Aircraft Noise Abatement—The Prospects for a Quieter Metropolitan Environment

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Aircraft noise abatement is oriented toward compatibility between airports and the adjacent metropolitan environs. The effectiveness of technical, operational, and land use strategies of noise alleviation, including proposed aircraft noise certification regulations, can be forecast. The impact of aircraft operations on people and communities near airports is presented, specifically regarding land use planning and alternative land use options available for dealing with expected residual noise exposed areas subsequent to foreseeable noise reductions. Consideration is given to areawide land use requirements and interrelationships between the airport and local agencies. Ratings for evaluating aircraft noise abatement are being quantified at an increasing rate; the use of these ratings by the air commerce industry and by metropolitan planners, at individual airports, is shown to lead to greater compatibility between the airport and its neighbors.

Introduction

AIRCRAFT noise has become an Achilles heel to the continued growth of the air commerce industry. In recent years, national attention has been focused on this problem to the extent that the Congress has directed the Administrator of the FAA, after consultation with the Secretary of Transportation, to prescribe and amend standards for the measurement of aircraft noise and sonic boom and to prescribe and amend rules and regulations for the control and abatement of aircraft noise and sonic boom (Public Law 90-411, July 21, 1968). In the Housing and Urban Development Act of 1968 (Public Law 90-488, August 1, 1968) Congress reaffirmed the national goals, as set forth in the Housing Act of 1949, of "a decent home and a suitable living environment for every American family." More specifically, the Housing and Urban Development Act of 1965, in Section 1113, directs the Secretary to make a study "...to determine feasible methods of reducing the economic loss and hardships suffered by homeowners as the result of the depreciation in the value of their properties following the construction of airports in the vicinity of their homes, including a study of feasible methods of insulating such homes from the noise of aircraft."

This paper analyzes, for theoretical and actual airports, results of some studies conducted to quantify the degree of noise reduction achievable by several abatement methods have become available. Both land area and population factors are quantified, and comprehensive planning for compatible metropolitan development in the airport environs as a complementary action are discussed.

Noise Abatement Objectives and the Federal Program

The Federal Government's goal in aircraft noise abatement is to achieve compatibility between the airport and its neighbors. More specifically, the objective is to stop the continued growth of adverse noise areas and ultimately to reduce such areas to the minimum while simultaneously restricting the noise exposed areas to the proximity of the airport, without changing the rate of air commerce growth. Noise reduction potentials can be categorized into three means for achieving this objective: reduce the noise at the source, i.e., that produced by the airplane; operate airplanes on paths and profiles over sparsely populated areas; and manage land uses so that areas exposed are compatible with the expected noise level.

Efforts to develop a coordinated Federal Program for Aircraft Noise Abatement were initiated in the Office of Science and Technology, Executive Office of the President, in 1965. In August 1967, the program was transferred to the Office of the Secretary of Transportation. Figure 1 depicts the organizational structure of this program in which there is diverse input from Federal agencies, augmented by assistance from representatives from all interested segments of the general public concerned with aircraft noise abatement.

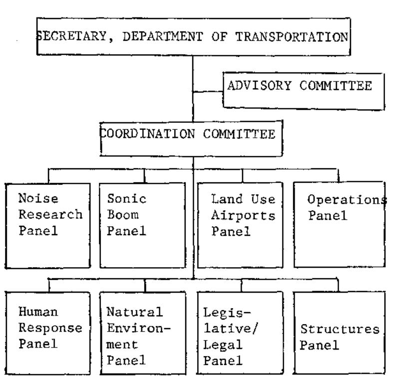

Fig. 1 Interagency aircraft noise abatement program.

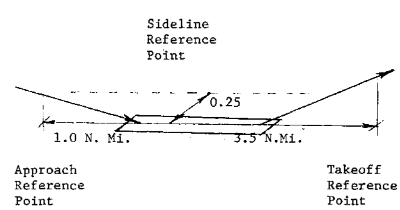

Fig. 2 Certification reference points.

