Analysis of Rural Community Perceptions of Helicopter Noise

P. D. PREVEDOUROS AND C. S. PAPACOSTAS

Helicopter noise intrusion in rural areas of Hawaii is described, and the impacts on exposed and nonexposed communities are compared using a mail-back survey. Analysis of variance, factor analysis, and logistic regression revealed factors underlying the attitudes and perceptions of residents, their preferred choice of filing complaints, and their level of tolerance to helicopter flyovers. Among the most important attributes were residential location, level of exposure, general attitudes toward growth, and propensity to complain. Specific recommendations are made. Whereas most results are specific to one geographic area, the methodology, general behavioral findings, and recommended actions could be useful elsewhere.

This paper describes the major findings of a study sponsored by the Airports Division of the Hawaii Department of Transportation (HDOT), which, in its role as operator of the statewide system of airports, is facing a growing problem with helicopter noise. The study (*1*) developed a set of recommendations based on (*a*) a literature review of human response to helicopter noise (*2*), (*b*) identification of the problem's extent in rural areas of the state and a comparison of the impact on exposed and nonexposed communities via the analysis of a mailback survey (this paper), and (*c*) measurement of ambient, traffic, and helicopter noise in exposed communities (paper in preparation).

Aviation-related complaints to HDOT's statewide, toll-free telephone hotline were analyzed. Helicopter complaint records were aggregated by Zip code; they revealed a decrease in the number of helicopter noise complaints on all islands except Oahu between 1990 and 1991. This occurred before the establishment of the local Fly Neighborly Program (FNP) by the Hawaii Helicopter Operators Association (HHOA). About half of all complaints during the period analyzed were filed on the island of Hawaii. The dot-density pattern in Figure 1 displays the areas with many, few, or no complaints per thousand residents and illustrates that, on Hawaii, the problem of helicopter noise may be acute in some areas, including a corridor between Hilo and Volcano. (In Figure 1, no complaints were filed in ZIP codes without a tag.)

SURVEY

The survey collected information on the perceptions of residents to answer (via estimated models) questions such as

- Is there public demand for increased helicopter regulation?
- Have people noticed a change since the FNP was enacted?
- Which complaint hotline would people prefer to call?
- Is helicopter noise annoying at home?
- What factors affect annoyance at home or outdoors?
- Do flyovers invade people's privacy?
- How many flights are people willing to tolerate?

Zip code areas with high and low frequencies of complaints on the islands of Hawaii and Maui were identified and selected so that, at the aggregate level, the key factors of income and land value were comparable, thereby reducing potential biases due to large socioeconomic differences between groups of high and low exposure to helicopter noise. This was accomplished by using a geographic information system and ZIP code Census files.

The questionnaire package consisted of three parts: (a) the cover page, a sheet with instructions, and an incentive-prize drawing card for four $50 prizes; (b) a questionnaire on general issues, including some helicopter noise questions, and household information; and (c) a questionnaire on the respondents' experiences, perceptions, and attitudes toward helicopter operations.

After pilot testing, 5,118 surveys were mailed out in November 1992; 1,560 responses were received. The 30 percent response rate was excellent given the length and complexity of the survey.

RESULTS

Annoyance

One part of the analysis distinguished between those who stated that they had heard no helicopters on the previous day (nonexposed respondents) and those who stated that they had heard one or more helicopters (exposed respondents). It was assumed that the reference day represented normal conditions. Sufficient and roughly equal samples were available for both groups. On average, the exposed respondents reported 8.65 helicopter flyovers, of which 3.94 were perceived as low-altitude (i.e., near tree-top) flights.

Both groups rated vehicular traffic, people, and natural noise sources as equally annoying (Figure 2); 20 to 40 percent of the respondents found most noises "somewhat" and "very" annoying. Thus, it is surmised that the exposed group did not include a higher proportion of people who are "hypersensitive" to noise. Such a finding would have threatened the validity of the inferences. Furthermore, both groups gave identical ratings to the noise-specific and overall quality of life in their neighborhoods.

As expected, exposed respondents had a less favorable disposition toward helicopter operations. For the nonexposed group, helicopters are not a major source of noise (Figure 2, *top*). The responses of the exposed group were much different. Helicopter noise was rated at the same level of annoyance ("somewhat" and "very" annoyed) as motorcycles and barking dogs. Those who indicated that they were "very" annoyed rated helicopters as the worst source of noise (Figure 2, *bottom*).

Department of Civil Engineering, University of Hawaii at Manoa, 2540 Dole Street, Honolulu, Hawaii 96822.

