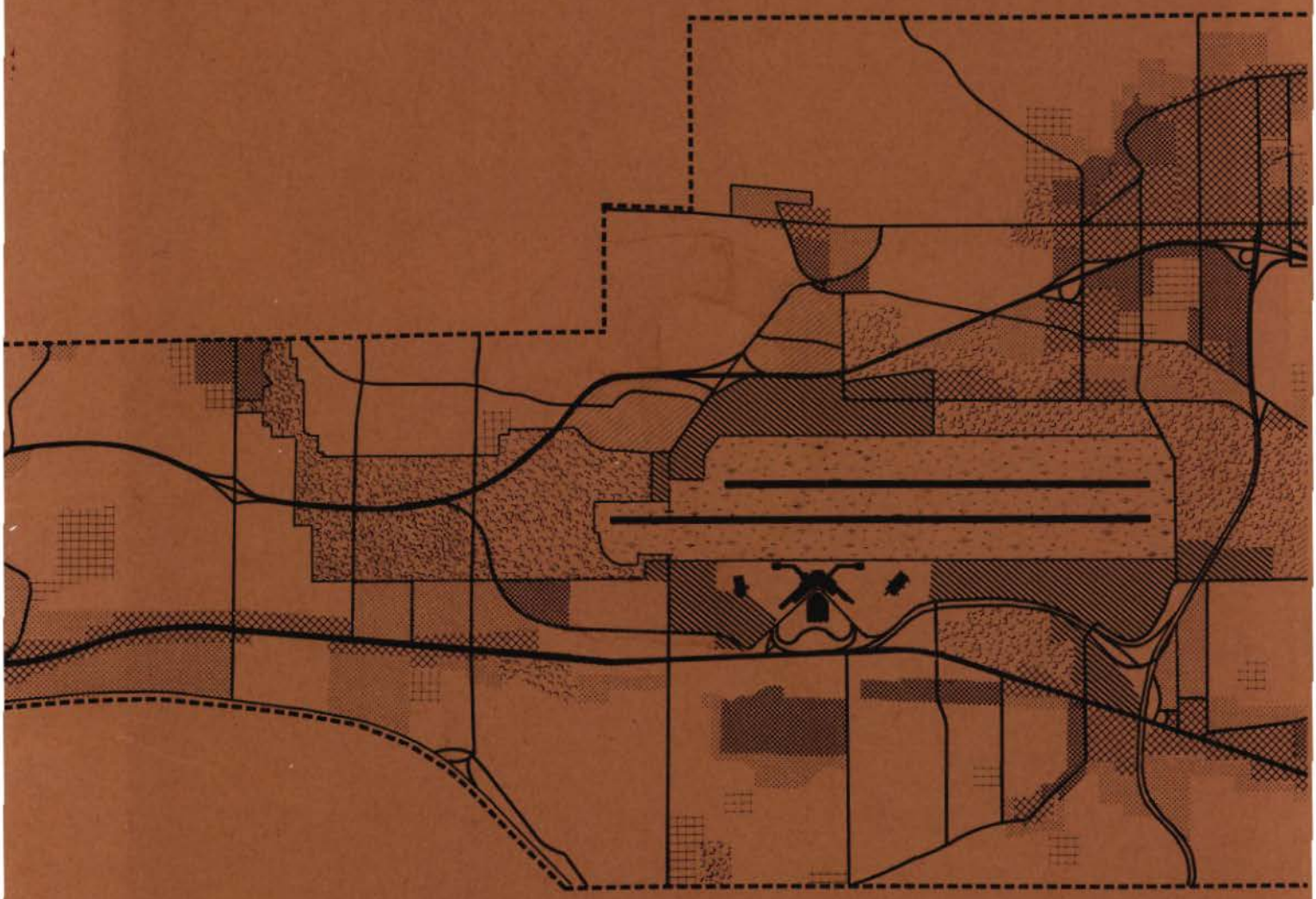
AC 150/5050-6

Airport-Land Use Compatibility Planning



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ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: AIRPORT-LAND USE COMPATIBILITY PLANNING

1. PURPOSE. This advisory circular provides generalized guidance for compatible land use planning in the vicinity of both new and existing airports. It is intended to assist airport sponsors, local government officials, and both airport and urban planners by presenting techniques and ideas available for planning and achieving long-term compatibility between airports and their environs. It also provides guidance which may be used in developing noise control plans as encouraged by the Department of Transportation Aviation Noise Abatement Policy issued on November 18, 1976.

2. CANCELLATION. Advisory Circular 150/5050-2, Compatible Land Use Planning in the Vicinity of Airports, dated April 13, 1967, is cancelled.

3. REFERENCES.

   a. The latest issuance of the following free publications may be obtained from the Department of Transportation, Publications Section, TAD-443.1, Washington, D.C. 20590. Advisory Circular 00-2, updated triannually, contains the listing of all current issuances of these circulars and changes thereto.

      (1) AC 00-2, Federal Register, Advisory Circular Checklist and Status of Federal Aviation Regulations.

      (2) AC 150/5050-4, Citizen Participation in Airport Planning.

      (3) AC 150/5100-7, Requirement for Public Hearing in the Airport Development Aid Program.

      (4) AC 150/5100-11, Land Acquisition and Relocation Assistance Under the Airport Development Aid Program.

Initiated by: AAP-440

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402

(5) AC 150/5190-4, A Model Zoning Ordinance to Limit Heights of Objects Around Airports.

(6) AC 150/5200-3, Bird Hazards to Aircraft.

(7) AC 150/5900-1, The Planning Grant Program for Airports.

b. The latest issuance of AC 150/5070-6, Airport Master Plans, which is a for-sale publication and can be found in AC 00-2, may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402. Use the GPO catalogue number when ordering, along with the FAA number and title.

c. Aviation Noise Abatement Policy, U.S. Department of Transportation, Federal Aviation Administration (FAA), November 1976, may be obtained from the Office of Environmental Quality, AEQ-120, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591.

d. Impact of Noise on People, U.S. Department of Transportation, Federal Aviation Administration, May 1977, may be obtained from the Office of Environmental Quality, AEQ-120, Federal Aviation Administration, 800 Independence Avenue, S.W., Washington, D.C. 20591.

e. FAA movie, "Where Airports Begin," a 20-minute sound and color 16mm film, may be obtained, on a loan basis, from: Film Library, AAC-44E, Federal Aviation Administration, P.O. Box 25082, Oklahoma City, Oklahoma 73125. Include title and film number (FA-05-75), the complete address where film is to be shipped, first choice of show date, and alternate choice of show date. Allow at least two weeks prior to showing date.

f. Major Airports and Their Effects on Regional Planning, U.S. Department of Housing and Urban Development, for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 2300-00264, 60 cents.

g. Airport Noise Impact: Planning Guidelines for Local Agencies, U.S. Department of Housing and Urban Development, November 1972, for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number 2300-00214, $5.60.

h. FAA Integrated Noise Model Version I (INM-1): Basic Users Guide for the Integrated Noise Model Version I, Report No. FAA-EQ-78-01, January 1978, and the FAA Integrated Noise Model (Brochure), Report No. FAA-EQ-78-02, January 1978, may be obtained from the National Technical Information Service, Springfield, Virginia 22151.

4. HOW TO OBTAIN THIS PUBLICATION. Additional copies of this circular, AC 150/5050-6, Airport-Land Use Compatibility Planning, may be obtained from the Superintendent of Documents, U.S. Government Printing Office. FAA field personnel may obtain copies from their respective Regional Distribution Officers.

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CHAPTER 1. INTRODUCTION

1. PURPOSE. This advisory circular has been prepared by the Federal Aviation Administration (FAA) to provide generalized guidance for compatible land use planning in the vicinity of both existing and new airports. It is intended to assist airport sponsors, local government officials, and both airport and urban planners by presenting techniques and ideas available for planning and achieving long-term compatibility between airports and their environs. It also provides guidance which may be used in developing noise control plans as encouraged by the DOT Aviation Noise Abatement Policy issued on November 18, 1976. These guidelines are general and should be considered as only one of many approaches. There are other techniques which can be used; the approach selected should be adjusted to suit the requirements of individual studies. The guidance is organized to provide a general discussion of airport-land use compatibility planning, with a series of appendices providing more specific examples of techniques and case studies. Compatibility planning is a continually evolving art; this advisory circular will be updated as the state of the art is enhanced by interagency experience in this significant area.

2. OBJECTIVES. The objective of airport-land use compatibility planning and implementation is the achievement and maintenance of compatibility between the airport and its environs. Inherent in this objective is the assurance that the airport can maintain or expand its size and level of operations to satisfy existing and future aviation demands and that persons who live, work, or own property near the airport may enjoy a maximum amount of freedom from noise or other adverse impacts of the airport. Equally important is the protection of the public investment in a facility for which there may be no feasible future replacement.

3. BACKGROUND.

   a. Need for Airport-Land Use Compatibility Planning. There are existing compatibility problems around many airports; conflicts between airports and their urban environments are evident across the United States. This represents a serious confrontation between two important characteristics of urban economics - the need for airports which meet transportation needs and the continuing demand for urban expansion. Airport owners are finding essential expansion to be difficult and expensive or even impossible at any cost. New residential and noise sensitive development seems to surround the airport on all sides and is the source of continual threat of law suits for noise damage. On the other hand, ordinary citizens with investments in homes view the airport and its noisy aircraft as a threat to both hearing and peace of mind. To them the airport seems to be ever expanding, with more and larger jets added every year.

There are often other important conflicts such as protection of runway approaches and the safety of persons and property on the ground. The conflicts may be reduced, however, and new ones substantially avoided through the development and implementation of airport-land use compatibility plans.

b. Aviation Noise Abatement Policy. The Secretary of Transportation and the FAA jointly issued an Aviation Noise Abatement Policy on November 18, 1976. The intent of the policy is to significantly reduce the adverse impacts of aviation noise upon the estimated six to seven million Americans presently impacted and to achieve a substantial degree of noise compatibility between airports and their environs. The policy recognizes that effective noise abatement requires coordinated actions by aircraft operator and owner, the FAA, airport sponsor, and airport neighbors. These actions include actual source noise reductions through aircraft retrofit/replacement; modifications in takeoff and landing procedures; and development of airport noise control and land use compatibility plans which have the objective of containing severe noise impacts within airport controlled areas through purchase of land, purchase of easements for development rights, changes in land use from noise sensitive to noise tolerant, acoustical treatment of critical noise sensitive uses, and the prevention of new incompatibilities through planning, public awareness, and locally adopted land use controls. A listing of the suggested actions which can be considered in development of a noise control plan is included in Appendix 3. The land use compatibility plan is a major segment of a total noise impact analysis which typically includes examination of the majority of the noise control planning activities outlined in that Appendix. The selection of specific aviation noise control actions can result in the determination of equally specific off-airport noise impact situations. These aviation to land use trade offs require investigation and weighing within the context of the overall compatibility planning process.

c. Airport and Community Interrelationships. The airport and the community exert a number of important influences upon each other. Those influences may be generally classified as economic, social, and environmental; and they must be taken into consideration during the process of developing a compatibility plan. The plan must also be integrated into the applicable comprehensive plans of the community, county, metropolitan area, or region.

(1) Economic. The airport and the community have an interdependent economic relationship which must be considered in the compatibility planning process. Although an airport's economic role in the community varies with size, it can be a significant employment center and often has adjacent commercial or industrial development which amplifies this role. This, in turn, affects

housing location, streets, and utilities. The airport is an entry port for the air-traveling vacationer or business people and can provide cargo, mail, and emergency transportation services. In many instances, the size, location, and capacity of the local airport are major considerations in the selection of new sites by industries of national stature. The airport is also a magnet for urbanization and an important shaper of the community's growth patterns. Conversely, the airport is dependent on the economic posture of the community. Often the airport will be a publicly owned facility and may be dependent on local tax support. In such a circumstance, the airport is dependent on support by local governments and citizens for revenue and/or general obligation bonds and for acceptance of Federal or state aid funds. The public's investment includes not only the obvious direct cost of the airport but also the opportunity costs, the expended social and environmental costs, the commitments and economic costs of private investment associated with the airport, and the costs of other public investments in the infrastructure necessitated by the airport in its present location.

(2) Social. The airport plays several important social roles in the life of the community. For a city with scheduled air carrier service, the airport can be a principal transportation link. For smaller isolated communities, the airport provides a vital emergency link for transporting the critically ill, as well as providing access for flying business people or farmers. The airport's influence upon the community's growth patterns, coupled with its possible traffic and noise impacts, affects the desirability of housing areas and hence the spatial aspects of the community's social structure.

(3) Environmental. Although noise is the most apparent environmental impact of the airport upon the community, there are others resulting from ground access and air and water pollution. Ground access, i.e., vehicular traffic, is often an overlooked environmental impact of airports. However, access routes can be designed to minimize pollution and community disruption. The airport's large open spaces can often have a beneficial effect upon the environment, allowing for dissipation of urban air pollution, surface water percolation, and visual relief from too much urbanization.

d. Safety. Safety of flight operations and safety of the public must be overriding factors during the consideration of various schemes to achieve or improve airport-environs compatibility. This could include actions which relate to protecting runway approaches from any form of interference or avoiding concentrations of people in airport approach areas. Safety is a primary consideration in

developing airport or flight operational changes designed to lessen noise impacts.

4. AIRPORT-LAND USE COMPATIBILITY PLANNING. For purposes of this guidance, "Airport-Land Use Compatibility Planning" includes the planning, implementation, and adoptive actions taken to achieve compatibility between the airport and its environs. This planning takes into account the existing and future needs of the airport as well as the existing and future needs of the surrounding areas. It typically consists of these major parts: the compatibility plan, plans and strategies for official adoption, and a procedure to assure monitoring and periodic review of the plan. There is significant interaction among the components, and in practice they should be developed concurrently. A brief overview is provided of each component with more detail included in ensuing chapters. It is also noted that the scale of the planning effort should be proportional to the existing or potential compatibility problems of the individual airport-environs situation.

   a. Compatibility Plan. The compatibility plan includes both a physical plan and an implementation program. It is normally prepared through the cooperative efforts of both the airport sponsor and the local planning agency(s) with inputs from the FAA, airport users, and residents of the airport's environs.

   b. Plans and Strategies for Official Adoption. Adoption and execution are obvious and critical aspects of the process which lead to achieving airport and environs compatibility. Developing an airport-land use compatibility plan without adopting it or providing for its execution can only be considered an "exercise." Official plan adoption, however, can be a time-consuming process with numerous pitfalls. This portion of the plan develops strategies and procedures to smooth the way for adoption and to help assure the execution of the plan.

   c. Plans for Monitoring and Periodic Review. Urban areas are in a continual state of change. Population growth and speculative entrepreneurism generate continuous pressure against zoning and other development controls established to achieve and protect compatibility. Because of this, a continual or periodic review and feedback process should be established to monitor the compatibility and implementation plan. During initial plan development, the frequency of review as well as the responsibility for this review by the airport sponsor and local planning authorities should be clearly defined.