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Table 1 Current aircraft noise levels and certification levels, EPNdB

Type aircraft	Takeoff 3.5 naut miles Current	Takeoff 3.5 naut miles NPRM	Approach 1.0 naut miles Current	Approach 1.0 naut miles NPRM
B-707-320, DC-8-5	118	104	118	106
B-727-200	103	98	108	104
B-737-100/200	96	96	108	103
DC-9	96	96	108	103

Measurement and Evaluation

As a part of the over-all Federal Program on aircraft noise reduction, the FAA/DOT has proposed that airplanes be approved to noise standards under similar procedures as now exist for safety. These procedures were publicized in a Notice of Proposed Rule Making 69-1, published in the Federal Register January 11, 1969. When noise rules are promulgated into Federal Aviation Regulations, airplanes will be approved for both safety and noise as a part of the type certification process of FAR Part 21. (Since the initial writing of this Paper, the regulatory action in NPRM 69-1 have resulted in amendments to Part 21 and new Part 36 of the Federal Aviation Regulation, effective December 1, 1969.)

Airplane noise will be measured at three locations near a runway; takeoff noise at 3.5 naut miles from brake release, sideline noise at 0.25 naut mile from the runway centerline, and approach noise at 1.0 naut mile from the threshold, as shown in Fig. 2. Test and measurement conditions, flight operating procedures, and measurement equipment and techniques are also specified in the NPRM. Noise levels at measurement locations are in effective perceived noise level, EPNL, in units of EPNdB.

EPNL has been selected as the evaluation rating since it includes the effects of pure tones and duration of noise exposure, both of which are important in evaluating qualities of aircraft noise particularly offensive to persons on the ground. A single EPNdB vaue is calculated for each airplane takeoff and landing, at each ground location. The complexity of EPNL has led many acousticians to doubt the value of using it in preference to simpler ratings, e.g., A-weighted sound pressure level, dBA. Debates on the issue have been held for the past several years, while concurrently the formulation of EPNL has been modified. Although there is not complete agreement, EPNL is proposed in NPRM 69-1.

Noise Reduction Potential

Figure 3 shows the maximum levels proposed in NPRM 69-1. In addition, certain airplanes, depending on the date of application for type certification, type of engine, and bypass ratio, must have noise levels as near to 80 EPNdB at each of the three measurement locations as is economically reasonable, technologically practical, and appropriate to the particular type design.

At some future date when all airplanes, because of their date of FAA type certification, are designed, manufactured and operated in accordance with noise regulations (assuming certification standards as proposed in NPRM 69-1) the reduction in noise level over existing levels will be similar to that given in Table 1. During takeoff, the greatest reduction will occur in large 4-engine airplanes. During approach, an average reduction of ~10 EPNdB under all current aircraft can be realized.

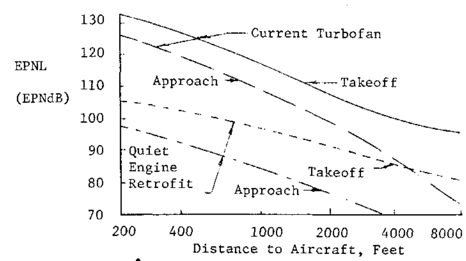


Fig. 4 Variation in EPNL with distance.

In addition to certification of new aircraft, noise levels of existing airplanes could be reduced by acoustically treating engine nacelles. Early results from NASA flight tests have shown that reductions of 7–10 EPNdB on DC-8-50 type aircraft and 10-15 EPNdB on B-707-320B type aircraft are technically achievable as measured at the 1.0 naut mile approach location.[1] The application of this technology to 2- and 3- engine aircraft can be achieved, although the reduction in noise levels may not be as great.

