaths and Injuries	4	All 160 passengers and crew onboard perish along with 25 people on the ground (in houses and on I-5).
Displaced Households and Suffering	3	220 people are displaced from their homes and require shelter. Of these 180 are able to return home after three days when the investigation is concluded and their homes are inspected. Outside the impacted area services are maintained.
Economy	2	Several businesses in the immediate neighborhood have to shut their doors while the structures are evaluated and investigators search for debris. They are able to resume operations once the investigation is concluded.
Environment	2	The aircraft crashed shortly after takeoff. It was loaded with fuel. Most of the fuel burns. Some enters the waste water system. Toxic dust enters the immediate area.
Structures	2	6 houses are destroyed in the crash or burn in the ensuing fire. Another 15 are yellow tagged due to debris impacts.



Category	Impacts 1 = low 5 = high	Narrative
Transportation	3	(WAS a 4). The crash temporarily halts traffic into and out of Sea-Tac and King County International Airports. It also completely blocks I-5 where a multiple vehicle accident has occurred due to debris. Transportation impacts are wide ranging but limited in duration.
Critical Services and Utilities	2	The response occupies a large amount of public safety resources, but mutual aid is available because this is a single site disaster. Utilities in the affected area are shut off as a precaution, but those outside the area are not affected.
Confidence in Government	3	Some members of the public are unhappy that planes have been allowed to overfly the City and believe that Sea-Tac's expansion led to the accident.
Cascading Effects	5	The crash releases hazardous materials, causes a major fire and a large transportation accident.

## Conclusions

Transportation safety has improved dramatically since the early days of motorized and air travel. Most of the major historical incidents date back to this earlier time. Still, transportation accidents hold the potential to produce very high casualty counts. As the amount of transportation increases, the total number of serious incidents may also increase despite safety improvements, especially as transportation networks become saturated and lose reserve capacity.

The possibility of terrorist attacking or using transport modes as weapons greatly increases the risks associated with the maximum credible events. The most likely events remain accidents that cause mass casualties among passengers and limited damage to surrounding infrastructure with the major caveat of damage to bridge or overpass structures.

<sup>i</sup> Forbes.com. America's Most Dangerous Airports. [http://www.forbes.com/2007/02/22/airports-americas-deadliest-biz-cz\\_mt\\_0223airports.htm](http://www.forbes.com/2007/02/22/airports-americas-deadliest-biz-cz_mt_0223airports.htm) accessed 12/7/2009

<sup>ii</sup> Seattle PI. [http://www.seattlepi.com/local/292571\\_dixdisaster16.html](http://www.seattlepi.com/local/292571_dixdisaster16.html) accessed 3/3/2010.

<sup>iii</sup> Seattle Times, 2/4/73

<sup>iv</sup> Seattle Times, 2/4/73

<sup>v</sup> Washington State Department of Emergency Management. [http://www.emd.wa.gov/hazards/haz\\_transportation.shtml](http://www.emd.wa.gov/hazards/haz_transportation.shtml). Accessed 3/3/2010.