5. RESPONSIBILITY FOR AIRPORT-LAND USE COMPATIBILITY PLANNING. The basic responsibility for this compatibility planning lies with the airport sponsor and with the local governments exercising land use and development control over the land areas affected by the airport.

These two groups have, between them, the planning and implementation authority to conduct the study and to execute the plan via the implementation program. This responsibility of the airport sponsor is articulated in the DOT Aviation Noise Abatement Policy (discussed in paragraph 3b) as well as in the Airport and Airway Development Act of 1970, as amended, through its requirement that sponsors receiving Federal airport development assistance must assure that, "appropriate action, including the adoption of zoning laws, has been or will be taken, to the extent reasonable, to restrict the use of land adjacent to or in the immediate vicinity of the airport to activities and purposes compatible with normal airport operations, including landing and takeoff of aircraft." Cooperative and constructive efforts are also required of airport users, the FAA, and interested or affected citizens.

6. CITIZEN INVOLVEMENT. The active participation of affected citizens in the compatibility planning process is desirable and is recommended. Guidance for a citizen participation program is contained in AC 150/5050-4, Citizen Participation in Airport Planning. However, because of the relevancy to compatibility planning, the following definition of citizen participation as well as the objectives and timing for a citizen participation program are presented.

   a. Citizen Participation. Citizen participation is defined as an open process in which the rights of the citizen to be informed, to influence, and to receive an adequate response from government are reflected, and in which a representative cross section of affected citizens interact with appointed and elected officials on all issues of planning and development. The participants in the process identify and examine all reasonable alternatives and their consequences to assist the appropriate decision makers in choosing the course of action that they believe to be needed and that they feel will best serve the needs and objectives of the community. In airport planning, the interaction in a given planning study takes place between the citizens and those planners and officials charged with the conduct of the study.

   b. Objectives. The basic objectives of citizen participation in the compatibility planning process are improved planning, minimization of controversy, and citizen support of the final plan. The planning can often be improved through the interaction of citizens and planners throughout the planning process and through clear identification of citizen views on all proposals. Citizen input is also invaluable in identifying the goals, objectives, and values of the affected communities or jurisdictions. Controversy can be minimized by identifying and resolving sensitive issues via citizen involvement before they become controversial. The citizen's involvement with the planning study and consequent understanding of its benefits, the

constraints encountered, and the trade offs necessary for their resolution can generate citizen support for the plan. Citizen participation is also an educational process which informs the general public of conflicts between airport use and other adjacent land use as well as the justification for using community resources.

c. Timing. Citizen involvement has its greatest effect during the formative stages of the planning process, before irreversible decisions have been made, and while the maximum number of alternative actions are still available. Citizen support is significantly enhanced by an early involvement in the study which may begin during the development of the work program. The earlier issues are recognized, the greater flexibility there is in planning. The planners may then proceed in reasonable confidence that their actions are in accord with community and citizen needs and desires. When the citizens become involved before major decisions or commitments are made, the planners can better deal with issues of community concern and improve the chances of reaching a solution on controversial matters. Chances that planning decisions may be overturned by adverse reactions at public hearings or referendums can then be greatly reduced. Conversely, the frustration generated if citizens become aware that the important decisions were made before they were invited to participate can quickly translate into distrust of the planners and into project opposition. When the public involvement opportunities are provided late in the planning process, there is greater reluctance to make changes. The tendency, instead, is to defend previously determined courses of action rather than to explore any new information or views received.

7. JOINT-USE AIRPORTS AND AICUZ. The U.S. Department of Defense has developed the Air Installation Compatible Use Zones (AICUZ) program for achieving compatibility at military air installations. The AICUZ is the military equivalent of the compatibility guidance contained in this advisory circular and is designed to take into account the special considerations necessary for military operations. It may also be in use or more suitable for use at joint civil-military use airports where there is a significant level of military operations. The goal of the program is to foster land use planning in areas surrounding military air installations consistent with the health, safety, and comfort of area users and with air operations at the installations. Additional information on the AICUZ and its use may be obtained from either the U.S. Air Force or the U.S. Navy at the following addresses:

Environmental Planning Division (AF/PREV)
Directorate of Engineering and Services
HQ U.S. Air Force
The Pentagon
Washington, D.C. 20330

AICUZ Project Office
Office of the Chief of Naval Operations
Hoffman II Building, Room 11567
200 Stovall Street
Alexandria, Virginia 22332

8. FINANCING THE AIRPORT-LAND USE COMPATIBILITY PLAN. Development and implementation of a compatibility plan is an expensive and time-consuming process. Although a study may be undertaken independently by a locality, it may also be accomplished at many public-use airports with the financial assistance of a Federal planning grant. The Airport and Airway Development Act of 1970, as amended, provides for this planning assistance through the Planning Grant Program (PGP). The PGP is administered by the FAA and provides Federal assistance for developing eligible airport master plans and airport system plans. For assistance under the PGP, land use planning studies are normally conducted in conjunction with preparing a complete airport master plan since future airport requirements may affect airport vicinity land use recommendations. This approach also permits changes in airport development proposals to achieve greater airport-environs compatibility. If a current airport master plan is available, a land use planning study may be funded as a supplement to the master plan. For Federal assistance, cosponsorship by the airport sponsor and the local government land use jurisdiction or an areawide planning organization is normally required. Detail regarding application procedures and sponsor and project eligibility is discussed in AC 150/5900-1, The Planning Grant Program for Airports. Department of Housing and Urban Development (HUD) Title 701 Planning Assistance Funds may also be available to eligible agencies for airport impact studies; detail regarding eligibility and application procedures may be obtained from HUD field offices.

9.-19. RESERVED.

CHAPTER 2. THE COMPATIBILITY PLAN

20. INTRODUCTION AND OVERVIEW. Compatibility planning has the overall goal of achieving an acceptable balance between the needs and tolerances of both the airport and its neighbors. The planning process requires that both the airport and the communities in its environs remain open and flexible, recognizing that some changes to present courses of action may be essential if compatibility is to be achieved. The planning approach discussed here is equally applicable to both new and existing airports. In the case of new airports, the emphasis would be upon preventative actions while for existing incompatibilities corrective measures would be examined.

a. Introduction. The compatibility plan includes both a physical plan and an implementation program. It is normally prepared through the cooperative efforts of the airport sponsor and the local planning agency(s). Inputs from both airport users and citizens affected by the planning are essential to the study effort and are best obtained through a citizen participation program.

(1) The physical plan describes both the location of the airport's noise and other impacts, fully reflecting agreed-upon noise control actions, and the basic land use and development patterns compatible with the airport's impacts and with the community's planning, goals, and needs. The plan should also indicate, as may be appropriate, other pertinent planning information such as thoroughfares, public facilities, or public transit. The plan should be viewed as a more detailed segment of the community or regional comprehensive plan. Use of FAA's Integrated Noise Model is encouraged in developing a compatibility plan.

(2) The implementation program is the detailed action program which executes and accomplishes the plan. It is an essential ingredient of the compatibility plan and is developed concurrently with and is in continuous interaction with the physical plan. In implementing the plan, a combination of strategies to reduce and control airport noise, prevent the creation of new incompatibilities, and resolve existing incompatibilities can be used. For best results, the program should be presented graphically, as well as verbally. For instance, when zoning is indicated as an implementation tool, the presentation should include a map of the recommended zoning and the texts of any new zoning districts. A typical program also includes an implementation schedule, the proposed financing scheme, and draft documents for adoption by the appropriate governments or agency accepting responsibility for accomplishing each of the various parts of the plan.

b. Overview.

(1) Land Use Guidance. A compatibility guidance system is described in paragraph 21 which introduces an approach to airport noise evaluation and compatibility planning. The airport's noise is divided into a series of quality zones which are then related to a comprehensive listing of land use categories. Injected into this process are community goals, values, and needs. The resulting land use to airport noise relationships are then used as planning inputs.

(2) Planning Actions. The development of an airport-land use compatibility plan, which is composed of both the physical plan and the implementation program, normally involves the following planning actions. These actions will have varying degrees of emphasis and will likely require adjustment as the planning proceeds, depending on the particular case.

(a) Identification of community goals, values, and needs.

(b) Development of work program.

(c) Identification of existing and future aviation needs and resulting impact patterns.

(d) Identification of study area.

(e) Identification of land use-noise exposure criterion.

(f) Identification of existing and unconstrained future land use patterns.

(g) Development of alternative compatibility schemes.

(h) Selection of preferred alternative, development into a plan, and recommendation of the plan for adoption.

These actions are discussed in greater detail in paragraph 22.

21. LAND USE GUIDANCE ZONES. The Land Use Guidance Zone (LUG) system is a uniform noise evaluation technique which directly relates to land use compatibility planning and which constitutes a single system for determining the impact of noise upon individuals resulting from the operations of an airport. The LUG system utilizes any of the common noise estimating methodologies as input and translates these via a series of noise quality zones into categories of land use compatible to the existing and forecast noise impacts of the particular airport or other noise source under study. A significant characteristic of the LUG system is that community goals, values, and needs are injected thereby refining the outputs to closely comply with the individual character of each of the affected communities. The LUG system may be used in

similar fashion to generate categories of land use compatible with highway, rail, or other noise sources when day-night average sound level (L_{dn}) is used as the primary noise input.

a. Airport Noise Interpolation - LUG Chart I. LUG Zones A, B, C, and D, as shown on Chart I, represent four levels of airport noise impact ranging from minimal for LUG A to severe for LUG D. LUG Chart I is used to interpolate noise inputs derived from the common airport noise estimating methodologies into LUG zones. These common methodologies include: The L_{dn}; Noise Exposure Forecast (NEF); Composite Noise Rating (CNR); and Community Noise Equivalent Level (CNEL). More detail on these is provided in Appendix 2. Others may be usable as inputs if they can first be interpolated into one of the given methodologies. The Integrated Noise Model (INM), latest and most sophisticated of the approaches, may be used to generate L_{dn} data as well as data for the site analyses often required for environmental impact statements (see paragraph 3, Appendix 2) and is recommended. The Department of Housing and Urban Development (HUD) Noise Assessment Guidelines are acceptability guidelines for site exposure to noise and are used for screening mortgaging guarantees and other HUD assistance. They are included for information and comparability purposes. The suggested noise controls are a generalized description of the actions typically desirable. The controls recommended for a specific airport-environs situation should be tempered to the individual situation.

b. Land Use Noise Sensitivity Interpolation-LUG Chart II. Different uses of the land have different sensitivities to noise. Schools, residences, churches, and concert halls are very sensitive to noise. By contrast, factories, warehouses, storage yards, and open farm land are relatively insensitive to noise. Other uses, such as offices, shopping centers, recreation areas, or hotels have intermediate levels of noise sensitivity. A table of suggested relationships of aircraft noise to categories of land use is shown in Land Use Guidance Chart II, Land Use Noise Sensitivity Interpolation. The term "suggested" is important since it is intended that these relationships be used only as starting points. Specific relationships should be established for each study via citizen involvement and the consideration of community goals. The noise exposure criterion that is considered appropriate by one community may not be considered appropriate by another. By starting with the suggested LUG value for each land use category as shown in LUG Chart II and weighing it against the identified community goals, LUG values can be established for each needed land use category. The selected value may be higher or lower than the suggested value, however, there are extra costs usually associated with each increase in compatibility quality. In general, all land within LUG Zone D should either be under positive control of the airport or be used only for those land uses which have little sensitivity to aircraft noise. An FAA goal as expressed in the Aviation Noise Abatement Policy is to confine, insofar as possible,

LAND USE GUIDANCE CHART I: AIRPORT NOISE INTERPOLATION

LAND USE GUIDANCE ZONES (LUG)	NOISE EXPOSURE CLASS	INPUTS: AIRCRAFT NOISE ESTIMATING METHODOLOGIES				HUD NOISE ASSESSMENT GUIDELINES	SUGGESTED NOISE CONTROLS
		L_{dn} DAY-NIGHT AVG. SOUND LEVEL	NEF NOISE EXPOSURE FORECAST	CNR COMPOSITE NOISE RATING	CNEL COMMUNITY NOISE EQUIVALENT LEVEL		
A	MINIMAL EXPOSURE	0 TO 55	0 TO 20	0 TO 90	0 TO 55	"CLEARLY ACCEPTABLE"	NORMALLY REQUIRES NO SPECIAL CONSIDERATIONS
B	MODERATE EXPOSURE	55 TO 65	20 TO 30	90 TO 100	55 TO 65	"NORMALLY ACCEPTABLE"	LAND USE CONTROLS SHOULD BE CONSIDERED
C	SIGNIFICANT EXPOSURE	65 TO 75	30 TO 40	100 TO 115	65 TO 75	"NORMALLY UNACCEPTABLE"	NOISE EASEMENTS, LAND USE, AND OTHER COMPATIBILITY CONTROLS RECOMMENDED
D	SEVERE EXPOSURE	75 & HIGHER	40 & HIGHER	115 & HIGHER	75 & HIGHER	"CLEARLY UNACCEPTABLE"	CONTAINMENT WITHIN AIRPORT BOUNDARY OR USE OF POSITIVE COMPATIBILITY CONTROLS RECOMMENDED

NOTES FOR LAND USE GUIDANCE CHART I

LUG - Land Use Guidance Zone (see paragraph 21).
LUG Zones are inputs to the compatibility planning process and are not intended for use in making direct comparisons of the various noise estimating methodologies.

L_{dn} - Day-Night Average Sound Level (see Appendix 2, paragraph 4).