Noise reductions could be achieved by implementing technology being developed and validated by the NASA Lewis Research Center.[2] The goal is an engine approximately 20 EPNdB lower in noise level than current JT3D engines. Figure 4 shows the differences in EPNdB vs distance to the aircraft in feet for 4-engine turbofan transports with and without the quiet engine retrofit.

Another noise reduction means has been studied, but must be considered with particular attention paid to the airport location with respect to the topography and population distribution within the metropolitan area. Noise reduction can be achieved if thrust is reduced to that needed for a preselected climb gradient (at a given altitude or distance from brake release after takeoff). However, due to the subsequent reduced rate of climb, the effect of the lower altitude at some point farther from the airport will result in a higher noise level than if takeoff thrust has been continued. This cross-over point varies with type of aircraft, but always occurs farther from the airport for higher gross weight 4-engine aircraft than for lighter 2- and 3-engine aircraft.

The effect on equal noise level contours is to reduce the sideline noise but increase the noise at all points beyond the cross-over location. General curves giving these relationships are shown in Fig. 5. The decreases in EPNdB at the time of thrust reduction are shown in Table 2.[3]

If the population is concentrated in a noise sensitive area, a thrust reduction is beneficial. Otherwise, there is little benefit or need for a thrust reduction.

Noise Exposure Magnitude

The measurement and evaluation of a single aircraft flyover event is not sufficient to describe the scope of airport-community relationships for all of the operation at an airport. To fill this void, Noise Exposure Forecast (NEF) methodology has been developed. An NEF contour is constructed from the noisiness (in terms of subjective response) of a single

Fig. 3 Certification noise levels.

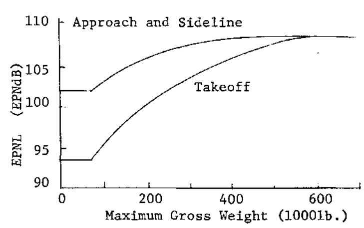
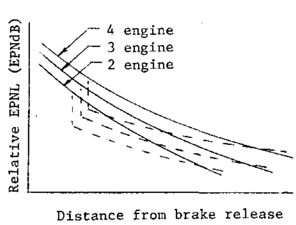


Fig. 5 Effect of thrust reduction.



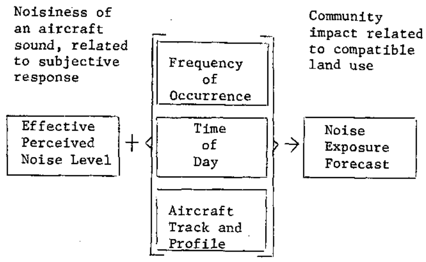


Fig. 6 Construction of the noise exposure forecast.

aircraft flyover to which is added consideration for frequency of occurrence, time of day and aircraft track and profile, which results in a criterion for evaluating community impact. NEF contour values decrease with increased distance from an airport. For areas near the airport where the NEF value is less than 30, case studies have shown that there should not be adverse effects from aircraft noise. For areas where the NEF value is more than 40, there could be considerable annoyance from aircraft noise. Figure 6 shows the construction of the noise exposure forecast.

The magnitude of the airport-community noise problem has been defined at several large airports in terms of noise exposure forecast areas and demographic data within these areas. Use of this methodology is helpful in defining existing and future problem areas. Table 3 shows the results of this type study for the International Airports in New York, Chicago, and Los Angeles.[4] For New York and Chicago, approximately twice as many people will be included within the NEF 30 area in 1975 as were in 1965.

The change in the magnitude of the problem stems primarily from the increased number of operations. In New York, e.g., the number of operations for 1975 is expected to increase by 137% over the number for 1965, forecast on the basis of demand for air commerce, if it can be handled.

The effect of number of operations should be considered, as well as the fact that whenever a new airport is constructed, there will be a minimum area exposed to aircraft noise unacceptable for many uses even though the number of operations is relatively small compared to older airports. That airport planners have recognized this phenomenon over the years is evidenced by the size of currently planned airports in comparison to existing airports. Los Angeles International Airport covers ~3000 acres (an older airport) while the new Dade County (Florida) Port Authority jetport will cover 24,960 acres, with a "buffer zone" at least one mile wide embracing the airport periphery against future noise complaints.

