

**The Impact of Airport Operations on Land
Values:
A Case Study of Seattle Tacoma International
Airport**

by

Theodore Lane, Ph.D.

Vice President

Thomas/Lane & Associates

Economics & Public Policy Consultants

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Background

Airports generate noise, visual blight, surface traffic congestion, possible air pollution and other effects which cause most households to consider residential areas immediately surrounding them less desirable places to live. Some households may have a primary wage earner employed at (or near) the airport and consider the reduction in commuting time an off-setting factor. For others, the airport's adverse impacts may be off-set by neighborhood or individual housing unit characteristics. But for most households, close proximity to an airport reduces a property's residential desirability.(Crowly,1973; Nelson, 1980) As a result, residential housing s located close to an airport will normally have a market value less than it would if located elsewhere in the region, other things(such as lot size and view) equal.

Airport operations (i.e., aircraft landings and take-offs) impact the value of close-by properties in two ways. First, the airport's operations may depress property values below the level real estate markets would produce if the airport did not exist. In this case, if a single family residential unit located adjacent to an airport were physically transported to an identical location on an identical lot in a community of identical status and prestige but elsewhere in the region, its value would increase. The amount of the increase represents the depression in real estate value caused by the unit's proximity to the airport. This is the phenomenon most studies of airport noise analyze.

A second way in which an airport impacts the value of real estate is the variation in value among properties caused by their proximity to the airport's flight paths for arriving and departing aircraft. It is this phenomenon that the current paper addresses. The phenomenon is sometimes referred to as the "shadow" effect (noise pollution, visual pollution, possible air quality pollution, and a generally degraded environment for human habitat) caused by living under low flying aircraft. Although noise is probably the most important single impact that results from living under an airport's approach/departure tracks, the analysis contained in this paper does not require causality between noise effects and reduced property values. The argument advanced here is simply that living under the "shadow" of an airport's flight paths for approaching/departing aircraft will reduce the real estate market valuation of a residence.

Since noise effects, health effects, visual blight, or other possible impacts are inseparably bundled when viewed from the perspective of a home owner experiencing approaching/departing aircraft directly over head, the important distinction is not between different noise level contours within which housing units are located, but between a residential housing unit's distance from being directly under the flight track of approaching and departing aircraft.

Description of Airport Flight Patterns

Located approximately 10 miles south of the City of Seattle, Seattle-Tacoma International Airport (SEA) has two north-south oriented parallel runways (16L/34R and 16R/34L0). Runway 16L/34R is 11,900 x 150 feet; runway 16R/34L is 9,425 x 150 feet. (AOPA, 1997) The airport's enplanement and operations statistics for 1993 are given in Table 1, below.

Aircraft operations reached a seasonal high during August in 1993 when there were 76 total operations during the peak hour of the average day. Among scheduled air carriers, total operations were greater than 40 per hour during three periods of the day: (1) between 7AM and 9AM when departures were almost three times as great as arrivals – 61 to 23, respectively; (2) between 10AM to 1PM when departures and arrivals were about equal – 92 to 89, respectively; and (3) between 6PM and 8PM when arrivals were greater than departures by a 74 to 57 margin (P&D Aviation, 1994). Prevailing wind conditions result in the majority of aircraft approaching from the north and departing to the south.

Table 1
Seattle Tacoma International Airport Operating Statistics
1993

	Number	Percent
Enplaned Passengers		
Domestic	8,700,000	92.6%
International	700,000	7.4%
Total Enplanements	9,400,000	100.0%
O&D Enplanements	6,580,000	70.0%
Aircraft Operations		
Air Carrier	188,000	55.4%
Air Taxi/Commuter	127,000	37.4%
All-Cargo	16,000	4.7%
General Aviation	8,100	2.4%
Military	400	0.1%
Total Operations	339,500	100.0%

Description of Surrounding Communities

There is considerable elasticity about the geographic area primarily affected by SEA. Numerous communities in the central Puget Sound region have at times perceived themselves adversely impacted by some factor (usually noise) connected with airport activity levels. However, it is generally acknowledged that the airport's primary adverse impacts occur in areas immediately surrounding the airport. (Coffman Associates, 1989; FAA and Port of Seattle, 1996).