NEF - Noise Exposure Forecast (see Appendix 2, paragraph 5.)

CNEL - Community Noise Equivalent Level (see Appendix 2, paragraph 6).

CNR - Composite Noise Rating (see Appendix 2, paragraph 9).
Note: Caution is suggested in applying CNR methodology to general aviation airports since in such use it tends to exaggerate indications of noise impacts.

The DOT/FAA Integrated Noise Model (INM) will produce contours for L_{dn}, NEF, and CNEL, as well as additional measures (see Appendix 2, paragraph 3).

HUD Noise Assessment Guidelines - Acceptability guidelines for site exposure to aircraft noise. The Department of Housing and Urban Development (HUD) promulgated a policy (Circular 1390.2, July 1971) and published Noise Assessment Guidelines (TE/NA-171, August 1971) for establishing noise levels and acceptability guidelines for site exposure to noise to be used for screening mortgaging guarantees and other HUD assistance. These acceptability categories are interpolated from Table I of TE/NA-171 and are shown for illustrative purposes to assist planners in relating HUD screening guidelines to the compatibility planning process. Although the guidelines control HUD assistance, they do not necessarily inhibit the actions of other financial institutions.

Suggested Noise Controls - These suggestions are generalized; see Chapter 3 for developing specific controls.

LAND USE GUIDANCE CHART II: LAND USE NOISE SENSITIVITY INTERPOLATION

LAND USE		LUG ZONE[1]		LAND USE		LUG ZONE[1]		LAND USE		LUG ZONE[1]	
SLUCM NO.	NAME	SUG-GESTED	STUDY	SLUCM NO.	NAME	SUG-GESTED	STUDY	SLUCM NO.	NAME	SUG-GESTED	STUDY
10	Residential.	A-B		30	Manufacturing (continued).[2]			60	Services.[4]		
11	Household units.			31	Rubber and miscellaneous plastic products—manufacturing.	C-D		61	Finance, insurance, and real estate services.	B	
11,11	Single units—detached.	A		32	Stone, clay, and glass products—manufacturing.	C-D		62	Personal services.	B	
11,12	Single units—semiattached.	A		33	Primary metal industries.	D		63	Business services.	B	
11,13	Single units—attached row.	B		34	Fabricated metal products—manufacturing.	D		64	Repair services.	C	
11,21	Two units—side-by-side.	A		35	Professional, scientific, and controlling instruments; photographic and optical goods; watches and clocks—manufacturing.	B		65	Professional services.	B-C	
11,22	Two units—one above the other.	A		39	Miscellaneous manufacturing.	C-D		66	Contract construction services.	C	
11,31	Apartments—walk up.	B		40	Transportation, communication, and utilities.			67	Governmental services.	B	
11,32	Apartments—elevator.	B-C		41	Railroad, rapid rail transit, and street railway transportation.	D		68	Educational services.	A-B	
12	Group quarters.	A-B		42	Motor vehicle transportation.	D		69	Miscellaneous services.	A-C	
13	Residential hotels.	B		43	Aircraft transportation.	D		70	Cultural, entertainment, and recreational.		
14	Mobile home parks or courts.	A		44	Marine craft transportation.	D		71	Cultural activities and nature exhibitions.	A	
15	Transient lodgings.	C		45	Highway and street right-of-way.	D		72	Public assembly.	A	
19	Other residential.	A-C		46	Automobile parking.	D		73	Amusements.	C	
20	Manufacturing.[2]	C-D		47	Communication.	A-D		74	Recreational activities.[5]	B-C	
21	Food and kindred products—manufacturing.	C-D		48	Utilities.	D		75	Resorts and group camps.	A	
22	Textile mill products—manufacturing.	C-D		49	Other transportation, communication, and utilities.	A-D		76	Parks.	A-C	
23	Apparel and other finished products made from fabrics, leather, and similar materials—manufacturing.	C-D		50	Trade.[4]			79	Other cultural, entertainment, and recreational.[5]	A-B	
24	Lumber and wood products (except furniture)—manufacturing.	C-D		51	Wholesale trade.	C-D		80	Resource production and extraction.		
25	Furniture and fixtures—manufacturing.	C-D		52	Retail trade—building materials, hardware, and farm equipment.	C		81	Agriculture.	C-D	
26	Paper and allied products—manufacturing.	C-D		53	Retail trade—general merchandise.	C		82	Agricultural related activities.	C-D	
27	Printing, publishing, and allied industries.	C-D		54	Retail trade—food.	C		83	Forestry activities and related services.	D	
28	Chemicals and allied products—manufacturing.	C-D		55	Retail trade—automotive, marine craft, aircraft, and accessories.	C		84	Fishing activities and related services.	D	
29	Petroleum refining and related industries[3]	C-D		56	Retail trade—apparel and accessories.	C		85	Mining activities and related services.	D	
				57	Retail trade—furniture, home furnishings, and equipment.	C		89	Other resource production and extraction.	C-D	
				59	Retail trade—eating and drinking. Other retail trade.	C-D		90	Undeveloped land and water areas.		
								91	Undeveloped and unused land area (excluding noncommercial forest development).	D	
								92	Noncommercial forest development.	D	
								93	Water areas.	A-D	
								94	Vacant floor area.	A-D	
								95	Under construction.	A-D	
								99	Other undeveloped land and water areas.	A-D	

1. REFER TO LAND USE GUIDANCE CHART I, PAGE 12.
2. ZONE "C" SUGGESTED MAXIMUM EXCEPT WHERE EXCEEDED BY SELF GENERATED NOISE.
3. ZONE "D" FOR NOISE PURPOSES; OBSERVE NORMAL HAZARD PRECAUTIONS.
4. IF ACTIVITY IS NOT IN SUBSTANTIAL, AIR-CONDITIONED BUILDING, GO TO NEXT HIGHER ZONE.
5. REQUIREMENTS LIKELY TO VARY — INDIVIDUAL APPRAISAL RECOMMENDED.

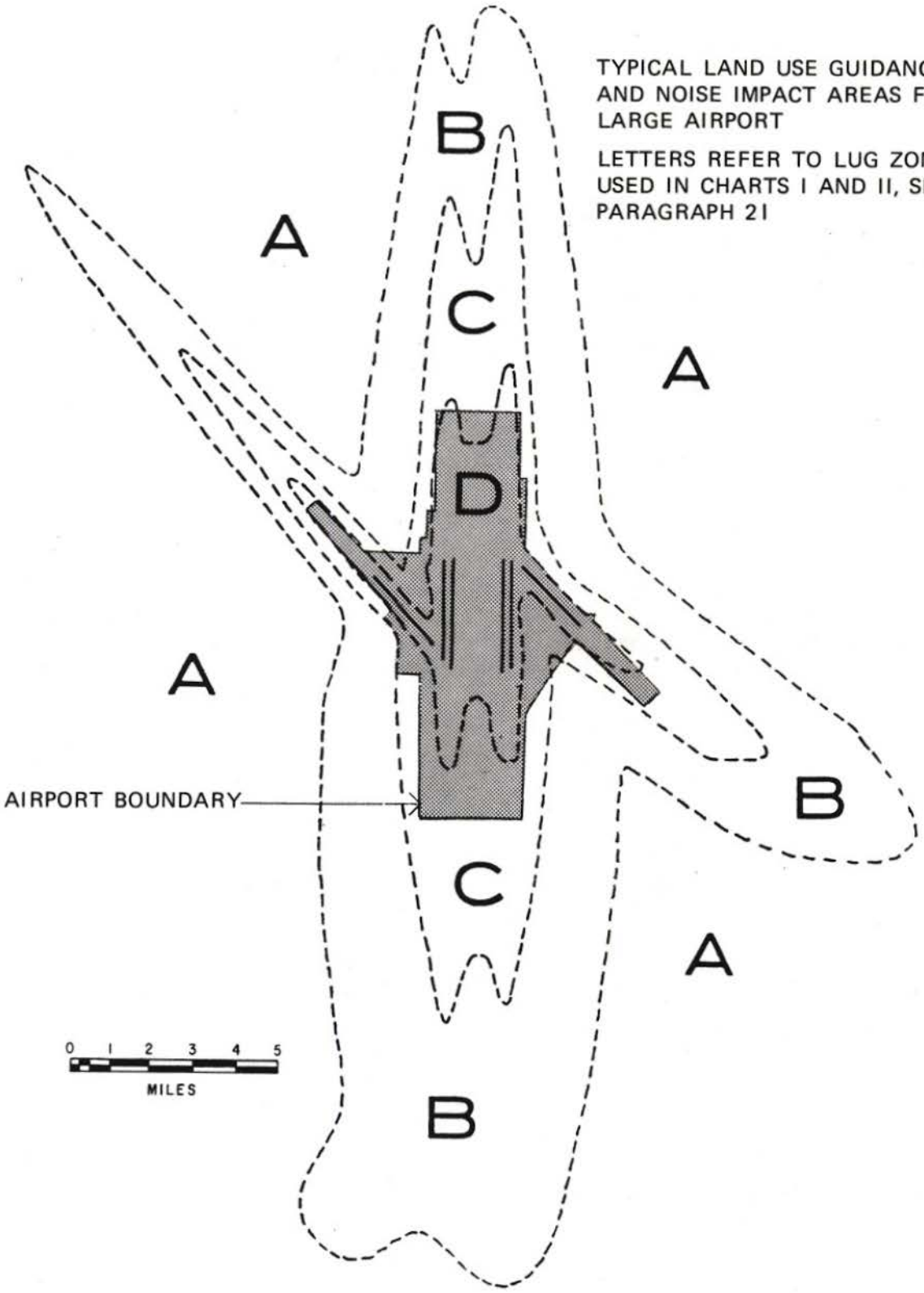
SLUCM: STANDARD LAND USE CODING MANUAL, SEE PARAGRAPH 21

severe aircraft noise exposure levels to the areas included within the airport boundary or over which the airport has a legal interest, to preclude development of noise sensitive areas therein, and to reduce substantially the number and extent of noise sensitive areas in the vicinity of airports subject to significant noise exposure. Land within LUG Zone A, however, may be used for almost any land use. In fact, normal urban noises such as auto traffic, motorcycles, lawnmowers, or air conditioners will often be greater intrusions than aircraft noise within this zone. Land within LUG Zones B and C may be used for a variety of land uses of intermediate sensitivity to aircraft noise and is usually the area where trade offs in uses require the most examination. Uses located within soundproofed structures may normally be placed in more intensive LUG zones. The land use categories in Chart II were developed by the Federal Highway Administration and HUD for their Standard Land Use Coding Manual (SLUCM). This manual has been in use since 1965 and is a standard planning reference.

22. PLANNING ACTIONS.

a. Identification of Community Goals, Values, and Needs. The community's goals, values, and needs serve as a base for projecting the future growth of the community, future growth of the airport, and for identifying the land-use noise exposure criterion. Many communities have already identified their goals, values, and needs through either a "goals" program or a comprehensive planning program. When this has not been done, they need to be identified only to the degree necessary to give direction to the compatibility study. Detailed discussion of a community goals program is, however, beyond the scope of this guidance.

b. Development of Work Program. The work program presents a description of what is to be accomplished, how it is to be done, and the responsibilities for accomplishment. Such a program should consist of a statement of objectives, a list of planning criteria, and a detailed outline of the planning steps. A statement of objectives is a single clear and concise statement of what is to be accomplished by the study. The planning criteria spell out the specific points which must be satisfied by the completed study and are more detailed statements based upon the study objectives and community goals, values, and needs. The detailed outline of the study describes each work step to be undertaken including planning responsibilities and coordination requirements. Substantial citizen involvement is suggested throughout this stage. Examples are contained in Appendix 1.



AIRPORT NOISE PATTERNS

c. Identification of Existing and Future Aviation Needs and Resulting Noise Patterns.

(1) Identification of Aviation Needs. The identification of the community's aviation needs is best accomplished in airport master planning. This process, as discussed in AC 150/5070-6, Airport Master Plans, is primarily the responsibility of the airport planning team with the citizens or a citizen planning group providing inputs and planner-citizen interaction. During this analysis, the airport's existing and forecast aviation needs are defined. This includes examination of general aviation requirements and forecasting passenger levels and numbers and types of air carrier aircraft which will be using the airport. From this information, the airport's future needs in terms of runways and taxiways, overall airport size, terminal facilities, and ground access requirements are determined.

(2) Noise Contours and LUG Zones. Noise contours are prepared by the planning team for each runway for both present and future conditions and for the airport's development alternatives by using the information obtained in the previous step and one of the standard methodologies for estimating airport noise impact. Noise patterns developed for the airport should also take into account all feasible noise reduction alternatives. Much can be accomplished in reducing the need for airport vicinity land use disruptions by first reducing the aircraft noise generated to the practical minimum and then channeling the remaining noise impacts into the less sensitive hours of the day and/or into corridors of maximum noise tolerance. Using LUG Chart I, the noise contours are converted into LUG zones. They will be used in this form throughout the remainder of the study. Where there are significant existing compatibility problems, it may be desirable to supplement the estimated existing noise contours with actual measurements. Also, where there are existing noise sensitive uses (as identified and described in paragraph 22e) located within LUG Zone C or D, the Integrated Noise Model (INM) noise analysis is suggested.

d. Identification of Study Area. The study area should be defined by giving consideration to noise exposure, jurisdictional boundaries, terrain features, urban characteristics, data resources, and other criteria as may be appropriate in the given situation. For practical purposes, this may usually be limited to areas within LUG Zones B, C, and D. In using the LUG zones as study area criteria, however, it should be noted that at the A/B boundary one out of every four people is either annoyed or highly annoyed by airport noise and that at the B/C boundary two out of every three people are either annoyed or highly annoyed (source: FAA, Impact of Noise on People,

Table III). Consideration should also be given to dividing the total study area into a general study area and an intensive study area. The intensive study area could be limited to areas having significant or severe noise exposures and the general study could cover the moderately exposed or presently undeveloped areas. Differing degrees of analysis are normally appropriate for these two areas.

e. Identification of Land Use-Noise Exposure Criterion. Using the approach discussed in paragraph 21b, the land use to noise exposure criterion is identified. These values, noted in the "study" column of LUG Chart II, are to be used for the study. Where multiple communities are involved and their goals and values differ significantly, it may be necessary for criterion to be identified for each of the jurisdictions. Although this entails extra effort in criteria identification, it permits generation of a compatibility plan more reflective of local needs.

f. Identification of Existing and Unconstrained Future Land Use Patterns. This involves identifying both the existing and unconstrained future land use patterns in the study area. For communities having comprehensive plans with viable land use elements, the identification of these existing and future use patterns is a relatively easy step. Without such plans, this can be a major and time-consuming requirement. Existing land use patterns are identified by a visual survey in which the use of each parcel of land in the airport vicinity is determined, categorized via a standard land use classification system as discussed in paragraph 21, and indicated on a map via an appropriate color or symbol. Citizen participants may assist in making such a survey. Unconstrained future land use patterns are the forecast future land use patterns unconstrained by any airport compatibility planning or controls other than may presently exist. Their identification is important as an indicator of the growth trends that must be countered or reinforced in developing the alternative compatibility schemes. The identification of these future patterns is somewhat more complex and involves primarily the professional planners on the planning team.

g. Development of Alternative Compatibility Schemes. Developing the alternative schemes is the nucleus of the compatibility planning process. The objective is to explore a wide range of feasible options and alternative compositions of land use patterns, noise control actions, and noise impact patterns, seeking optimum accommodation of both airport users and airport neighbors within acceptable safety, economic, and environmental parameters. The alternatives should address both the physical planning and the implementation aspects of the proposed solutions.