The size of the area exposed to aircraft noise, for a constant number of operations, is a function of the noise output of the aircraft using the airport. If other variables are held constant, the NEF value at any given location increases by 3 when the number of operations doubles. The NEF 40 area at a airport with a single runway, with 100 operations per day (0700-2200), for an average mix of 2-, 3-, and 4-engine short range current turbofans, would be approximately 2.5 sq miles. The NEF 30 area would be approximately 10 sq miles.[3]

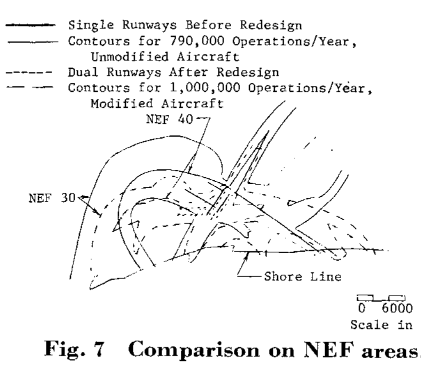


Fig. 7 Comparison on NEF areas.

Table 2 Decrease in noise levels due to thrust reduction after takeoff

Class aircraft	EPNdB decrease for 6% climb gradient Short flight	long flight
4-engine turbojet	6	4
4-engine turbofan (standard)	1	1
4-engine turbofan (stretched)	1	1
3-engine turbofan (standard)	6	6
3-engine turbofan (stretched)	4	4
2-engine turbofan	6	6
4-engine turbofan (jumbo)	4	6
3-engine turbofan (airbus)	4	4

Application of Noise Reduction Methods

To date results from research efforts in progress have been applied in two complementary analyses. In one study, a hypothetical airport was used;[3] in the other, an existing airport was utilized although the number of runways was increased and relocated into a new configuration.[5] The studies were undertaken to quantify the reduction in area and people exposed to aircraft noise.

The aircraft noise problem is complex, consisting of many parameters which have not been successfully formulated into a paradigm. Many diverse parties are affected by action or lack thereof, and can be grouped into: airline passengers, and operators, airport operators, aircraft and engine manufacturers, residents in the vicinity of airports, taxpayers of the community in which the airport is situated and taxpayers to the Federal Government, and the local business community and the local, state, and federal governments.

Depending on the perspective of the individual or group the following points may be beneficial or deterimental, i.e., a benefit or a cost. Suffice to say that regardless of viewpoint, a reduction in noise exposed area achievable without changing the average rate of air commerce industry growth is beneficial to the entire nation.

Effectiveness of Various Methods

An airport with a single runway was chosen, with only one runway direction used for departures and arrivals.[3] Aircraft were categorized into the 8 classes given in Table 2. Noise reductions achievable by a thrust reduction on takeoff, modification with acoustically lined nacelles, and retrofit of the NASA quiet engine were applied, and results measured in changes in relative land area in percent within NEF 30 and NEF 40 contours.

Table 4 shows a part of the results of this study. Changes in area vary from an increase of 10% to a reduction of 86%, illustrating the wide range of consequences attendant to any one abatement method. In a pragmatic sense, however,

Table 3 Populated land area and demographic data for NEF 30 areas around three international airports[4]

	New York		Chicago		Los Angeles	
	1965[a]	1975[b]	1965[a]	1975[b]	1965[a]	1975[b]
Population, millions	0.7	1.8	0.2	0.4	0.2	0.3
Total area, mile^2	80	122	72	123	34	44
Schools	80	122	86	142	58	84
Parks	19	37	48	60	18	22
Hospitals	3	12	4	4	8	9

[a] Based on the actual number of operations/year and the noise abatement procedures in use at that time.
[b] Based on demand forecast number of operations, and the noise abatement procedures in use in 1967. (Assuming airports can handle the demand.)

the methods must be applied to each given airport, with consideration given to the particular topographic, demographic, and atmospheric conditions there.