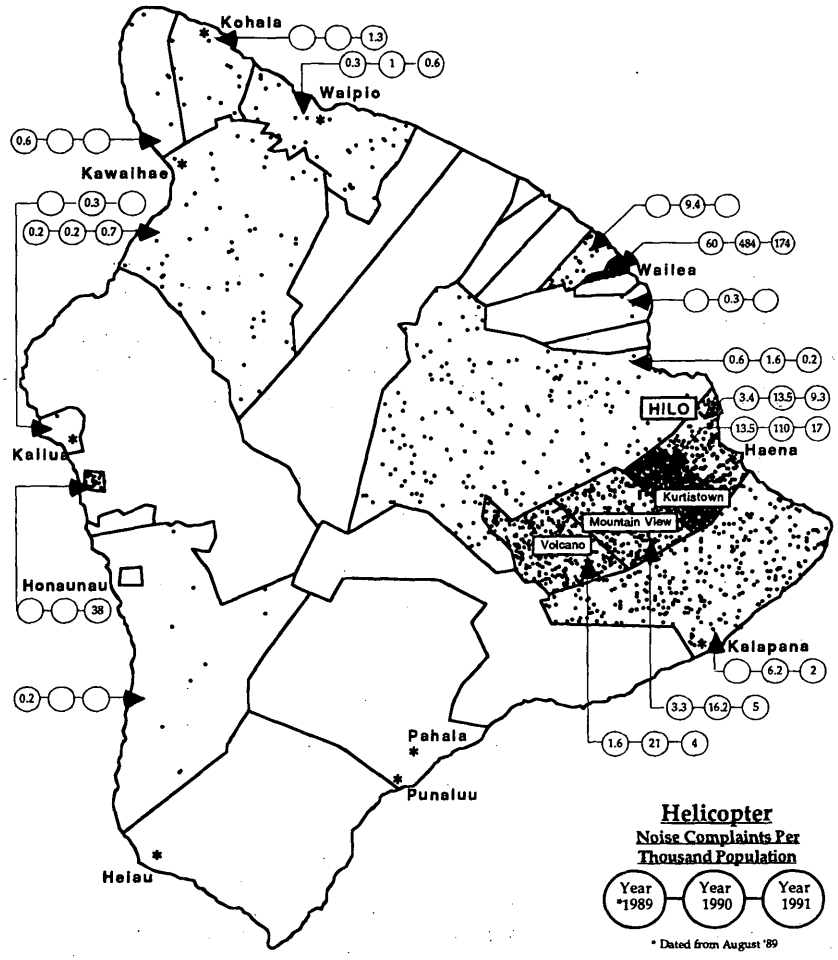


FIGURE 1 Rate of helicopter noise complaints on island of Hawaii.

Hotlines

Respondents in the exposed group were considerably more aware of the FNP and the HDOT and HHOA hotlines. Very few in the nonexposed group had called either hotline. Of the exposed group, 21.3 percent called the HDOT hotline and only 9.4 percent called the HHOA. The latter rate suggests that people may not prefer self-regulation by the helicopter industry. Moreover, about 32 percent of the exposed group declared that they would not call any hotline if annoyed, partly because of perceived ineffectiveness of hotlines.

Most of the nonexposed group (64 percent) reported no change in helicopter noise since 1991 (when the FNP was introduced), 12 percent reported more noise, and 24 percent reported less noise. The exposed group had a much different distribution, with 48 percent reporting no change, 33 percent more noise, and 19 percent less noise.

MODELING AND INTERPRETATIONS

Methodology

The analysis consisted of three steps:

1. Analysis of variance revealed that residential location, attitudes toward supplemental uses of tour helicopters, attitudes toward growth, exposure to helicopter flights, and propensity to file a complaint ("*call soon?*") were the most important explanatory variables. The last variable has a complex role because it may mean either that a person is not bothered by helicopter noise or that he or she is willing to tolerate it.