(1) Approach. The suggested approach uses the basic urban planning process with the inclusion of noise quality (LUG) zones and airport safety as additional inputs or criteria. Noise quality zones are a variable input since trade offs in location and length of the noise corridors are often possible through application of the noise control actions discussed in Appendix 3. This emphasizes the need for a planning team which includes both airport planning and urban planning disciplines. This approach is equally applicable to the new airport situation and the existing incompatibility situation. In the instance of an existing airport undergoing expansion, both conditions are likely to exist. In the first case, emphasis is placed upon a plan assuring compatibility with minimum disruption of natural growth patterns and with maximum assurance that new incompatibilities will not be created. It is preventative rather than remedial. Where there are existing incompatibilities, the emphasis is upon taking advantage of every available favorable trend or factor to find feasible corridors of maximum noise compatibility, taking remedial actions to minimize noise incompatibilities which cannot be avoided, and establishing controls adequate to assure that new incompatibilities will not be created. This must be done within the context of good urban planning practice; safety; consideration of social, economic, and environmental factors and costs; the goals, values, and needs of both citizens and airport users; and the rights of the individual property owner or resident. These alternatives are normally prepared by the planning team. Affected and interested citizens, however, should be given the opportunity to offer constructive inputs and insights based upon their knowledge of the area and community.

(2) Planning Inputs. The primary inputs are those discussed earlier in this chapter, i.e., noise quality (LUG) zones, noise sensitivity criteria (LUG Chart II), existing land use patterns, and the direction and rate of change in these patterns (unconstrained future land use patterns). Other inputs to the urban planning process normally required, but not detailed here, include: land suitability analysis (i.e., slope analysis, drainage and flooding, soils and bearing, vegetation and fauna, environmental analysis, cultural or historic sites, etc.); water and sanitary sewer availability; thoroughfares and access; existing zoning; existing easements and restrictive covenants, total acres of need for each major land use category for future years; and the interrelationships of each use. Protection of runway approaches from interference by high objects or buildings, smoke, glare, bird hazards, electromagnetic radiation, and concentrations of people is also an essential aspect of the compatibility schemes. Many uses having high noise tolerance

can create such interferences. As examples, sanitary landfills, solid waste dumps, and certain kinds of agricultural operations, while unaffected by noise, tend to attract large numbers of feeding birds and can be safety hazards to airport operations. Commerical and industrial districts may also create potential safety hazards (glare, smoke, etc.) unless adequate protection is included in the plan. Additional detail is contained in AC 150/5190-4, A Model Ordinance Zoning to Limit Heights of Objects Around Airports, and AC 150/5200-3, Bird Hazards to Aircraft.

(3) Implementation Tools. The implementation tools for compatibility are those strategies and actions that may be used to control noise, to control development, and to remedy existing incompatibilities. These are discussed in Chapter 3, Implementation Strategies, and in Appendix 3, Noise Control Actions.

(4) Examples. Examples of a variety of approaches to achieving compatibility between airports and their environs are discussed in Appendix 4, Example Compatible Land Use Planning and Implementation Schemes. The compatibility problems, planning, and implementation strategies of five different airport-environs situations are analyzed. While each airport-environs situation is likely to be unique, these five airports demonstrate that viable solutions can be reached.

h. Selection of Preferred Alternative, Development into Plan, and Recommendation for Adoption.

(1) Selection of an Alternative Scheme. The selection of a preferred compatibility scheme requires the evaluation of many competing and often conflicting requirements including those of the airport and those of a social, economic, or environmental nature. Often a matrix type evaluation of these factors can be used in performing a trade off analysis and in arriving at a decision. Acceptability by both the airport and the community is a prime consideration in analyzing the available options. The selected scheme may be one of the defined alternatives or a combination of several. The method of arriving at a decision and the responsibilities of the involved parties should be defined early in the planning program in order to avoid an impasse at this stage. A study which has been properly structured and conducted in accordance with good planning practice where citizen participation has been meaningful, however, offers excellent potential for acceptability by the involved interests.

(2) Development of the Selected Alternative into a Compatibility Plan. Once the preferred scheme has been selected, it must be developed into a complete plan. As mentioned previously, the compatibility plan consists of both a physical plan and an implementation program. They are based upon the preliminary work accomplished in developing the alternative and may only entail additional development and detailing of this earlier work. Also, any documents which may be required for adoption of the plan by the airport sponsor and local governments should be prepared. During plan development, it is advisable that those actually preparing the plan consult with participating citizen groups to assure that the plan is accurately interpreting the selected scheme. The typical airport-land use compatibility plan should include, in addition to any required airport master planning, at least these elements:

(a) Physical plan.

(b) Implementation program.

1 Financing scheme.

2 Zoning map and new zoning districts (if required).

3 Implementation responsibility matrix.

(c) Adoption documents.

(3) Recommendation of Plan for Adoption. After preparation and coordination of the complete plan by those involved in its development, the plan should be presented for adoption to the airport sponsor and the responsible local governmental body(s) charged with land use and development control authority. This can normally be accomplished by a briefing to these parties and submission of the final study report. State or local regulations may require that public hearings be held. Even where not so required, consideration should be given to holding hearings or public information meetings prior to plan adoption. This provides an effective means to publicize study outcomes to the general public in addition to any such publicity which may have been accomplished through a citizen participation program.

23.-29. RESERVED.

CHAPTER 3. IMPLEMENTATION STRATEGIES

30. OVERVIEW. Implementation of the compatibility plan is accomplished by actions relating to controlling noise and development and to correcting or remedying incompatibilities. The applicability of the various strategies is, to a certain extent, dependent upon legislation within individual states and upon each unique airport and environs situation. Noise control includes airport development and operational controls designed to assure that aircraft noise will be contained within the noise impact areas delineated by the compatibility plan. Development control relates to the land use controls which can protect the noise impact areas from encroachment by unprotected noise sensitive uses. Corrective or remedial actions are those which may be utilized to resolve noise sensitive uses within the noise impact areas.

31. NOISE CONTROL. Assurance that aircraft noise will be contained within designated noise impact areas is a necessary, but yet difficult, aspect of achieving airport-environs compatibility. Without the assurance of fixing where noise will impact land use, the stability of compatibility planning is seriously jeopardized. The restricting of noise impacts to known areas is largely influenced by airport development actions and aircraft operational and air traffic control procedures. Coupled with the consideration of noise confinement is safety of operation, economics of development, and aircraft operational efficiency. The need to examine these considerations as they relate to implementation lends further credence to concurrent development of the plan and the implementation program.

a. Airport Development. Development at an airport can significantly affect the location of its future noise impacts. The alignment and location of runways, terminal buildings, access roads, and navigational facilities are prime examples of development actions which influence where noise impacts will occur. Since an airport-land use compatibility plan is preferably developed in conjunction with the airport master plan, the opportunity exists to opt for airport development actions which contribute toward confining aircraft noise within designated noise areas or within those areas where noise compatible uses can be achieved. Consequently, development decisions made in master planning must consider the attendant impacts on the land use planning process and how they influence implementation of the compatibility plan.

b. Operational Procedures. Control over the operation of aircraft on and around an airport is a sensitive subject involving safety as well as service and efficiency. Yet, the viability of the entire compatibility scheme is dependent upon keeping aircraft and their noise footprints within defined areas where noise sensitive uses have or will be excluded. As stated in Chapter 1, participation in the

development of the compatibility scheme by airport and aircraft operator interests as well as by interests in the airport vicinity is suggested to reduce conflicts in implementing the plan. Safety, service, and efficiency of aircraft operations should have been among the considerations examined in arriving at a final land use scheme. However, after the compatibility plan is adopted, agreed upon procedures must be respected. The operation of aircraft on and about the airport in accordance with these procedures is essential to achieving consistency between actual and forecast noise patterns. Responsibility for assuring that procedures are adhered to is shared by airport management, aircraft operators, and the FAA. Development and institution of a means to monitor procedures requires the joint efforts and constructive cooperation of all involved. In order for the controls to be viable and lasting, they must be logical, realistic, relatively simple and direct, and represent the optimum compromise among potentially diverse objectives.

c. Other Options. Other possible noise control actions such as preferential runway use, preferential approach and departure flight tracks, etc., are described in Appendix 3. The use of these is dependent upon the individual airport situation but can be explored in assessing projected aircraft noise. A pilot program to study and implement noise and land use controls as outlined by the Aviation Noise Abatement Policy was initiated in Fiscal Year 1977 at a selected number of airports. An objective of this pilot effort, besides providing an opportunity for these airports to seek solutions to or prevent incompatible uses, is to form a basis for FAA review of the various strategies considered and implemented.

32. DEVELOPMENT CONTROL. Land use and development controls can be used to protect the noise impact areas designated by the plan from encroachment by noise sensitive uses. A number of different controls are normally available to local governments and/or to airport sponsors to prevent such intrusions. The controls which are generally most useful for achieving airport compatibility - zoning, easements, and land purchase - will be discussed here. Other controls having either less or special applicability include building codes (noise insulation requirements), health and housing codes, programming of public capital improvements, and cooperation of financial institutions.

a. Zoning. The most common and useful land use control is zoning. Zoning is an exercise of the police powers of state and local governments which designates the uses permitted on each parcel of land. It normally consists of a zoning ordinance which delineates the various use districts and includes a zoning map based upon the land use element of the community's comprehensive plan (the airport-land use compatibility plan is a part of the comprehensive

plan). The primary advantage of zoning is that it can promote compatibility while leaving the land in private ownership, on the tax rolls, and economically productive. At the same time it is subject to change and must be continually monitored if it is to remain a viable compatibility tool.

(1) Use of Zoning. Zoning should be applied fairly and be based upon a comprehensive plan. This plan must consider the total needs of the community along with the specific needs of the airport. To zone a parcel of land for industrial or warehouse usage, for example, simply because it lies within a noise impact area is not sufficient. Such an action could be considered "arbitrary, capricious, or unreasonable" and thus vulnerable in the event of judicial review. The plan must clearly demonstrate that there is a reasonable present or future need for such usage. Zoning can and should be used constructively to increase the value and productivity of land within the noise areas. In one instance, planning and zoning for land impacted by a new large airport assisted materially in raising the value of the land in the planning area several times its initial value. Used within its limitations, zoning is the preferred method of controlling land use in the noise impact areas.

(2) Limitations of Zoning. Zoning has a number of limitations which must be considered when using it as a compatibility implementation tool.

(a) Zoning is usually not retroactive. That is, changing zoning primarily for the purpose of prohibiting a use which is already in existence is normally not possible. However, if such zoning is accomplished, the use must be permitted to remain as a "nonconforming" use until such time as the use changes voluntarily to a conforming use or until the owner has had ample opportunity to recoup his investment.

(b) Zoning is jurisdiction limited. Airport impacts often span more than one zoning jurisdiction. This requires coordination of the efforts of the involved jurisdictions. Zoning which implements a compatibility plan will often be a composition of existing and new zoning districts within each of the zoning jurisdictions covered by the plan (see the Dallas-Fort Worth Regional Airport illustration in Appendix 4). Each of the jurisdictions is likely to have a different base zoning ordinance with districts having different applicability for implementing in these states stops at the municipal boundary.

(c) Zoning is not permanent. In any jurisdiction, zoning can be changed by the current legislative body; it is not bound by prior zoning actions. Consequently, zoning which achieves compatibility is subject to continual pressure for change from both urban expansion and those who might profit from such changes. When such changes are proposed, the environmental impacts may require assessment. Also, from time to time the entire zoning ordinance for a jurisdiction will be updated to accommodate increased growth or incorporate new land use concepts.

(d) Cumulative zoning can permit incompatible development. A number of communities still have "cumulative" type zoning districts which permit all "higher" uses (such as residential) in "lower" use districts (such as commerical or industrial), thus permitting development that may be incompatible. In these instances it is necessary to prepare and adopt new or additional zoning use districts of the "exclusionary" type which clearly specify the uses permitted and exclude all other uses. An example of an "exclusionary" district is shown in Illustration 4-D-2 in Appendix 2.

(e) Zoning Board of Adjustment actions in granting variances to the zoning district or exceptions (for example, schools or churches) written into the zoning ordinance can also permit development that may be incompatible.

(3) Zoning to Limit Heights of Objects Around Airports. This is a special form of zoning that is used to protect airspace in the vicinity of the airport and its runway approaches from intrusion by high objects (natural or manmade) or other forms of interference. The objective is to protect the public investment in the airport by assuring that full runway lengths are available for use and that instrument landing systems are not restricted. For additional information, refer to FAA AC 150/5190-4, A Model Zoning Ordinance to Limit Heights of Objects Around Airports.

b. Easements. Easements may be used as an effective and permanent form of land use control. In many instances, they may be better for airport compatibility purposes than zoning. Easements are permanent, with title held by the purchaser until sold or released, and work equally well inside or outside zoning jurisdictions. They are directly enforceable by the holder through civil courts and may often be acquired for a fraction of the cost of the land value. Also of consideration is that the land is left free for full development with noise compatible uses.