This area includes all or parts of what are currently the cities of Burien, Des Moines, Federal Way, Normandy Park, SeaTac and Tukwila plus the southern parts of the City of Seattle and parts of unincorporated King County.³

Literature Review

Most studies of direct adverse impacts of airports have concentrated on measuring noise impacts on property values.(Frankel, 1991; Mieszkowski and Samper, 1978; Newman and Beattie, 1985) A recent report prepared for the Federal Aviation Administration (FAA) found that the impact on property values of "airport noise varies from negligible [\$627 for lower priced housing units around Baltimore International Airport] to significant [\$60,873 for moderately priced housing units around Los Angeles International Airport] and appears to be more pronounced in higher priced neighborhoods."(Booz-Allen & Hamilton, 1994)

A study prepared for the Port of Seattle in 1994 looked at the noise issue by comparing the assessed values of 32 residences located within the Seattle-Tacoma International "Noise Remedy Area" boundary The study compared 16 residences that within both the airport's 65 L_{DN} and Noise Remedy Area boundaries with 16 other residences that were outside the airport's 65 L_{DN} boundary but within the its Noise Remedy Area boundary. (Shapiro, 1994) This study made no attempt to compare houses near to the airport with comparable units in other parts of the central Puget Sound region, and it not surprisingly concluded, "given the limitation of this study, neither the existence nor the magnitude of any general effect on rates of appreciation of property values from airport noise is demonstrated".

Analysis

The impact of aircraft operations at SEA on the value of surrounding single family residential property values was estimated using the linear regression model:

$$y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10}$$

where:

- Y= assessed value of land and structures
- X₁= lot size (sq. ft.)
- X₂= structure size (sq. ft.)
- X₃= number of bedrooms
- X₄= number of bathrooms
- X₅= distance from center of a jet flight track (east of runway 16/34R or west of runway 16/34L), measured in tenths of a mile.
- X₆= a binary variable representing the City of Des Moines
- X₇= a binary variable representing the City of Normandy Park
- X₈= a binary variable representing the City of SeaTac
- X₉= a binary variable representing Unincorporated King County
- X₁₀= a binary variable representing the City of Tukwila

The model's parameters were calculated using cross sectional data from the King County Assessors office for 3,026 properties in ten Census Tracts⁴ immediately surrounding the airport.⁵ The property value data were all for the year 1995.

The regression results for the model are given in Table 2.

The independent variable X₅, the east-west distance a single family residence was located from the center of a north-south oriented jet flight track (measured miles), is significant at the 0.999 probability level using a 2-tail test. The variable's coefficient is 17,784, meaning that, all other things remaining equal, the value of a single family residence increases by about 3.4 percent (\$4,446 on the average valued house of \$129,887) for every quarter of a mile the house is farther away from being directly underneath the flight track of departing/approaching jet aircraft. This relationship is plotted as a property value gradient relating distance from the center line of a jet flight track to value of a single family residence.

Table 2
Regression Results for Single Family Residential Property Value Model

Variable	Coefficient	Std. Error	T-Statistic	2-Tail Significance
Constant	-32,496.034	4,050.767	-8.022	0.000
X ₁	1.364	0.051	26.636	0.000
X ₂	51.570	1.399	36.856	0.000
X ₃	1283.146	777.824	1.650	0.099
X ₄	20,116.649	1,271.476	15.821	0.000
X ₅	17,783.989	1,255.178	14.169	0.000
X ₆	6,215.734	3,130.810	1.985	0.047
X ₇	43,733.428	3,659.276	11.951	0.000
X ₈	5,496.861	2,968.653	1.852	0.064
X ₉	9,878.686	2,569.998	3.844	0.000
X ₁₀	-7,433.414	3,810.491	-1.951	0.051
R ²	0.65288	Mean of Dependent variable	129,887	
Adjusted R ²	0.65173	S.D. of Dependent variable	49,690	
S.E of Regression	29,324	Sum of Sq. Residual	2.59E+12	
Log Likelihood	-35,379	F-Statistic	566	
Durbin-Watson	1.44	Prob(F-Statistic)	0.000	

