

Appendix B
CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

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CLEAR ZONES AND ACCIDENT POTENTIAL ZONES

B.1 Guidelines For Accident Potential

Areas around airports are exposed to the possibility of aircraft accidents even with well-maintained aircraft and highly trained aircrews. Despite stringent maintenance requirements and countless hours of training, history makes it clear that accidents do happen.

When the AICUZ Program began, there were no current comprehensive studies on accident potential. To support the program, the Air Force completed a study of Air Force aircraft accidents that occurred between 1968 and 1972 within 10 nautical miles of airfields. The study of 369 accidents revealed that 75 percent of aircraft accidents occurred on or adjacent to the runway (1,000 feet to each side of the runway centerline) and in a corridor 3,000 feet (1,500 feet either side of the runway centerline) wide, extending from the runway threshold along the extended runway centerline for a distance of 15,000 feet. The Air Force updated these studies and this information is presented later in this section.

The CZ, APZ I, and APZ II were established based on crash patterns. The CZ starts at the end of the runway and extends outward 3,000 feet. It has the highest accident potential of the three zones. The Air Force adopted a policy of acquiring property rights to areas designated as CZs because of the high accident potential. APZ I extends from the CZ an additional 5,000 feet. It includes an area of reduced accident potential. APZ II extends from APZ I an additional 7,000 feet in an area of further reduced accident potential.

Research in accident potential conducted by the Air Force was the first significant effort in this subject area since 1952 when the President's Airport Commission published "The Airport and Its Neighbors," better known as the "Doolittle Report." The recommendations of this earlier report were influential in the formulation of the APZ concept.

The risk to people on the ground being killed or injured by aircraft accidents is small. However, an aircraft accident is a high consequence event, and when a crash does occur, the result is often catastrophic. Because of this, the Air Force does not attempt to base its safety standards on accident probabilities. Instead, the Air Force approaches this safety issue from a land use planning perspective.

B.2 Guidelines For Accident Potential

Military aircraft accidents differ from commercial air carrier and general aviation accidents because of the variety of aircraft used, the type of missions, and the number of training flights. In 1973, the Air Force performed a service-wide aircraft accident hazard study to identify land near airfields with significant accident potential. Accidents studied occurred within 10 nautical miles of airfields.

The study reviewed 369 major Air Force accidents during 1968-1972, and found that 61 percent of those accidents were related to landing operations, and 39 percent were takeoff

related. It also found that 70 percent occurred in daylight, and that fighter and training aircraft accounted for 80 percent of the accidents.

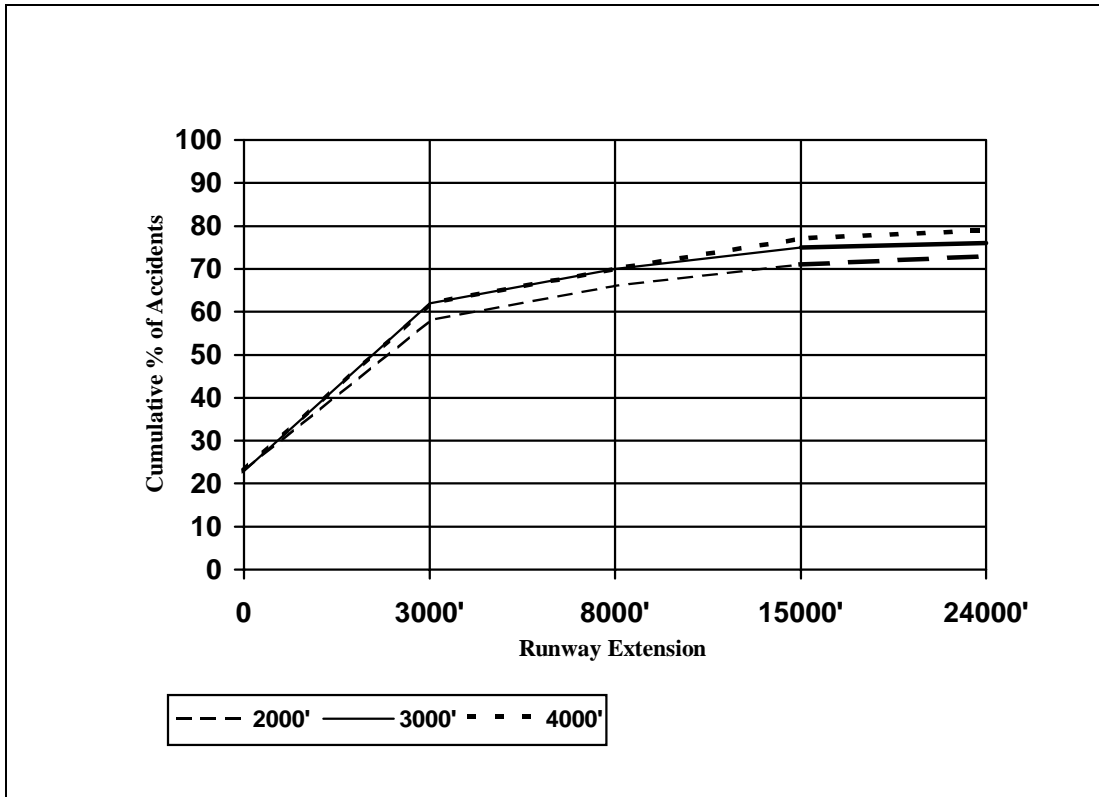
Because the purpose of the study was to identify accident hazards, the study plotted each of the 369 accidents in relation to the airfield. This plotting found that the accidents clustered along the runway and its extended centerline. To further refine this clustering, a tabulation was prepared that described the cumulative frequency of accidents as a function of distance from the runway centerline along the extended centerline. This analysis was done for widths of 2,000, 3,000, and 4,000 total feet. Table B.1 reflects the location analysis.