(1) Definition. An easement is a right of another to part of the total benefits of the ownership of real property. Ownership of property consists of the possession of a series of "rights" to the utilization of that property. Certain rights in the property are always retained by the state or the general public, i.e., police power, taxation, eminent domain, and escheat (right of the sovereign to own those properties not in the ownership of others). Other rights are retained by neighboring property owners (for example the flow of water across land). The rights which go with ownership, i.e., ownership of all rights in the land except those retained by the state, the general public, or neighbors, may be bought and sold separately. When property is acquired, usually all rights are purchased, i.e., in fee simple. However, it is possible to buy only the select rights which are actually needed. These can be acquired in the form of easements with the other rights retained by the owner. There are many types of easements. They may be categorized as subsurface easements such as pipelines or underground utilities; surface easements, such as roads, utilities, or access; and above surface easements such as air rights or avigation easements. The cost of an easement is determined by the value of those rights to the land owner. If the easement will not significantly impair his contemplated usage or sale of the land, the cost should be low; but, if it does so impair, the cost will be higher. There are two basic classes of easements - positive and negative. In positive easements, the right to do something with the property (for example, build a road, build a power line, or make high levels of noise over the property) is acquired. In negative easements, the rights to prevent the use of the property by the property owner for certain things are acquired. These may include, for example, the owner's rights to erect billboards, to cut timber, to build above a certain elevation, or perhaps use the land for any noise sensitive use. For compatibility purposes both the positive easement to make noise over the land and the negative easement to prevent the creation of an unprotected noise sensitive use upon the property may require acquisition to assure adequate control. The easement should give the easement owner the right of avigation and the right to make noise over the property. It should also include purchase of all the property owner's rights to establish or maintain an unprotected noise sensitive use on the property. In the case of an existing unprotected noise sensitive use, the cost of the easement could include the cost of either soundproofing or removing the noise sensitive use from the property. A specific list of the noise sensitive uses, based upon the criteria used for the compatibility study, should be included in the easement. "Protection" for such uses should be specified as sound attenuation or other protection sufficient to place the noise sensitive uses within the sound environment specified by the criteria.

(2) Obtaining Easements. Easements may be obtained in a number of ways including purchase, condemnation, and dedication. For each easement acquired, consideration may be given to including a legal description of the noise that may be created over the property, classes of uses which may be established or maintained with and without soundproofing, and, where applicable, an avigation easement.

(a) Purchase. Easements may be purchased via negotiation with the price based upon the value to the owner of the rights surrendered. Timing can have a significant effect upon the price paid; once the subject land has gotten into the arena of speculation, prices tend to rise quickly. Under certain circumstances, Federal assistance may be available for such purchases.

(b) Condemnation. Easements, as well as full rights in property, may also be obtained by condemnation. The cost, while still likely to be less than that of outright acquisition (fee simple), is likely to be significantly higher than similar rights obtained via negotiation. Also, the cost of any ill will generated by a condemnation action, while difficult to measure, can be significant.

(c) Dedication. Dedication is another way to obtain easements. Two common types of dedication, subdivision and voluntary, are briefly discussed here.

1 Subdivision. Subdivision regulations governing the development of land for industrial or other purposes can include provision for dedicating private land or easements upon private land for public purposes. When easements for airport-environs compatibility are considered necessary and when they are determined to be compatible with the intended use of the land, the need for such easements should be a required consideration in the review and approval of subdivision dedications.

2 Voluntary. Land owners in unzoned areas may sometimes be persuaded to voluntarily dedicate easements for compatibility over their undeveloped land if assured of a fixed location for noise impact areas. Thus, when the land is eventually zoned, the easement will help assure the owner of obtaining a zoning classification compatible with the noise. This may permit a lower tax rate during the interim years and may, coincidentally, ultimately generate a higher price for the land.

c. Transfer of Development Rights (TDR). TDR involves separate ownership and use of the various "rights" associated with a parcel of real estate. Under the TDR concept, some of the property's development rights are transferred to a remote location where they may be used to intensify allowable development. With TDR, for example, lands within an airport's noise impact area could be kept in open space or agricultural uses and their development rights for residential uses transferred to locations outside the area. Landowners could be compensated for the transferred rights by their sale at the new locations or the rights could be purchased by the airport. Depending upon market conditions and/or legal requirements, the airport could either hold or resell the rights. The TDR approach must be fully coordinated with the community's planning and zoning. It may be necessary for the zoning ordinance to be amended in order to permit TDR's. Also, such transfers must usually be contained within single zoning jurisdictions.

d. Land Purchase. Purchase of noise impacted land in fee simple is the most positive of all forms of land use control. It is also usually the most expensive. However, when combined with either resale for compatible uses or retention and use for a compatible public purpose, the net cost may be effectively reduced significantly. As a preventative measure, purchase should usually be limited to critical locations or to hard core cases where other solutions are not workable. Acquisition can be accomplished through negotiation with the property owner, by deed or gift, or through condemnation. Additional discussion on land purchase is provided in paragraph 33.

33. CORRECTIVE ACTIONS. Corrective actions include those which can be taken to resolve the conflicts of existing unprotected noise sensitive uses within the noise impact areas. The scope of this program is dependent upon the degree of urbanization around the airport and may vary considerably from study to study. Where the noise impact falls upon predominately rural land or, where a new airport is built in an undeveloped area, there may be only a few scattered noise sensitive uses to be resolved. In urban areas and for many existing airports, however, it is possible that significant areas of noise sensitive uses can be involved which require some form of corrective action. Change of land use to less sensitive usages, addition of soundproofing or noise protection, and acquisition of full or partial interest in the land are examples of possible actions.

a. Changes in Land Use. Changes in the use of noise impacted land or changes in occupancy to uses or persons less sensitive to noise are an obvious and practical strategy for resolving noise conflicts. There are many ways of causing, encouraging, or assisting such changes. The approaches discussed here are but a few of the many options available.

(1) Encouragement of Existing Favorable Trends. Urban areas are in a continual state of change and transition. Many of these changing trends will tend to favor a turnover in land uses from noise sensitive to noise tolerant. A typical example of this would be the changeover of an older residential area into retail, commercial, or office uses. Maximum advantage should be made of such trends through both public policy and whatever influence the planning process may have over the private sector, i.e., financial institutions, entrepreneurs, and realty investors.

(2) Constructive Use of Planning and Zoning. Detailed planning of land within the noise impact areas by local authorities and constructive use of zoning changes can often achieve both compatibility and increased land and tax values. Existing uses must be permitted to continue as long as the use is continuous and unchanged and until the owner has had an opportunity to get fair value from the use. Therefore, noise sensitive uses cannot be forced into moving by simply zoning them out. However, constructive use of planning and zoning finds productive and compatible uses for the land which will give the present land owner a fair return on his investment in addition to covering his relocation expenses. The land should then be zoned accordingly. As an example of such a strategy, an area of expensive homes on one acre lots directly under the noise impact areas of a major airport was revitalized into an area of expensive specialty restaurants and clubs. Similar imaginative solutions suited to unique local situations can greatly minimize or even generate positive benefits from changing land uses to achieve compatibility.

(3) Constructive Use of Public Capital Improvement Projects. Locating and programming of public works projects can exert strong influences over land use trends and demands. These include road construction and widenings, transit service, schools, parks and recreation facilities, water and sewer mains, and flood control projects. Within the constraints of local authority, denial or delay of these facilities discourages development while early completion encourages development. Exercised judiciously within and as an implementation tool for the compatibility plan, constructive use of public works related capital improvements can greatly assist changes in land use.

(4) Purchase Assurance Program. These are purchase guarantees applied to residential properties within the lightly or short-term impacted noise areas which assure their saleability. The sales would most likely be to individuals having less noise sensitivity or higher trade off values for residing in the

particular area. Also, adequate controls should be included in sales agreements which assure that all future purchasers are cognizant of the noise levels and sign appropriate releases or easements. The advantages of such a program are its relatively low costs and the retention of viable residential areas.

(5) Voluntary Relocation Program. This program assists residents in the noise areas (and the local businesses serving them) who wish to voluntarily relocate outside the noise areas. The assistance could include expedition of any locally controlled legal constraints and grants or low interest loans to cover the actual costs of relocation. These costs could include loss in property value between comparable old and new residences, any mortgage penalties incurred, realty fees, and actual moving costs. Adequate provision should again be included to assure that all future owners are cognizant of the noise levels and sign appropriate releases or easements. Provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) are applicable whenever Federal or federally assisted programs are involved.

b. Reducing Noise Transmission (Soundproofing). Where noise sensitive uses cannot be reasonably relocated, compatibility may be achieved by reducing their noise sensitivity through soundproofing treatment. Soundproofing is, in effect, a leak-sealing process. It consists of reducing the exterior to interior sound transmission losses of a building by identifying those structural elements providing transmission paths and applying appropriate modifications to improve noise attenuation. The effect of applied soundproofing varies as a function of the degree/cost of modification and condition and construction of the building. As to costs, if some form of sharing arrangement between the municipality and the owner is considered, it should be established within the context of the soundproofing analysis and the means of the participants. Suitable agreements or easements for noise should be included in any contractual arrangements. While soundproofing is both a feasible and practicable means of alleviating the impact of external noise, the analysis must be made on a case-by-case basis in concert with both acoustical and architectural expertise. Benefits derived will be directly related to the modification required considering any constraints or limits of application.

(1) Soundproofing Modifications. Achieving noise reduction through soundproofing modifications includes minimal efforts of sealing and/or weatherstripping of windows, doors, vents, and external openings. Replacement of hollow-core doors with solid ones and elimination of direct exterior-interior transmission paths

should also be considered. For progressive levels of noise reduction, additional measures include: full-time air conditioning, acoustically treated ceiling panels, double-glazed windows, elimination of windows, acoustical entryways, attic treatment, wall paneling, treated crawl-spaces, and other sound "sealing" applications. Ventilating systems would be required with sealed windows. The selection of a single or combination of approved soundproofing measures should be made only after a case-by-case analysis. Modifications to a light frame wooden structure, for example, would vary greatly compared to those for a solid brick building to achieve the same desired results.

(2) Soundproofing Limits. The general condition, age, and repair of a structure normally dictate the degree of soundproofing application. Also, the building's location and noise exposure levels, both ambient and impact, must be quantified to identify the appropriate reduction in noise to be obtained. Although aircraft noise impacts are reduced after soundproofing, objections could be raised to the internal environment as being "sealed in" with windows sealed or removed. The difference between indoor-outdoor living activities, after soundproofing, could provide further psychological objections. Soundproofing, limits of application, and trade offs in costs and benefits should be identified and agreed upon before any soundproofing changes are undertaken.

(3) Other Benefits. Soundproofing, in addition to its primary intent of improving sound transmission losses, can provide side benefits and energy conservation and air pollution. Energy can be saved through reduction of structural heat loss due to improved insulation. Also, filtered air in positive ventilating systems is cleaner than outside air. These additional benefits should be considered in preparing a cost/benefit analysis.

c. Acquisition of Interest in Land. There are often locations or circumstances within the noise impact areas which leave little choice other than direct acquisition of full or partial interest in the impacted land by either the airport sponsor or, perhaps, by state or local levels of government. The Airport and Airway Development Act Amendments of 1976 provide for Federal participation in the purchase of interest in land adjacent to the airport for noise compatibility purposes. Additionally, constructive use of land purchases for other public purposes can considerably enhance compatibility. Land or interest in land (easement) may be acquired by negotiation, through a voluntary program, or via condemnation. The first two methods are the preferred approaches. In any case,

the provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (P.L. 91-646) are applicable whenever Federal or federally assisted programs are involved.

(1) Land Added to Airport. This is land which is either incorporated into the airport or dedicated to the service or economic benefits of the airport.

(a) Land for Airport Uses. This is land which is necessary for any operational purpose of the airport related to, in support of, or complimentary to the flight of aircraft to or from the landing area. It includes land for runways, taxiways, clear zones, fixed-based operations, airline service facilities, future expansion, and any other areas used for services and facilities related to the operation of aircraft. Other typical uses include the terminal and its associated uses, parking, remote parking, access roads, and rapid transit line and station. When possible, land in this category should be used to effectively reduce noise impacts rather than extend them; for instance, structures or landscaping placed upon the land could be designed to also act as noise barriers or absorbers.

(b) Land for Airport Related Uses. This is land outside but adjacent to the airport which is owned by and dedicated to the service and/or the economic benefit of the airport. Such uses may include industrial or commerical developments, hotels, motels, restaurants, service stations, retail shops, and other facilities. Where feasible, structures and landscaping should be designed to also function as noise barriers.

(2) Land for Other Public Uses. This is land not generally considered to be a part of the airport but which is acquired by a public or semi-public agency either to implement the compatibility plan or in cooperation with the plan while fulfilling another public purpose. Typical uses may include sites for equipment maintenance or storage yards, water or sewer works, and floodways or reservoirs. Other possibilities include selected park, recreation, and open space uses which are noise tolerant (golf courses, skeet ranges, natural areas, etc.). All uses must avoid the types of interferences outlined in paragraph 22g(2) and be tolerant of future airport growth. Also, due precautions should be taken relative to Section 4(f) of the Department of Transportation Act regarding interim public recreational use of land which may ultimately be required for airport development.

(3) Land for Compatible Resale. This is land which is purchased via negotiation, voluntary sale, or condemnation and then resold with covenants or easements retained to assure long-term compatibility. In some cases, it may be feasible to change the acquired land to compatible uses within existing or remodeled structures. In other cases, it would be desirable to clear and redevelop the land before making it available for sale. In either case, the changes should be in compliance with the land use plan and be supported by appropriate zoning. Caution must be exercised in assessing whether there is a market for uses considered compatible and the sponsor should be prepared to accept a slow turnover of the land. Appropriate covenants or easements should be retained to assure long-term compatibility. Since this strategy approaches the complexity of urban renewal, appropriate expertise should be consulted.

34.-39. RESERVED.