Application of Methods to an Existing Airport

John F. Kennedy International Airport, New York, was selected as an existing airport for application of the noise abatement methods. The New York City area is an excellent example of the "Achilles heel" analogy drawn earlier, since all recent attempts to increase the air traffic capacity of the area have been largely unsuccessful, mainly due to the efforts of unhappy residents of nearby communities. During the last half of 1968, after a summer of air-traffic delays that were sometimes as long as three hours, the growth rate dropped to 2.5%. By comparison, the national growth rate was up to 13%; traditionally, that at JFK has been about the same.

The existing runways were eliminated and a "dual-lane, multirunway" configuration was selected because it offers up to 1,000,000 operations per year. This runway configuration (shown on Fig. 7) was relocated so as to achieve maximum benefit from sparsely populated areas. Departure paths were located so as to achieve the highest altitude prior to overflying populated areas; arrival paths were located with the same objective in mind.

Aircraft were categorized into the eight classes shown in Table 2 with 1370 landings or departures per 24-hr period. Assignment of runway and flight-path utilization was made on the basis of recorded wind rose data. Historically, VFR conditions occur about 87.3% of the time at JFK while IFR exists about 12.7% of the time. Assignments to IFR and VFR flight paths were made accordingly.

Four separate sets of NEF calculations were made. Each set accounted for a different aircraft noise abatement method. The four sets of calculations were 1) Unmodified airline fleet—no thrust reduction on departure; 2) unmodified airline fleet—thrust reduced on departure at 3.5 naut miles from brake release; 3) modified airline fleet—no thrust reduction on departure; and 4) modified airline fleet—thrust reduced on departure at 3.5 naut miles from brake release. The results are summarized in Table 5. Based on these results, it can be concluded that

1) Maximum aircraft noise-exposed-area reduction is achieved with a modified fleet and thrust reduction at 3.5 naut miles.

2) Land area within the NEF 30 + contour is approximately 36 square miles, a reduction of 70% from the 122 square miles forecast to be within the NEF 30 + contour for the existing runway configuration with a theoretical capacity of 790,000 operations per year forecast for 1975. (790,000 operations per year could only be achieved at best with extensive delays/operation and capacity operation per 24-hr period, if then.) Clearly, the increased capacity and "rollback" of noise exposed area is significant.

3) Approximately 512,000 people will reside within the NEF 30 + contour compared to 1,800,000 for the 1975 existing-runway configuration a reduction of almost 72%.

Table 4 Relative NEF areas for noise abatement methods[a]

Method	Takeoff area 40+	Takeoff area 30-40	Takeoff area 30+	Landing area 40+	Landing area 30-40	Landing area 30+
Baseline	100	100	100	100	100	100
Thrust reduction[b]	97	110	108	...	...	...
Acoustically lined nacelles[c]	53	51	51	21	39	35
Quiet engine[d]	14	31	28	15	31	28

[a] Based on 100 takeoffs and 100 landings per day.
[b] See Table 2. increase due to mix of 90% 4-engine, 10% 2/3-engine aircraft.
[c] Based on reductions of 7–10 EPNdB for DC-8-50 type aircraft and 10–15 EPNdB for 707-320B type aircraft.
[d] See Fig. 4.