Table B.1 Location Analysis

Length From Both Ends of Runway (feet)	Width of Runway Extension (feet)		
	2000	3000	4000
Percent of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	35	39	39
3,000 to 8,000	8	8	8
8,000 to 15,000	5	5	7
Cumulative Percent of Accidents			
On or Adjacent to Runway (1,000 feet to each side of runway centerline)	23	23	23
0 to 3,000	58	62	62
3,000 to 8,000	66	70	70
8,000 to 15,000	71	75	77

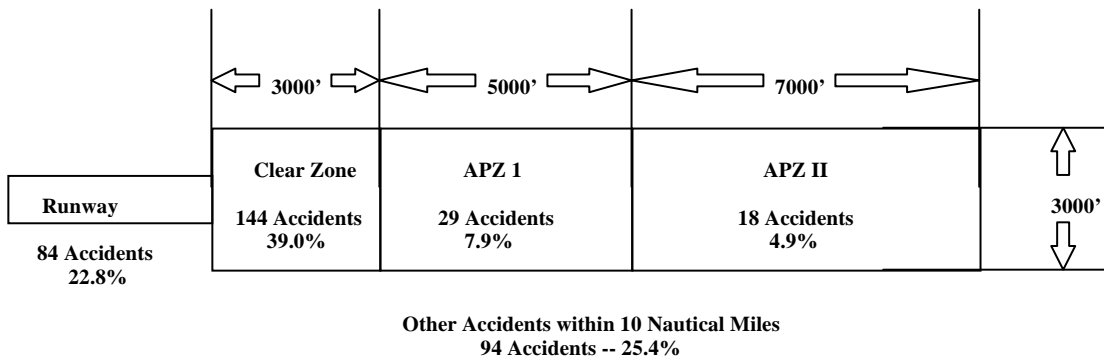
Figure B.1 indicates that the cumulative number of accidents rises rapidly from the end of the runway to 3,000 feet, rises more gradually to 8,000 feet, then continues at about the same rate of increase to 15,000 feet, where it levels off rapidly. The location analysis also indicates 3,000 feet as the optimum runway extension width and the width which includes the maximum percentage of accidents in the smallest area.

Figure B.1 Distribution of Air Force Aircraft Accidents (369 Accidents - 1968 - 1972)



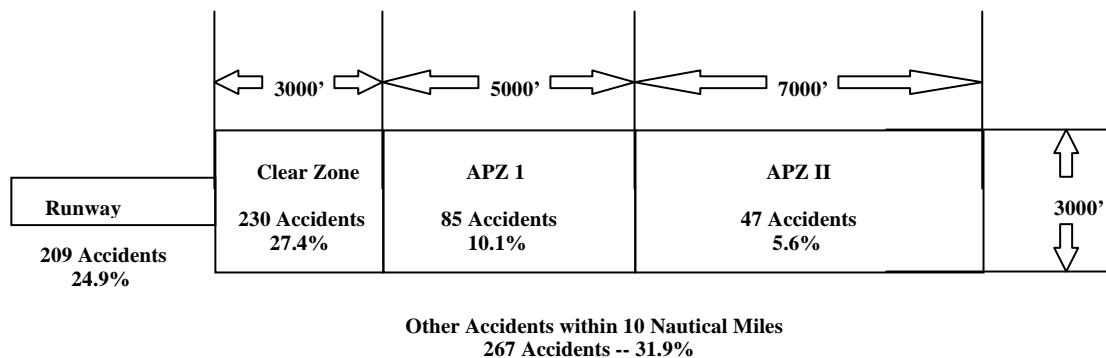
Using the optimum runway extension width, 3,000 feet, and the cumulative distribution of accidents from the end of the runway, zones were established that minimized the land area included and maximized the percentage of accidents included. The zone dimensions and accident statistics for the 1968-1972 study are shown in Figure B.2.