CHAPTER 4. PLAN ADOPTION

40. INTRODUCTION AND OVERVIEW.

a. Introduction. Throughout the land use planning process, consideration should be given to the adoption of the plan. An important criterion in selecting compatibility schemes or implementation measures is their acceptability to the units of government charged with their execution. A successful process provides for coordination between those preparing and those who must ultimately adopt the plan. In addition to the necessary coordination, other actions can be taken to help assure plan adoption. Adoptive procedures can be identified and assistance given in the preparation of changes to zoning ordinances or building codes. The level of this support, which will likely vary among the involved agencies, should be determined during the study and is considered an integral part of overall plan development. The objective of the preadoptive strategy is to identify and thoroughly prepare for various adoptive procedures, to anticipate problems, and to avoid or minimize controversy or possible stalemate. A plan's potential for implementation is greatly diminished if developed without giving adequate consideration to its adoption.

b. Overview. Adoptive procedures and requirements are necessary for the land use and noise controls and the corrective actions recommended in the compatibility plan. Each of these controls may involve the adoption of rules, ordinances, procedures, special legislation, etc. by appropriate local governmental agencies which may be accomplished during the planning process. The refinement of these to fit the requirements of each adopting agency may also be beneficial.

41. GENERAL APPROACH. The following actions are considered as a generalized approach for analyzing adoptive requirements and providing assistance to adopting agencies. Other steps or actions may be more appropriate in a particular instance because of the wide spectrum of procedures and involved organizations.

a. Identify each agency or unit of government which plays a part in plan adoption.

b. Identify and analyze the adoptive processes used by each of these agencies.

c. Based on recommendations contained in the plan and identified adoptive procedures, determine the nature of assistance which can be offered and provided to each adopting agency.

42. IDENTIFYING THE ADOPTING AGENCIES. The agencies or local governments which should adopt the compatibility plan and undertake various implementation measures are normally identified in the early stages of the study. This is necessary to assure adequate coordination. During plan development, additional groups not identified initially which should either endorse or implement portions of the plan may be identified. The tendency for overlapping and partial jurisdictions in urban areas calls for a careful review in order to assure full coverage. Typically, the organizations involved include the airport sponsor and study cosponsors, planning and zoning commissions, citizen groups having participated in the study, and local governmental bodies. Depending on the individual case, adoption or endorsement may also be required by the metropolitan or regional planning organization. Involvement of these organizations is especially appropriate when the airport impact area covers multijurisdictional areas. In many instances, they are study cosponsors and adoption is an obvious consideration. This group may also act as a clearinghouse to obtain concurrence from other organizations having an interest in airport-land use compatibility.

43. IDENTIFYING THE ADOPTIVE PROCESSES. After the responsible agencies are identified, the adoptive process for each should be determined. This may include reviewing enabling legislation or local charters to determine required procedures such as statutory waiting periods or the need for public hearings. Consultation with the legal staff of each agency may be appropriate and is suggested. A common basis for successful challenge of zoning ordinances, for example, is failure to fully comply with the procedures set out in enabling legislation or municipal charters.

44. LEVEL OF ASSISTANCE. Once the agencies and their adoptive requirements are known, the type of assistance the planning team can offer to each can be determined. This can be accomplished in close consultation with the respective agencies. The assistance may include preparing changes to existing zoning ordinances or developing special ordinances proposed in the plan. Assistance could also be in the form of providing support for public hearings, assembling information for public presentations, or drafting adoptive instruments, such as resolutions. This should be accomplished for each of the involved adoptive bodies since the level and type of support will likely be different for each. If there are complex procedures, schedules may be necessary to assure timely and phased actions which allow for all statutory advertising, review, and waiting periods. The primary objective of this effort is to smooth the way for and expedite official adoption.

45.-49. RESERVED.

CHAPTER 5. PLANS FOR MONITORING AND PERIODIC REVIEW

50. INTRODUCTION AND OVERVIEW.

a. Introduction. Growth and transition in urban locations create pressures for changes to zoning and other controls established to achieve and protect compatibility. Although this is more prevalent in urban environments, it may also occur in relatively undeveloped areas around new airports. These same community growth stimuli are also likely to generate greater aviation activity and airport requirements with consequent changes in airport noise impacts. Due to the diverse and changing conditions which may affect the plan, a procedure should be established for maintaining plan viability.

b. Overview. A suggested method for assuring plan responsiveness, consisting of both a monitoring activity and periodic and formal reviews, should be outlined during initial plan development. Also, responsibility for these activities should be identified in order to assure that all involved organizations are cognizant of their roles.

51. MONITORING. Monitoring includes surveillance of requested zoning actions, Board of Adjustment actions, performance of the plan, and changes in community attitudes. Included in the monitoring function is continued coordination between the airport sponsor, local planning and zoning officials, airport user groups, the FAA, and the public.

a. Plan Performance. After the plan is adopted, there is a need to continually evaluate its effectiveness and to identify those aspects of the plan which may require more formal review. This includes an evaluation to determine if proposed implementing actions are being carried out as scheduled. For instance, it should include review of land acquisition or soundproofing projects and ascertain whether they are effective, on schedule, or whether modifications are necessary. Also, operational procedures adopted as part of the noise control plan must be monitored to assure that they are being adhered to.

b. Land Use Actions. The responsible organization, either the airport sponsor or the local planning authority, should monitor all requests for changes in zoning, Board of Adjustment, or subdivision actions within the study area. This is needed to identify proposed land use changes which would not be consistent with the adopted land use plan.

(1) The airport's sponsor and/or management could, for example, assume as a routine function of airport management the primary role in monitoring zoning and other land use actions in the airport's impact area. In this role it should:

(a) Specifically make arrangements with each land use control body to receive notification of all zoning or Zoning Board of Adjustment requests, all subdivision applications, and all proposed road or utility extensions.

(b) Participate in public hearings associated with the above actions.

(c) Establish informal working contacts and agreements with personnel in the various public agencies.

(d) Establish informal communications with local financial and lending institutions to be sure they are aware of the agreed upon and adopted corridors and their expected noise impacts.

(2) Local planning authorities, in a similar manner, could establish informal working contacts with airport management and should be familiar with any studies or activities that could result in changes to the noise impact corridors.

c. Community Attitudes. Changes in community attitudes toward airport impacts or changes in local growth objectives may affect the plan. Consequently, they should be monitored for use in subsequent formalized reviews of the compatibility plan.

52. PERIODIC REVIEW. Periodic or formal reviews, at intervals of three to five years or when the airport master plan is updated, should be scheduled and budgeted for during the period of initial plan development. Such a periodic update would be eligible for Federal planning assistance under the PGP. This prescheduling reduces the chances of postponement or even total elimination of the reviews. Included within the formalized review should be consideration of those problems or deficiencies identified during the monitoring process and most notably those pertaining to the performance of the plan. This review should be sponsored and conducted by a planning group similar in composition to that which developed the initial plan. Again, citizen input should be encouraged.

a. Review. The review will normally not be as extensive as the original effort but should establish whether the plan remains viable or what actions are necessary to correct existing or forecast deficiencies. The types of activities included in the review are:

(1) A comparison of the current compatibility of the airport and its environs to that outlined in the plan goals and objectives.

(2) Appraisal of the rate of growth of both the community and airport to determine the current and future adequacy of the compatibility plan.

(3) Review of the airport noise contours and zones in light of both current and forecast operations and the noise performance levels of aircraft.

(4) Review of the adequacy of current operational controls in maintaining aircraft noise within the designated noise impact areas.

(5) Review of the adequacy of the adopted development controls in protecting the designated noise impact areas from encroachment by noise sensitive uses.

(6) Review of the effectiveness of the corrective actions employed in resolving existing unprotected noise sensitive uses within the noise impact areas.

b. Plan Adjustments. As a result of the review, it may become apparent that the plan will require adjustment or even extensive revision. If this occurs, steps should be taken to initiate a formalized plan update with consideration given to readoption by the responsible authorities. Of more immediate benefit are those actions taken to resolve procedural or coordination problems identified in the review. This could include improved coordination between the airport sponsor and zoning officials, reaffirmation of understandings of the plan and responsibility for its implementation, or even a reassignment of responsibility. These actions could also consist of briefings to pilots where flight procedures are outlined along with emphasis upon the reasons for such procedures. The overall intent is to remedy problems which have retarded or precluded achievement of planned compatibility.

53.-59. RESERVED.

APPENDIX 1. DEVELOPMENT OF WORK PROGRAM

1. GENERAL. The work program is developed to structure the planning effort and must be sufficiently detailed to assure that essential work is not overlooked. It requires a coordinated effort between the study sponsors and cosponsors, the citizen planning group, and local planning authorities. Community needs, as well as aviation needs and established land use policies, are influencing factors in preparing the work program. Developing a comprehensive program offers the opportunity to draw together often diverse interests with the objective of "setting the stage" for the actual planning process. The importance of the initial work cannot be overlooked since it becomes the framework for accomplishing the land use plan. The major steps suggested in the design of a work program include formulating a statement of objectives, developing planning criteria, and writing a detailed work program.

2. STATEMENT OF OBJECTIVES. The statement of objectives is a clear and concise statement of what is to be accomplished by the planning effort. The formulation of a statement of objectives is an initial step in program development as well as in the planning process and has a basis founded on community goals, values, and needs. The statement of objectives should begin with a goal statement and include a series of objective statements which support this goal. The sample shown in Illustration 1-1 illustrates the tone and scope of a typical statement but is not intended to serve as a model. The statement for each individual study must be designed to satisfy the needs of a particular situation.

3. PLANNING CRITERIA. The second suggested phase in developing a work program is the preparation of planning criteria which expand and provide detail on the statement of objectives. The criteria include the parameters within which the plan is to be accomplished, specific goals to be satisfied, as well as minimum accomplishments of the plan. Some examples of possible design criteria are shown in Illustration 1-2. Again, these are not intended to serve as models but only to illustrate the scope and form they might take. The citizens and planners should develop criteria based upon their own statement of objectives and their own goals, values, and needs.

4. PROGRAM WRITING. The final step in program development is the actual writing of a work program. A sample program for airport-land use compatibility planning study, in outline form, is shown in Illustration 1-3. The program developed for a particular study would be sufficiently detailed to provide an understanding of how the study is to be conducted.

ILLUSTRATION 1-1
SAMPLE STATEMENT OF OBJECTIVES

The goal of this airport-land use compatibility study is to achieve a broad-based and lasting compatibility between the airport and its environs by:

1. Identifying existing and potential conflicts including, but not limited to, those caused by noise and airport-environs incompatibilities.

2. Resolving existing incompatibilities and precluding realization of potential incompatibilities via the development of suitable plans and implementation procedures;

3. Actively involving the affected citizenry in the planning and decision-making process;

4. Keeping the general public fully informed on the direction, activities, progress, and achievements of the study; and

5. Unifying, through constructive coordination, area agencies and resources for a common cause.

6. Minimizing noise at the source directly through local programs where possible.

7. Blending the airport with its environs on all four sides and enhancing and protecting permanent residential neighborhoods.

8. Directing the economic and land use development of airport-related activities, general urban development, and public projects toward deliberate improvement of the local community.

9. Preserving and protecting the natural environment.

ILLUSTRATION 1-2
SAMPLE PLANNING CRITERIA

The sample planning criteria shown here are not intended as models but as examples of the form and level desired, using subjects which might typically be encountered. This is neither a complete nor a minimum listing of possible criteria.

1. At least 95 percent of all residential uses shall fall within acceptable noise sensitivity zones.

2. No existing schools, churches, hospitals, performing arts facilities, or libraries may be located within a Land Use Guidance Zone higher than that specified by local agreement unless suitable soundproofing measures are included in the implementation scheme.

3. Ground access to the airport shall not be routed through any established residential area except via previously established routes or via facilities having suitable expansion capability.

4. The plan may not place any form of nighttime curfew upon airport operations, but preferential runways may be assigned for any time of day or night if operational capability exists on such runway.

5. The plan and its implementation procedures shall fully respect all environmental criteria, factors, or considerations.

ILLUSTRATION 1-3

WORK PROGRAM OUTLINE FOR TYPICAL AIRPORT-LAND USE COMPATIBILITY PLANNING STUDY

1. Program Formulation.

   a. Recognition of Need.

   b. Preliminary Work Program.

   c. Establishment of Cosponsorship.

      (1) Cosponsorship Agreements.
      (2) Delineation of Responsibilities.

   d. Planning Team.

      (1) Identification of Functions.
      (2) Selection of Team.
      (3) Organization of Team.

   e. Citizen Participation Program.

      (1) Development of Citizen Participation Program.
      (2) Organization of Citizen Planning Group.

   f. Identification of Community Goals, Values, and Needs.

2. Planning Study.

   a. Development of Work Program.

      (1) Statement of Objectives.
      (2) Planning Criteria.
      (3) Detailed Work Program.

   b. Identification of Existing and Future Aviation Needs and the Resulting Noise Quality Patterns (LUG Zones).

   c. Identification of Study Area.

   d. Identification of Community Noise Sensitivity Criterion (LUG Chart II).

   e. Identification of Existing and Unconstrained Future Land Use Patterns.

   f. Development of Alternatives.

      (1) Alternative Physical Scheme.
      (2) Draft Implementation Program for Each Scheme.
      (3) Evaluate Social, Economic, and Environmental Costs for Each Scheme.

g. Selection of Alternative.

(1) Preparation of Decision Matrix.
(2) Citizen Involvement and/or Public Information Meetings.
(3) Selection of Alternative.

h. Development of Alternative Into a Plan.

(1) Coordination With Citizen Planning Group.
(2) Development of Physical Plan.
(3) Development of Implementation Program.

(a) Financing Scheme.
(b) Noise Controls (see paragraph 31).
(c) Development Controls (see paragraph 32).
(d) Corrective Actions (see paragraph 33).

1 Changes in Land Use.

a Actions to Encourage Favorable Trends or Discourage Unfavorable Trends.
b Detailed Planning and Zoning Actions.
c Recommendations on Public Capital Improvement Projects.
d Purchase Assurance Program.

2 Reduction in Noise Sensitivity (Soundproofing Program).
3 Acquisition of Interest in Land.
4 Other Actions.

(e) Implementation Responsibility Matrix.

(4) Adoption Documents.

i. Recommendation for Adoption.

(1) Staff Endorements (Airport, Urban Planning, Public Works, Legal, etc).
(2) Citizen Planning Group Endorsement.
(3) Public Information Meetings.