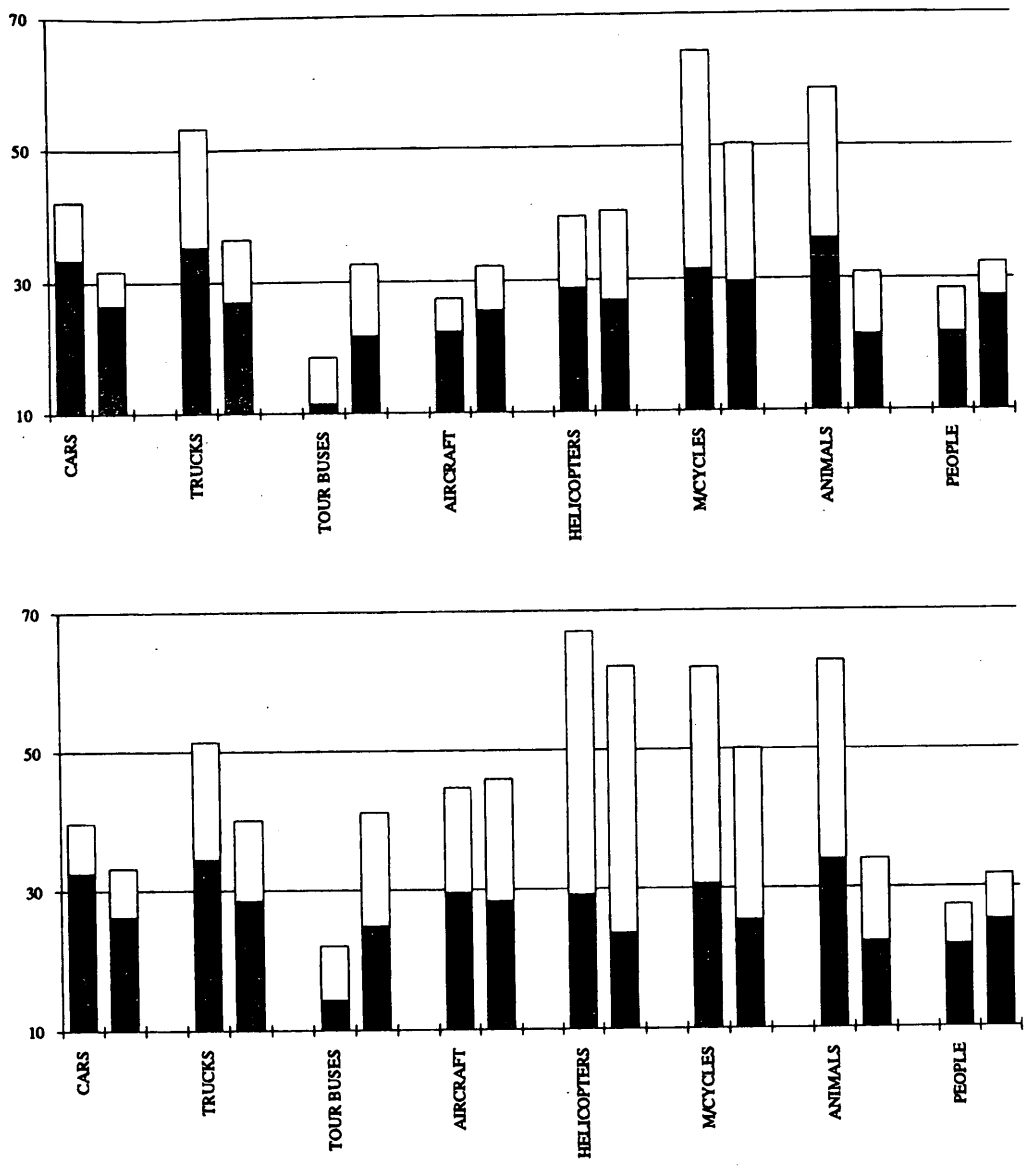
2. Factor analysis was used to combine related variables into composite variables. For example, the following three variables were combined into the composite factor "*attitude*":

   –*Important*: Tour helicopters are important to island's tourism and economy.

   –*Drug*: Hired tour helicopters help eradicate drug traffic.

   –*Crisis*: Tour helicopters can be helpful in an emergency.

3. Model estimation: Most of the questions were dichotomous (i.e., agree or disagree, yes or no), thus binomial logistic regression models were estimated. Tables 1 and 2 present two of the models. The heading of each model describes the dependent variable. The left three columns present the explanatory variables, the coefficient estimates, and the statistical significance of each coefficient. The remaining six columns of each model enable the derivation of answers. The mean values for each explanatory variable are furnished separately for each island and for four specific subareas: two on the island of Hawaii (rural Hilo—exposed—and Kona) and two on Maui (Haiku-to-Hana—exposed—and Pukalani/Kalawao). Goodness-of-fit statistics are also shown.



Legend: 1) For each pair of columns, the first represents daytime at home and the second outdoors.
2) Within each column, black represents "% somewhat annoyed" and white "% very annoyed".

FIGURE 2 Perception of annoyance from helicopter noise by nonexposed (*top*) and exposed (*bottom*) residents.

Interpretations

Model 2 showed that all but respondents from Kona (who are seldom exposed to helicopter noise) found helicopter noise annoying compared with the noise from other sources (probability 36.6 percent) (Table 1). Respondents from areas with frequent flyovers display a high probability of being annoyed: 76 percent for rural Hilo and 60 percent for Haiku-to-Hana.

Model 10 was designed to answer whether respondents were willing to tolerate four or more helicopter flyovers a day as compared with three or less (Table 2). The answer was affirmative, but the probability decreased from about 65 percent (tolerate one or more) to about 57 percent (tolerate four or more). Another model (i.e., willing to tolerate five or more flights) showed a reversal of the majority. Thus, four flights a day appears to be the threshold of tolerance (using the simple majority as criterion).