Figure 1

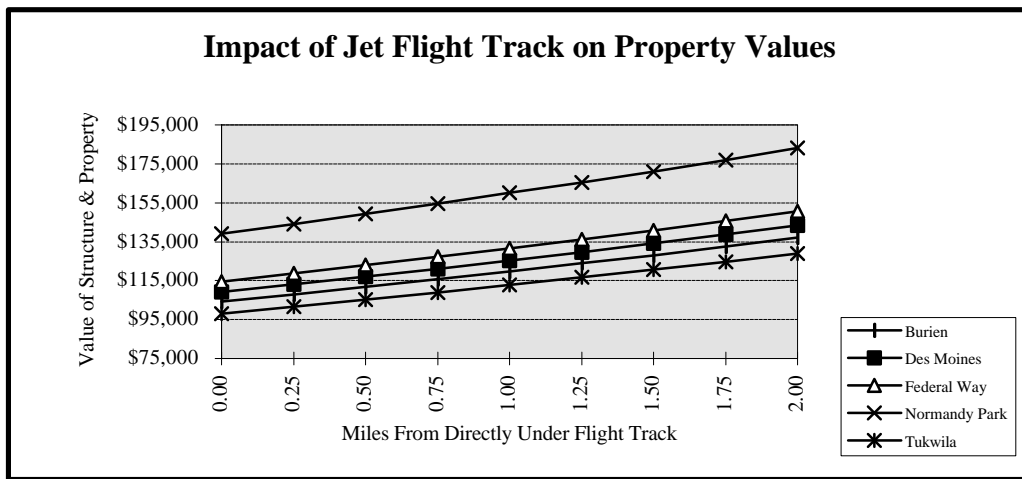


Table 3
Model Estimated Impact of Jet Flight Tracks on Average Property Values

Miles From Flight Track	Average Value Structure & Property, By Community				
	Burien	Des Moines	Federal Way	Normandy Way	Tukwila
0.00	\$104,151	\$109,122	\$114,574	\$139,189	\$ 98,138
0.25	\$107,843	\$112,990	\$118,636	\$144,123	\$101,617
0.50	\$111,666	\$116,996	\$122,841	\$149,232	\$105,21C
0.75	\$115,625	\$121,143	\$127,196	\$154,522	\$108,949
1.00	\$119,724	\$125,438	\$131,705	\$160,000	\$112,811
1.25	\$123,822	\$129,732	\$136,214	\$165,478	\$116,673
1.50	\$128,062	\$134,174	\$140,878	\$171,143	\$120,668
1.75	\$132,446	\$ 138,767	\$145,701	\$ 177,002	\$124,799
2.00	\$136,980	\$143,518	\$150,689	\$183,062	\$129,072

In addition to the loss of private property value resulting from being under the flight track of approaching/departing, the political jurisdictions around the airport experience fiscal losses.

Approaches/departures create a flight track approximately half a mile wide. To the south, the affected single family housing units are in Des Moines, Federal Way and Normandy. To the North, the airport's flight tracks pass over the City of Burien.

To estimate the fiscal consequences of flight track impacts, the linear north-south distance of SEA's flight tracks was calculated for each of the impacted cities. Each flight track "impact band" was assumed a quarter mile wide. The linear distance a runway's flight track over each impacted city multiplied by a quarter mile was used as the estimate of the area of each impact band within each city. The average lot size of single family residential housing unit was assumed to be 12,950 square feet. This produces an estimate of 538 single family housing units for each linear mile of a flight track.

Multiplying this estimate by the dollar value of the average annual depression in single family housing units for each city produced the estimated total value reduction in single family residential housing units as a result of value loss from being under a flight track. Multiplying the loss of value by each city's property tax levy rate produced estimates of annual property tax revenue loss for each city. The results are summarized in Table 3.

Table 4
Average Annual Single Family Property Tax Revenue Losses Resulting
from the Third Runway's Flight Track Gradient.