3. Plan Adoption.

4. Monitoring and Periodic Review.

APPENDIX 2. AIRCRAFT NOISE ESTIMATING METHODOLOGIES

1. INTRODUCTION. This appendix is intended to provide a general familiarization with several noise methodologies in common use in the United States. A brief description of the methodologies is given, followed by a listing of references which may be consulted to obtain detailed technical information. The descriptions are proceeded by a brief glossary of some terms often encountered in discussing noise.

2. GLOSSARY OF NOISE TERMS.

   a. Decibel (dB). A numerical expression of the relative loudness or level of a sound, i.e., the sound pressure level.

   b. A-Weighted Sound Level (dBA). The human ear is more sensitive to sound energy at high frequencies than at low frequencies. Also, the ear's sensitivity to sounds of different frequencies changes with the level of the sound. The A-weighted sound level is the actual measured sound level weighted to match the sensitivities of the human ear. This may also be written dB(A).

   c. Noise Metric. Noise metrics are the different measures by which a given noise may be expressed, for example, Noise Exposure Forecast or Day-Night Average Sound Level.

3. FAA INTEGRATED NOISE MODEL VERSION I (INM-1).

   a. Overview. The INM-1 was developed by DOT/FAA to provide a conceptually simple and flexible method for characterizing aircraft noise near airports. For acceptable definitions of aircraft operations, the INM-1 is capable of computing noise exposure for five different noise measures.

      (1) Measures. Noise measures (metrics) available from the model are Noise Exposure Forecast (NEF), Day-Night Average Sound Level (L_{dn}), Equivalent Sound Level (L_{eq}), Community Noise Equivalent Level (CNEL), and Time of Exposure Above (TA) a number of user specified A-weighted sound levels in decibels, dBA, (TA_{85}, TA_{95}, etc.). All of these measures can be displayed in the form of contours of equal noise exposure to a desired map scale. The users will normally choose a single measure of greatest interest for contour plotting, although plots in more than one metric can be readily obtained. The INM-1 also automatically provides numerical listings of the calculated noise values at all intersecting points on a grid which encompasses the airport and its environs. This printed output includes computations of the four noise measures based on accumulated acoustical energy, and time-above-A-weighted sound levels for six selected noise

thresholds, from 65 decibels to 115 decibels. The time of exposure calculations are further broken down into three daily periods: a 24-hour day, evening hours (7 p.m. - 10 p.m.), and night hours (10 p.m. - 7 a.m.).

(2) Inputs. The input of certain characteristics of the airport and its operation is a necessary step in the calculations. The user must define runway user and flight tracks and must allocate the traffic by specific aircraft types.

(3) Outputs. The program output consists of a printout of the input data, plotted noise contours, and computed noise levels at grid points. Options are provided to plot contours of any of the four cumulative energy metrics or contours of equal exposure in minutes over specified A-weighted sound levels. A very convenient option is specification of the contour plot scale so it matches the scale of a desired map. The runways are drawn on the contour map to provide visual orientation and reference when the contours are used as overlays on maps of the same scale. Calculations at each grid point are printed in tabular form.

b. References. The Basic User's Guide for the DOT/FAA Integrated Noise Model Version I, Report Number FAA-EQ-78-01, January 1978, and the DOT/FAA Integrated Noise Model (Brochure), Report Number FAA-EQ-78-02, January 1978 (available through the National Technical Information Service, Springfield, Virginia 22151).

4. DAY - NIGHT AVERAGE SOUND LEVEL L_{dn}.

a. Description. L_{dn} was developed in 1973-1974 for the Environmental Protection Agency. It is receiving wide use for estimating noise impacts at both civil and military airports and is based upon an Equivalent Sound Level (L_{eg}). The L_{dn} is weighted to account for the quieter background noise levels from 10:00 p.m. to 7:00 a.m., with a 10 dB penalty applied. It is a measurable quantity and can be measured directly at existing airports using portable monitoring equipment. Also, L_{dn} may be used for quantifying other noise sources, such as auto traffic, and for comparing them to airport-generated noise. Contour values usually range from less than 55 L_{dn} for lightly impacted areas to more than 75 L_{dn} for heavily impacted areas. The contours are drafted upon a map of the airport and its environs as shown in Illustration 2-1. Although contours are typically computer-produced, they can be produced by "desk-calculation" methods (see reference (2)(a) below).

TYPICAL DAY-NIGHT AVERAGE SOUND LEVEL (L_{dn}) CONTOURS

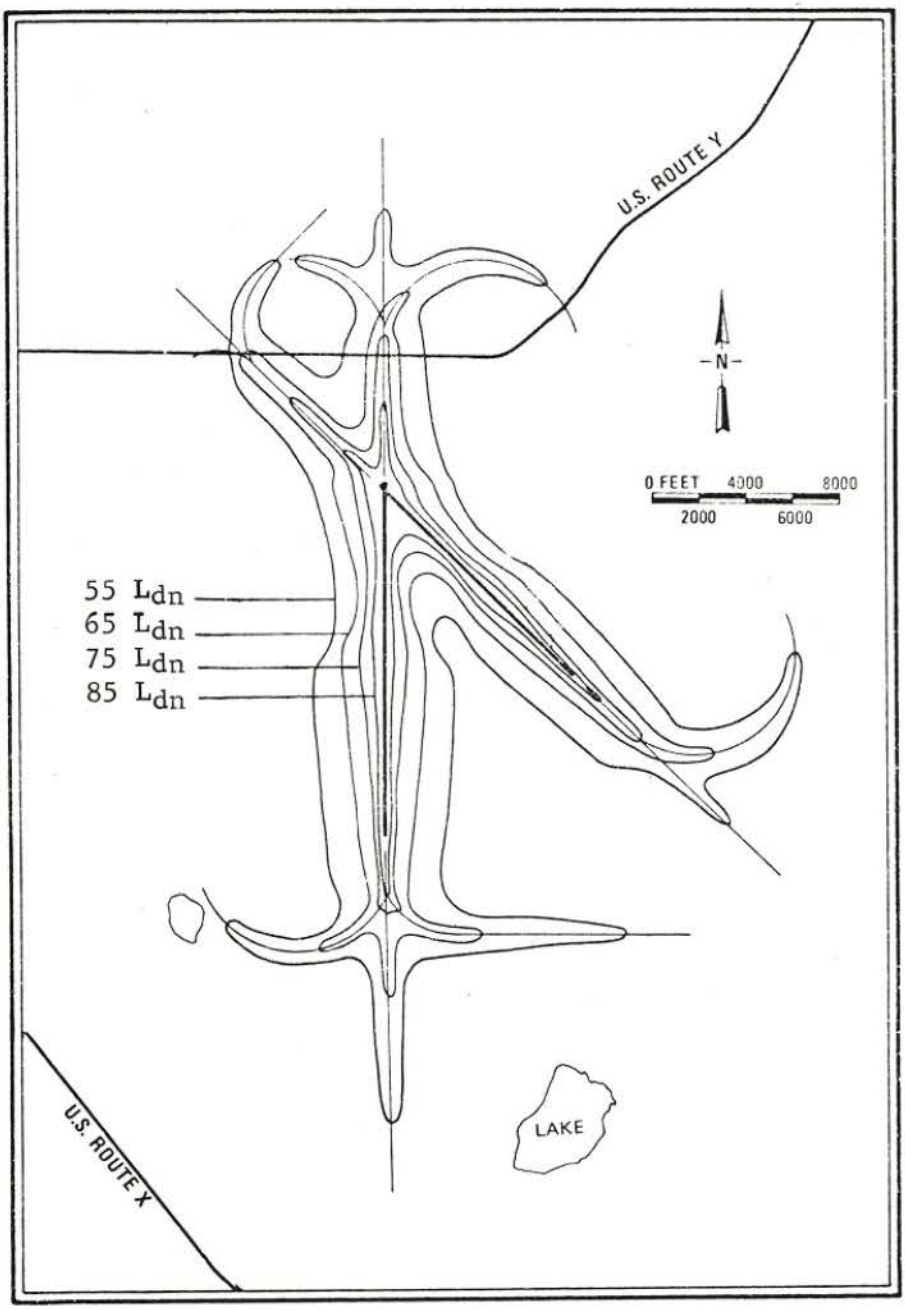


ILLUSTRATION 2-1

b. References.

(1) General Information. Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety; Environmental Protection Agency; Report No. 550/9-74-004; March 1974 (document for sale by U.S. Government Printing Office, Stock No. 055-000-00120-1, $2.10).

(2) Technical Information.

(a) Calculation of Day - Night Levels (L_{dn}) Resulting From Civil Aircraft Operations; Environmental Protection Agency; Report No. 550/9-77-450; January 1977 (available from Environmental Protection Agency, (AW-471), Washington, D.C. 20460).

(b) Developing Noise Exposure Contours for General Aviation Airports; D.E. Bishop and A.P. Hays; Bolt, Beranek, and Newman, Inc.; Report No. FAA-AS-75-1; December 1975 (available through National Technical Information Service, Springfield, Virginia 22151, No. ADA 023429, $7.75).

5. NOISE EXPOSURE FORECAST (NEF).

a. Description. The NEF was developed in 1967 as a refinement of the composite noise rating (CNR) methodology (see paragraph 9). It takes into account the factors considered by the CNR plus the additional exposure factors of the duration of aircraft flyovers and of discrete (pure) tones such as turbine "whine". The NEF is a complex procedure, usually requiring the use of a computer for noise contour development. NEF for general aviation with some jet operations can, however, be obtained from reference (1) below. Contours derived via this method usually range from less than 20 NEF for lightly impacted areas to more than 40 NEF for heavily impacted areas. The NEF is a calculated noise exposure value and cannot be directly measured.

b. References.

(1) General Information. Developing Noise Exposure Contours for General Aviation Airports; D.E. Bishop and A.P. Hays; Bolt, Beranek, and Newman, Inc.; Report No. FAA-AS-75-1; December 1975 (available through the National Technical Information Service, Springfield, Virginia 22151, No. ADA 023429, $7.75).

(2) Technical Information.

(a) Noise Exposure Forecast: Evolution, Evaluation, Extensions, and Land Use Interpretations; W.J. Galloway and D.E. Bishop; Bolt, Beranek, and Newman, Inc.; Report No. FAA-NO-70-9;

August 1970 (available through the National Technical Information Service, Springfield, Virginia 22151, No. AD 771-131, $5.25).

(b) Procedures for Developing Noise Exposure Forecast Areas for Aircraft Flight Operations; D.E. Bishop and R.D. Horonjeff; Bolt, Beranek and Newman, Inc.; Report No. DS-67-10; August 1967 (available through the National Technical Information Service, Springfield, Virginia 22151, No. AD 660-706, $5.25).

6. COMMUNITY NOISE EQUIVALENT LEVEL (CNEL).

a. Description. The CNEL was developed for the State of California. It is quite similar to the L_{dn}, except that it introduces an intermediate weighting for the early evening hours between 7:00 p.m. and 10:00 p.m. in addition to the weighting for the nighttime hours (10:00 p.m. to 7:00 a.m.). Contour values usually range from less than 55 CNEL for lightly impacted areas to more than 75 CNEL for heavily impacted areas. CNEL, like L_{dn}, is a measurable quantity and can be measured directly. The contours are typcially computer-produced.

b. References.

(1) The Adopted Noise Regulations for California Airports, TITLE 4, Register 70, No. 48-11-28-70, Subchapter 6, Noise Standards (distributed by Documents Section, State of California, P.O. Box 20191, Sacramento, California 95820).

(2) Community Noise; Environmental Protection Agency; Report No. PB-207-124; December 1971 (document for sale by Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402, Stock Number EP 1.2:N69/6, $2.25).

7. EQUIVALENT SOUND LEVEL (L_{eq}).

a. Description. The L_{eq} is formulated similarly to L_{dn} and CNEL, except that it includes no time of day corrections. L_{eq} is an energy summation of the aggregate noise environment as measured in A-weighted sound level. Contour values usually range from less than 50 L_{eq} for lightly impacted areas to more than 70 for heavily impacted areas.

b. References. Computation of Noise Exposure Values - Integrated Noise Model, Wyle Research Report WCR-77-1, January 1977; Evaluation and Sensitivity Analysis of Airport Noise Characterization Methodologies, MITRE MTR-6994, August 1975.

8. TIME ABOVE A THRESHOLD OF A-WEIGHTED SOUND LEVEL (TA).

a. Description. Time Above a Threshold of A-weighted Sound Level (TA) is a noise measure recently developed by the FAA. TA indicates the amount of time that a threshold sound level is exceeded at a given point. TA, which uses no time of day weighting, can be directly measured and provides an objective description of the noise climate around airports. However, no criteria have been developed for either excessive or appropriate exposure. TA is available for noise thresholds ranging from 65 to 115 dBA.

b. References. Computation of Noise Exposure Values - Integrated Noise Model, Wyle Research Report WCR-77-1, January 1977.

9. COMPOSITE NOISE RATING (CNR).

a. Description. The composite noise rating (CNR) is a summary measure of the aircraft generated noise environment in the vicinity of airports over a 24-hour period. The CNR methodology was developed in 1952 and is the oldest of the methodologies in use. The CNR is a calculated noise exposure value and cannot be directly measured. CNR contours cannot be produced via the INM. They are calculated from aircraft noise expressed in terms of the maximum perceived (i.e, identified by the human ear) noise level (PNL) and the number of operations in day and nighttime periods. They are based upon statistical analyses correlating given individual reactions to measured aircraft noise levels, and numerical corrections are applied to the aircraft noise contours to reflect public response to noise under varying conditions. Night operations are weighted to account for the quieter overall noise levels and the resting activity of the majority of the population during the late evening and early morning hours (10:00 p.m. to 7:00 a.m.). Nighttime aircraft operations need to be only a fraction of the number of daytime operations to generate the same perceived noise level; similarly, nighttime operations have a much greater effect upon perceived noisiness than daytime operations. Contours developed via the methodology are drafted upon a map of the airport and its environs. The contour values usually range from less than 90 CNR for minimally impacted areas to more than 115 CNR for heavily impacted areas. Caution is suggested in applying CNR methodology to general aviation airports since in such use it tends to exaggerate indications of noise impact.

b. Reference.