Models 2 and 10 show that employment status, presence of children in the household, attitude toward helicopters, and perception of helicopter noise relative to noise from heavy trucks are important explanatory variables. Helicopter noise annoyance (Model 2) also is affected by the propensity to complain and the level of exposure.

Only about 25 percent of the respondents had an overall negative reaction to the consequences of helicopter noise in terms of annoyance, fear of crashes, invasion of privacy, and disruption of sleep. The very exposed rural Hilo area, where more than 60 percent of the respondents harbored negative perceptions, was the exception.

TABLE 1 Sample of Model Estimations, Model 2

Explanatory Variables	Parameter Estimates	Stat. Sign.	Mean values for each explanatory variable: MAUI	HAWAII	RURAL HILO	KONA	HAIKU TO HANA	PUKA-LANI
Constant	-1.563	0.0000						
Full time	0.293	0.0687	0.67	0.55	0.45	0.51	0.58	0.69
Child	0.280	0.0867	0.38	0.32	0.31	0.30	0.39	0.39
Attitude	-0.449	0.0000	0.39	0.60	0.00	0.56	0.10	0.49
Other noise	-1.515	0.0000	-0.70	-0.73	-1.02	-0.55	-0.61	-0.74
Kona	-0.386	0.0549	0.00	0.00	0.00	1.00	0.00	0.00
Call soon?	0.110	0.0000	6.72	6.27	7.24	6.51	6.94	6.64
Exposure	0.683	0.0000	0.47	0.42	0.67	0.33	0.52	0.45
Heavy truck	0.045	0.0640	0.34	0.50	1.00	0.34	0.74	0.21
Police	-0.201	0.0547	1.89	2.02	1.75	1.86	1.74	1.93
Prob[negative perception] =			0.580	0.529	0.759	0.366	0.598	0.577

% Correctly Predicted:	P=0	67.17	Number of cases = 1003
	P=1	77.98	Model chi- square = 336
	overall	73.08	Model significance = 0.0000

TABLE 2 Sample of Model Estimations, Model 10

Explanatory Variables	Parameter Estimates	Stat. Sign.	Mean values for each explanatory variable: MAUI	HAWAII	RURAL HILO	KONA	HAIKU TO HANA	PUKA-LANI
Constant	0.041	0.6749						
Full time	0.234	0.0419	0.67	0.55	0.45	0.51	0.58	0.69
Child	0.237	0.0475	0.38	0.32	0.31	0.30	0.39	0.39
Attitude	0.092	0.0513	0.39	0.60	0.00	0.56	0.10	0.49
Heavy truck	-0.058	0.0009	0.34	0.50	1.00	0.34	0.74	0.21
Change	-0.081	0.0000	-0.15	0.05	0.61	-0.23	0.10	-0.24
Prob[willing to tolerate 4+] =			0.578	0.567	0.528	0.570	0.557	0.586

% Correctly Predicted:	P=0	43.63	Number of cases = 1409
	P=1	73.40	Model chi- square = 56
	overall	59.36	Model significance = 0.0000

Another model revealed that clear majorities in rural Hilo and Haiku-to-Hana felt that their homes' privacy was invaded by helicopter flyovers. This compares with only 21 percent in the overall sample.

The answer to the question on more active government involvement was unequivocally affirmative regardless of place of residence. Respondents from districts that experience frequent flyovers showed a higher degree of agreement (75 and 63 percent) than those from other districts (53 and 55 percent).

RECOMMENDATIONS

Reduction of exposure to helicopter noise and some government regulation are part of the solution. Exposure to helicopter noise can be decreased by using separate corridors for the outgoing and return trips and sufficiently separated over-the-land routes (e.g., 1 mi apart). Each of the designated routes should be assigned about four flights a day.

Government actions (by FAA and HDOT) that may ameliorate the problem include the creation of a task force to determine alternative routes. Involvement of helicopter operators and affected communities could result in a mutually acceptable plan of routes. A governmental unit could become more active in the reception and investigation of noise complaints, too. The HHOA hotline could fold, because people clearly prefer the HDOT hotline, by a 3 to 1 margin. HDOT could subcontract this service to a private firm. The complaint hotline operation is crucial in assessing the effectiveness of any actions that may be taken. A campaign to increase public awareness is necessary. The hotline should be an easily memorized number (e.g., 800-TOO-LOUD).

Much could be gained if the local FAA office were to become the arbitrator of unacceptable patterns of helicopter operations, instead of the HHOA. This would be a preferred way to satisfy the respondents' need for government regulation.

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