	Burien	Des Moines	Federal Way	Normandy Park	Tukwila
Track Miles by Noise Gradient					
0.00 mi.	1.28	2.77	1.99	0.00	0.00
0.25 mi.	1.28	2.77	1.99	0.00	0.00
0.50 mi.	1.28	2.17	1.99	1.14	0.00
Average Prop Value Loss/HU					
0.00 mi.	\$ 7,551	\$ 7,874	\$ 8,267	\$ 10,043	\$ 7,081
0.25 mi.	\$ 7,782	\$ 8,153	\$ 8,560	\$ 10,399	\$ 7,332
0.50 mi.	\$ 8,057	\$ 8,442	\$ 8,864	\$ 10,768	\$ 7,592
Total Value Loss From Gradient					
0.00 mi.	\$ 5,170,645	\$ 11,737,775	\$ 8,848,167	\$	\$
0.25 mi.	\$ 5,353,943	\$ 12,153,876	\$ 9,161,832	\$	\$
0.50 mi.	\$ 5,543,738	\$ 12,584,727	\$ 9,486,616	\$ 6,585,531	\$
Total	\$ 16,068,326	\$36,476,378	\$27,496,615	\$6,585,531	\$
Property Tax Levy Rate	0.00300969	0.00225795	0.00155887	0.0017	0.00321043
Annual Loss of Property Tax Revenues					
0.00 mi.	\$ 15,562	\$ 43,962	\$ 28,597	\$ 0	\$ 0
0.25 mi.	\$ 16,114	\$ 45,520	\$ 29,611	\$ 0	\$ 0
0.50 mi.	\$ 16,685	\$ 47,134	\$ 30,660	\$ 20,415	\$ 0
Total	\$ 48,361	\$ 136,616	\$ 88,868	\$ 11,195	\$ 0

For the five impacted cities combined, tax collections from single family residential units lying directly under or close to the third runway's jet flight tracks are reduced by \$285.5 thousand a year, (expressed in constant value 1995 dollars).

Conclusions & Suggestions for Additional Research

Noise, and other environmental pollutants, associated with arriving/departing aircraft negatively impact the market value of single family residences located under these aircraft's' flight tracks. Evidence from around the country indicates a general decline in the relative value of property surrounding airports, with the greatest relative declines experienced where higher valued properties are impacted.. This paper analyzed the effects on a residential property's value of its location under or close to the approach/departure flight tracks of aircraft using the airport. It found that all other things remaining equal, the value of a single family residence increases by about \$17,784 for every quarter of a mile it is farther away from being directly underneath a flight track. Using the area immediately surrounding Seattle-Tacoma International Airport as a case study, the decreased property values result in a fiscal loss of \$285.5 thousand a year to the local taxing jurisdictions.

The analysis in the paper can be improved along several promising research avenues. First, it's reasonable to assume the elevation of the aircraft on its approach/departure track will influence its effect on property values below. The regression would probably benefit from the addition of an additional independent variable for aircraft elevation. Finally, the regression analysis would likely benefit from use of a more complex form. The regression equation was specified in both linear and logarithmic form and the linear specification gave the best fit. However, it would probably be worthwhile to test the specification of some complex higher order forms.

Finally, while little doubt exists that the location of a housing unit under a low flying aircraft's flight track will negatively effect its market value, additional quantitative research is needed to establish estimates of any general decline in property values caused by proximity to an airport. In the past, virtually all airport impact studies were conducted by advocates with large financial stakes in the outcomes of the research. The availability of county assessor's data on airports throughout the country now allows such research to be undertaken outside the context of competing self interests.

ENDNOTES

- 1 Vice President, Thomas/Lane & Associates, Economic Consultants
- 2 Research for this paper was supported, in part, by a contract between the City of Burien and Thomas/Lane & Associates for an analysis of socio-economic impacts and off-setting mitigating actions related to expansion of Seattle-Tacoma International Airport through construction of a third runway.
- 3 The Airport Communities Coalition (ACC) consists of general and special purpose local governments that have organized to oppose the SEA-TAC's expansion. Consisting of the cities of Burien, Des Moines, Federal Way, Normandy Park and Tukwila plus the Highline School District, the ACC sees itself representing the primary area affected by the airport's adverse impacts.
- 4 To ensure comparability of the single family housing units used in the analysis, the following units were excluded: [a] units with fewer than three bedrooms; [b] units whose condition was rated by the Assessor's office as less than "good" or "very good"; [c] units with a view; and [d] units not in single family residential zoned areas.
- 5 The model initially contained variables for the Cities of Federal Way and Kent, but these places had too few cases to be meaningful and were dropped from the final model. The distance from each parcel to the center of the airport was also initially used as a variable but its coefficient was not statistically significant and it was also dropped from the final model.

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