Figure B.2 Air Force Aircraft Accident Data (369 Accidents - 1968 - 1972)



The original study was updated to include accidents through September 1995. This updated study includes 838 accidents during the 1968-1995 period. Using the optimum runway extension width of 3,000 feet, the accident statistics of the updated study are shown in Figure B.3.

**Figure B.3 Air Force Aircraft Accident Data
(838 Accidents - 1968 - 1995)**



Using the designated zones and accident data, it is possible to calculate a ratio of percentage of accidents to percentage of area size. These ratios indicate the CZ, with the smallest area size and the highest number of accidents, has the highest ratio, followed by the runway and adjacent area, APZ I, and then APZ II. Table B.2 reflects this data.

**Table B.2 Accident to Area Ratio
Ratio of Percentage of Accidents to Percentage of Area
(Air Force Accident Data 1968 - 1995)**

	Area ¹ (Acres)	Number ² Accident	Accident Per Acre	Percent of Total Area	Percent of Total Accidents	Ratio: ³ % Accidents to % Area
Runway Area	487	209	1 Per 2.3 acres	0.183	24.9	136
Clear Zone	413	230	1 Per 1.8 acres	0.155	27.4	177
APZ I	689	85	1 Per 8.1 acres	0.258	10.1	39
APZ II	964	47	1 Per 20.5 acres	0.362	5.6	16
Other Area	264,053	267	1 Per 989 acres	99.042	31.9	0.3

1 Area includes land within 10 nautical miles of runway.

2 Total number of accidents is 838 (through 1995).

3 Percent total accidents divided by percent total area.

Additional accident data for 1986 through July 1995 has been analyzed. Specific location data for some of the 1986-1995 accidents were not available and these were not included in the analysis. Table B.3 compares the 1968-1985 data with the data through July 1995:

Table B.3 Additional Accident Data

ZONE	1968-1985		1968-1995	
	Accidents	% of Total	Accidents	% of Total
On-Runway	197	27.1	209	24.9
Clear Zone	210	28.8	230	27.4
APZ I	57	7.8	85	10.1
APZ II	36	5.0	47	5.7
Other (Within 10 nautical miles)	228	31.3	267	31.9
Total	728	100.0	838	100.0

Analysis shows that the cumulative changes evident in accident location through July 1995 reconfirm the dimensions of the CZs and APZs.

B.3 Definable Debris Impact Areas

The Air Force also determined which accidents had definable debris impact areas, and in what phase of flight the accident occurred. Overall, 75 percent of the accidents had definable debris impact areas, although they varied in size by type of accident. The Air Force used weighted averages of impact areas, for accidents occurring only in the approach and departure phase, to determine the following average impact areas:

Average Impact Areas for Approach and Departure Accidents

Overall Average Impact Area	5.06 acres
Fighter, Trainer, and Misc. Aircraft	2.73 acres
Heavy Bomber and Tanker Aircraft	8.73 acres

B.4 Findings

Designation of safety zones around the airfield and restriction of incompatible land uses can reduce the public's exposure to safety hazards.

Air Force accident studies have found that aircraft accidents near Air Force installations occurred in the following patterns:

- 61% were related to landing operations.
- 39% were related to takeoff operations.
- 70% occurred in daylight.
- 80% were related to fighter and training aircraft operations.
- 25% occurred on the runway or within an area extending 1,000 feet out from each side of the runway.

- 27% occurred in an area extending from the end of the runway to 3,000 feet along the extended centerline and 3,000 feet wide, centered on the extended centerline.
- 15% occurred in an area between 3,000 and 15,000 feet along the extended runway centerline and 3,000 feet wide, centered on the extended centerline.

Air Force aircraft accident statistics found 75 percent of aircraft accidents resulted in definable impact areas. The size of the impact areas were:

- 5.06 acres overall average.
- 2.73 acres for fighters and trainers.
- 8.73 acres for heavy bombers and tankers.