Table 5 Summary of JFK annual operations noise analysis, 1975

Airport configuration		Commercial jet fleet configuration/operating procedure: Baseline	Power cut[b]	Retrofit[c]	Retrofit with power cut
current[a] NEF					
Land (sq mi)	30+	122	112	100	53
	40+	36	40	24	16
People (No.)	30+	1,800,000	1,700,000	900,000	800,000
	40+	400,000	420,000	150,000	120,000
Redesigned NEF					
Land (sq mi)	30+	94	86	77	36
	40+	20	22	13	9
People (No.)	30+	1,200,000	1,100,000	600,000	500,000
	40+	140,000	150,000	70,000	60,000

[a] Based on 790,000 operations per year, the predicted 1975 demand without a fourth jetport. This capacity would have to be obtained by additional parallels to the existing runways.
[b] Thrust reduction at 3.5 naut miles from brake release to that power required for a 6% climb gradient.
[c] Four-engine airplanes modified with acoustically treated nacelles.
[d] Based on 1,000,000 operations per year.

4) The location of the nearest residents is as follows: arrivals—8,000 ft from the runway threshold; departures—18,000 ft from brake release; sideline—3700 ft for arrivals, 3000 feet for departures.

Figure 7 shows in pictorial form a comparison of the noise exposure area for NEF 30 and 40 contours for the year 1975 for the current JFK configuration (FAA Report DS-67-11, August 67) and the same contours for the redesigned (low noise profile) JFK configuration.

Metropolitan Planning

Nearly two-thirds of the total U. S. population now live in Standard Metropolitan Statistical Areas (SMSA's). The concept of an SMSA is that it is "an integrated, economic and social unit with a recognized large population nucleus." The Bureau of the Census population criterion for an SMSA is one or more central cities of 50,000 or more people. From 1960 to 1968 the population of 212 areas defined as SMSA's in 1960 grew by 15.6 million persons, an increase of 14% during this period as compared to a growth rate of six % for the non-metropolitan population. Since 1960 most metropolitan population growth has taken place outside of central cities; a majority of metropolitan residents now live in suburban areas. To accommodate this large population influx into the Nation's metropolitan areas, vast land areas are required for residential and associated land uses.

Table 6 indicates current and projected air carrier operations for 21 large air transportation hubs, and also population projectives for the SMSA's or combinations of SMSA's in which they are located. It is estimated that from 1965 to 1975 air carrier operations will increase by 88%, while during the same period the surrounding metropolitan areas will experience a population growth of better than 8 million persons. The SMSA's in which 21 hubs are located, with 66,980,000 persons in 1965 accounted for 55% of the total metropolitan population of the U. S. Also within these SMSA's are 7210 local government units (counties, municipalities, townships, school districts, and special districts), averaging 343 political units for each SMSA listed. A study of the 21 major hub airport areas shows that all are to some degree impacted by surrounding incompatible land uses, and prospects are that the continued competition for land will increase the conflicts between the airports and their neighbors.

Table 6 Air carrier operations for large hubs[6] and population for SMSA's[7]

Air transportation hub	Operations (in 000) 1965	Operations (in 000) 1975	Population (in 000) 1965	Population (in 000) 1975
New York/Newark[a]	589	1050	13,217	14,123
Chicago	442	753	6,688	7,288
Los Angeles	326	556	7,877	9,893
Washington, D.C.[a]	303	594	4,263	5,079
Atlanta	198	454	1,216	1,496
San Francisco	195	410	3,081	3,625
Miami[a]	177	377	1,502	1,958
Dallas/Ft. Worth	174	334	1,915	2,298
Detroit	167	292	3,987	4,174
Boston[b]	150	308	3,205	3,334
Philadelphia	131	238	4,659	5,080
Cleveland	128	206	1,871	1,956
Pittsburg	114	210	2,385	2,306
St. Louis	99	142	2,198	2,356
Denver	94	188	1,075	1,317
Minneapolis	85	162	1,611	1,814
Kansas City	80	151	1,116	1,200
Houston	80	159	1,494	1,843
Seattle[a]	79	175	1,522	1,704
New Orleans	76	162	973	1,107
Cincinnati	75	140	1,125	1,185

[a] Population for two SMSA's combined.
[b] Includes Boston, Lawrence-Haverhill, and Lowell SMSA's.

It is against this backdrop of increasing population growth, increasing airport operations and activity, and the multi-jurisdictional nature of the noise exposure problem that solutions for compatible development between the airport and its neighbors must be solved.

Elements of a Comprehensive Approach

Concurrent with the definition of the noise exposure a survey of land use and related data is needed to provide the basis for an assessment of the noise impact and possible land-based solutions. There are four major steps in this process.

Definition of existing noise exposure problems

Within projected NEF areas, examination of land use and related data to determine: a) number and kind of properties in indicating the noise sensitivity of the land uses; b) number and type of structure; c) number and characteristics of people; and d) value of residential and other noise sensitive properties. Special attention should be given to especially sensitive uses such as schools and hospitals.

Review of development actions that have reduced or intensified the community-aircraft noise problem

Identification of major development actions to isolate causes which may ameliorate the situation. Attempts to control development in noise exposed areas should be evaluated to determine their successes and failures.

Identification of land use related strategies

The range of land-use options appropriate for a given airport location needs to be identified and the cost associated with each estimated. Among these are: a) the preservation of open space; b) land use controls; c) redevelopment; d) insulation of existing buildings. The impact that each would have on the growth and operation of the airport must be determined. Legal review of enabling legislation and court decisions affecting local regulatory measures should be investigated.

Evaluation of alternatives

Estimates of nonresidential development in the noise areas and the potential additional use of the NEF areas for compatible development considering the affect of diversion of such development from other locations should be made. Analyses should also consider the impact of reuse of land in the affected areas on the region and communities in the environs, i.e., a) economic impact as it relates to employment patterns and tax base, b) social impact, including relocation problems, c) effects of land conversion on existing and proposed community land uses and the provision of public facilities, and d) relation to local planning proposals in these locations. The foregoing process should lead to recommendations to reduce airport-community noise conflicts and should include: a) estimates of cost; b) funding sources; c) timetables and phasing of the program.

Alternative Land-Use Strategies

Land-use strategies for aircraft noise abatement involve the control of future uses of land around the airport and the alternation of current uses, and the acoustical treatment of structures to reduce annoyance and interference to the occupants.

Zoning, the most common approach to controlling land use, has two major shortcomings. First, it is not retroactive and does not affect pre-existing uses that will conflict with airport operations. Secondly, jurisdictions with zoning powers (usually cities, towns) rarely take effecting zoning action. This is partly because the airport affects several jurisdictions and coordination of zoning is difficult. Another problem is that the interest of the community is not always consistent with the needs and interests of the aviation industry. The locality wants more tax base, population growth, and rising land values, all of which are not often consistent with the need to preserve the airport environs for other than residential uses. There is also the problem in that zoning vacant land for compatible uses of an exclusive nature, such as commercial or industrial, may be considered a "taking" if there is no demand for such activity. A possible solution to overcoming the problem of multi-jurisdictional interests in the airport environs would be to transfer zoning power to a regional authority, which could legitimately be given police powers. If airport environ zoning is not feasible for legal or political reasons, another approach needs to be tried.

Many airport authorities have eminent domain powers, and the purchasing of easements may offer some solutions in this field. If airport authorities were given an adequate source of funds, they could use eminent domain power to acquire development rights over land within noise exposed areas around airports.

An obvious third alternative in controlling land use is the use of urban renewal funds and the authority to eliminate existing incompatible uses. This technique raises many questions, but it may be worth exploring for severe noise-exposure situations. Substantial additional funding would be required and problems of relocation and neighborhood disruption would have to be handled in terms of benefits to the entire area.

In summary, the management of land use in noise-exposed areas whether through control of existing vacant land or redevelopment of currently noncompatible uses will require a comprehensive approach which involves planning, the political process, funding of programs, use of zoning processes, acquisition, and condemnation procedures. The decision to implement any noise abatement strategy, whether through operational procedures or land use change and management, will involve a balancing of interest between those who are interested in unrestricted expansion of airport operations and those who are concerned with the problems of community development. The management of an adequate aircraft noise abatement program must balance the goals and develop a plan which can be mutually accepted by the various parties.

Innovative Approaches to Compatible Land Use

Several approaches merit attention and evaluation to determine their usefulness for developing airport environs.

Joint airport-environs development

This concept is based on the fact that separation between the noise-generating components of an airport and adjacent land uses often requires enormous amounts of land which are difficult to keep in a state of nondevelopment due in no small part to economic growth pressures generated by the airport itself. It would, therefore, be desirable to commit the surrounding land to a more intensive form of development which is compatible with the airport and which could be developed jointly with it. The latter would then permit capitalizing on the growth generated by the airport and recovering, through increased land values and the development of income producing properties, and may defray some of the cost of developing the airport proper. There is some precedence for this concept in the joint development concept for highways presently being pursued by both HUD and DOT in the planning for freeway and related developments.

Noise encroachment zones

Since one of the major problems in controlling land uses around airports is the fragmentation of zoning powers among many individual municipalities, it would be desirable to develop an overriding mechanism, probably administered by the State government, which could be applied on top of or in addition to local zoning. A precedent for such action may be found in the flood encroachment zones which have been established by some states and which provide for the delineation of encroachment lines on either side of a streambed within which conditions are attached for the use and development of the properties. Using this principle, it might be possible for states to delineate noise encroachment zones within which it would be similarly illegal to construct or develop incompatible uses. This might be restricted to only certain uses or might preclude any urbanization of the area.

Building code noise attenuation districts

Ex post facto insulation of homes adversely affected by aircraft and other forms of noise is simply not sufficient protection for the average citizen. Too many individuals and families can unknowingly buy and rent in such areas and only later learn of the expenses they must undergo to take ameliorative action. It is much more desirable to control insulation requirements for such buildings, if they must indeed be constructed in such areas, from the outset. Insulation requirements should be a part of local building codes, without which building permits cannot be issued. This becomes an even more powerful tool when it is linked to an occupancy permit and an appropriate housing code. One of the problems with noise insulation requirements is that they are not appropriate nor required in many portions of the city and would simply operate to inflate the costs of housing, which is already too high in many areas. However, it is equally obvious that homes and other noise sensitive uses will continue to be built in noise affected areas simply because there is not enough land available elsewhere and because the noises are caused by various necessary service functions, e.g., roads and highways.

This being the case, it would be desirable to develop selective noise attenuation districts within which insulation would be required as a condition of issuing the building permit. The local municipality can delineate such districts around airports, railroad yards, expressways, and other such noise generators in a manner similar to the delineation of fire prevention districts as now practiced in most larger municipalities.

Prospects for a Quieter Metropolitan Area

Aircraft noise abatement in the environs of existing airports is a many faceted problem. Several vested interest groups are involved, each viewing the costs and effectiveness of alternative abatement means from at least a slightly different point. In addition to the technical problems involved, the picture is clouded by psychological reactions, since to date there is no evidence that any physiological damage has been done.

Regardless of viewpoint, a "roll-back" of exposed land areas and population while simultaneously maintaining current air commerce growth rate is desirable. The technical prospects for such a roll-back are encouraging. By implementing runway relocation plans, selected path and profile procedures, and nacelle and quiet engine technology, it should be possible to reduce the land area and population at many airports by close to 70% over that existing today. Whether or not these alternatives are implemented depends on economic and other related considerations. The extent of implementation of operational alternatives dictates to a large degree the scope of metropolitan planning for a compatible environment.

The interjurisdictional and metropolitan-wide nature of the airport impact requires that planning for both the airport and its impact be metropolitan in scale. Metropolitan and areawide planning is taking place in each of these metropolitan areas and is becoming more comprehensive including planning for the airport environs giving consideration to question of land use compatability, local controls in addition to the facility and service requirements of potential development that is expected to be generated by the airport.

References

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