(1) General Information. Developing Noise Exposure Contours for General Aviation Airports; D.E. Bishop and A.P. Hays; Bolt, Beranek, and Newman, Inc.; Report No. FAA-AS-75-1; December 1975

(available through the National Technical Information Service, Springfield, Virginia 22151, No. ADA 023429, $7.75).

(2) Technical Information. Land Use Planning Relating to Aircraft Noise; W.J. Galloway and A.C. Pietrasanta; Bolt, Beranek, and Newman, Inc.; Technical Report No. 821; October 1964 (available through the National Technical Information Service, Springfield, Virginia 22151, No. AD 615-015, $5.25).

APPENDIX 3. NOISE CONTROL ACTIONS

1. INTRODUCTION. This appendix includes the noise control actions outlined in the November 18, 1976, DOT/FAA Aviation Noise Abatement Policy. It is noted that some of the actions can be undertaken independently by the airport sponsor, while others require the coordination and cooperative efforts of citizens, affected local levels of government, users, and Federal agencies.

2. ALTERNATIVE ACTIONS.

   a. Evaluating alternative development plans such as the construction of new runways, extending runways, and displacing thresholds which would shift noise away from populated areas or reduce noise impact over presently impacted areas.

   b. Investigating the feasibility of establishing a preferential runway use system, preferential approach and departure flight tracks, flight operational procedures such as thrust reduction or maximum climb on takeoff, increasing glide slope angles, or increasing glide slope intercept altitudes.

   c. Identifying measures that should be taken to reduce the impact of aircraft noise such as installation of noise suppressing equipment, construction of physical barriers, and landscaping.

   d. Identifying times of day when engine run-up for maintenance can be done with the least amount of noise impact.

   e. Determining location of engine run-up areas.

   f. Examining feasibility including the legal restraints of establishing landing fees based on aircraft noise emission characteristics or time of day.

   g. Examining feasibility including legal restraints and effects on interstate commerce of:

      (1) Limitations on the use of or operations at the airport in a particular time period or by aircraft type, such as:

         1 Limiting the number of operations per day or year;

         2 Limiting or minimizing operations at certain hours - curfews;

         3 Limiting operations by a particular type or class of aircraft; and

      (2) Shifting operations to neighboring airports or rescheduling operations by aircraft type or time of day.

APPENDIX 4. EXAMPLE COMPATIBLE LAND USE PLANNING AND IMPLEMENTATION SCHEMES

1. INTRODUCTION. The following examples illustrate a variety of approaches to achieving compatibility between airports and their environs. They are not necessarily model solutions but are representative of the many possible ways to attack incompatibility. As explained in the main text, zoning and other land use controls available to local levels of government and/or to the airport sponsor vary from state to state. In selecting strategy for a particular airport and its environs, all of the factors unique to that situation must be considered. The five airports discussed are:

   a. Seattle-Tacoma International Airport, Seattle-Tacoma, Washington. This example shows the use of a number of remedial controls at an existing airport in a built-up area.

   b. Dallas-Fort Worth Regional Airport, Dallas-Fort Worth, Texas. This example shows constructive use of local planning and zoning to maintain compatibility around a new airport in a rapidly developing urban area.

   c. Huntsville-Madison County Jetport, Huntsville, Alabama. This example shows the use of a combination of land use and operational controls to maintain compatibility at an expanding airport in the open countryside.

   d. Phoenix Sky Harbor International Airport, Phoenix, Arizona. This illustrates the use of operational procedures and navigation aids to take advantage of an existing noise tolerant corridor.

   e. Logan International Airport, Boston, Massachusetts. This illustrates the use of a combination of remedial and operational controls to minimize incompatibility at an existing airport in an intensively developed urban area.

2. SEATTLE-TACOMA INTERNATIONAL AIRPORT.

a. The Airport. Seattle-Tacoma International Airport serves a large hub and is the principal commercial airport for Seattle-Tacoma and the Pacific-Northwest (see Illustration 4-S-1). The airport has grown from 906 acres in 1942 to 2,200 acres in 1974. The activity statistics for Fiscal Year 1976 are as follows:

(1) Total operations: 167,427 (air carrier: 113,155).

(2) Enplanements: 3.21 million.

b. The Problem. Rapid post World War II growth experienced by both the airport and the surrounding communities had generated numerous problems. Owners of nearby residential properties had become increasingly concerned about aircraft noise, and information about such aircraft noise exposure was either unavailable or in dispute. In addition to law suits against the sponsor, the airport noise situation had caused HUD to withhold mortgage commitments in certain areas near the airport. Continuing growth of the airport through the years had created concern among nearby property owners as to what additional land would be needed in the future. The combination of these factors produced a general "climate of uncertainty" about property value and real estate in the vicinity of the airport.

c. Format of the Study. The planning program selected involved five major components: airport planning, community planning, environmental studies, community involvement (citizen participation), and coordination. The plan was based upon a melding of airport, community, and environmental considerations with community involvement and on-going coordination throughout the study.

d. The Compatibility Plan. The plan developed detailed goals and policies to:

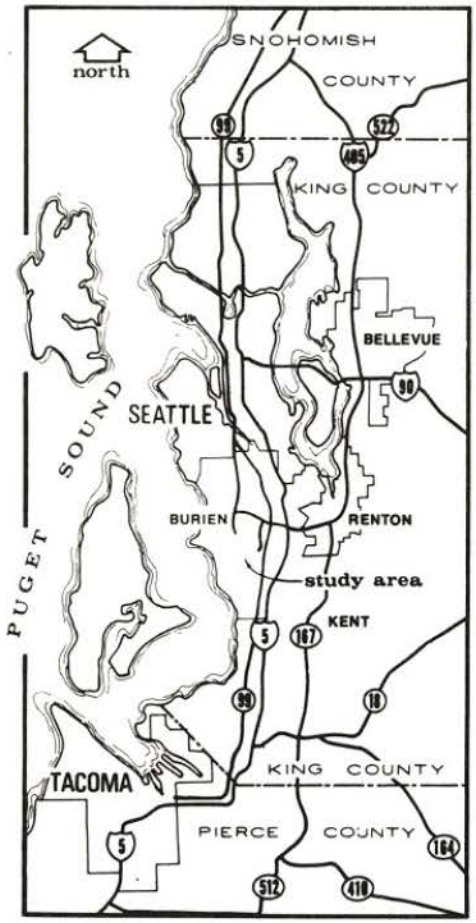
(1) Blend the airport with its environs on all four sides.

(2) Recognize freeways and other arterials as potential barriers between neighborhoods and nonresidential use areas.

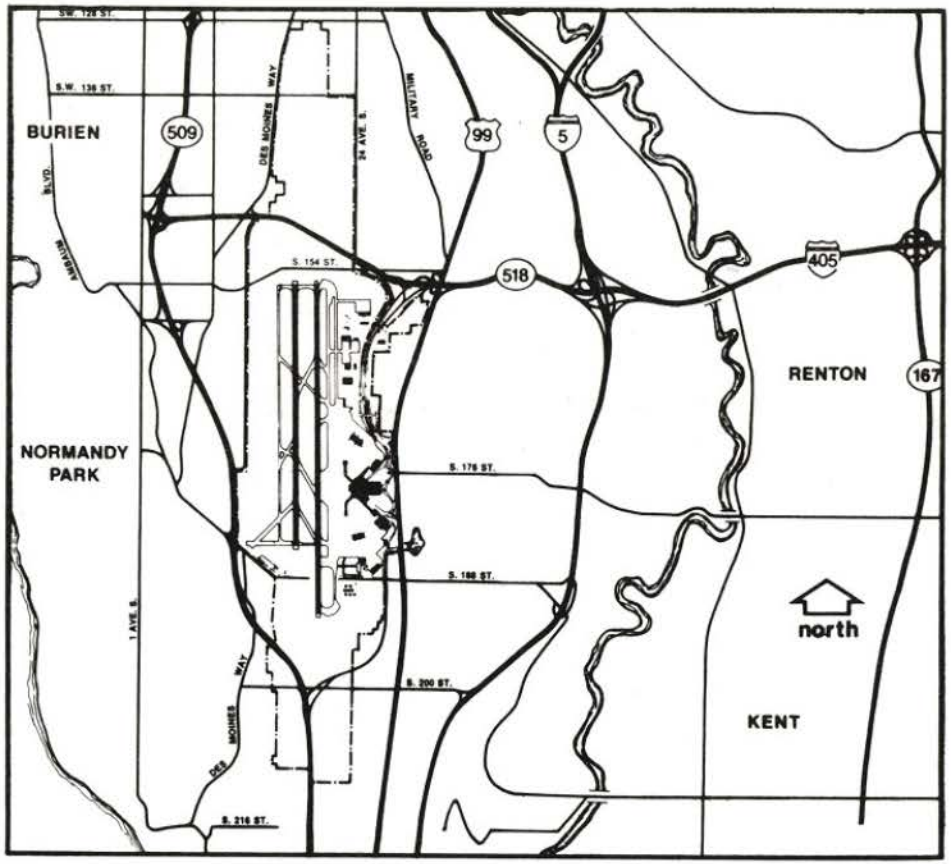
(3) Direct the economic and land use development of airport-related activities, general urban development, and public projects toward deliberate improvement of the local community.

(4) Preserve and protect the natural environment.

(5) Use the drainage holding ponds, watercourses, and wet lands for recreation incorporated into a network of open spaces.



LOCATION



SEATTLE–TACOMA INTERNATIONAL AIRPORT

ILLUSTRATION 4-S-1

SEA-TAC INTERNATIONAL AIRPORT PROPOSED LAND USE PLAN

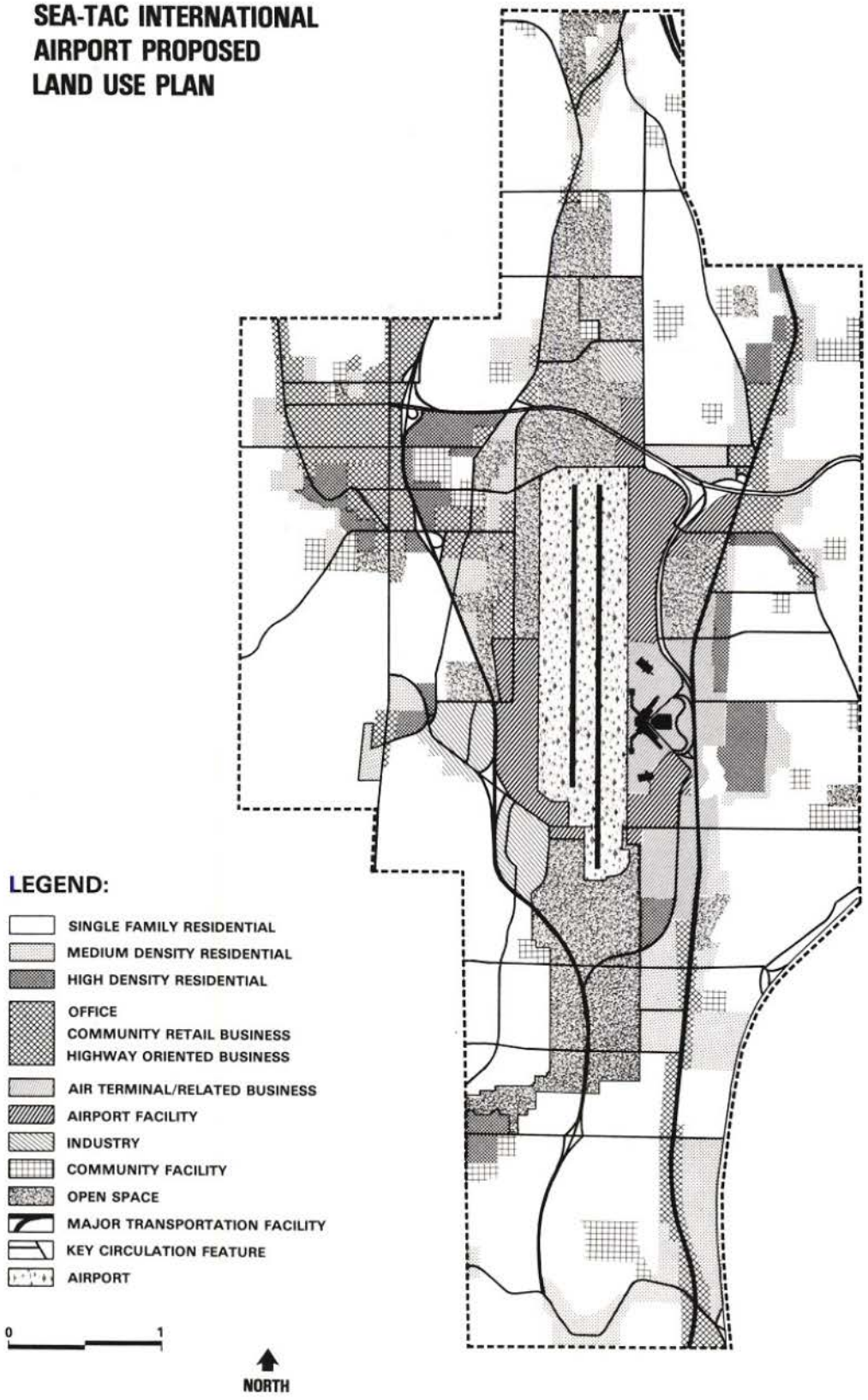


ILLUSTRATION 4-S-2

(6) Use natural features and open spaces to separate different land uses.

(7) Enhance and protect permanent residential neighborhoods.

(8) Resolve the uncertainty connected with noise impact.

(9) Accomplish land use conversion within or near single-family residential areas via orderly transition programs.

e. Implementation Strategy. Implementation is based upon acquisition of prescribed lands by a public authority, private redevelopment, or land use conversion, and reinforcement of existing land use areas or neighborhoods.

(1) Acquisition Areas. Land areas having the highest noise impacts will be primarily devoted to open space type uses upon removal of the existing incompatible uses. The planned uses include agriculture; parks; landscaped buffer areas; and recreational areas for nature trails, golf courses, soccer, rugby, field archery, horseback riding, and water sports. Also, a portion of the area will be reserved for future air facility purposes, i.e., air cargo, maintenance, general aviation, etc.

(2) Conversion Areas. Recognizing the problems involved in coverting large areas of land from one use to another, the Planned Unit Development (PUD) zoning format was adopted. Conversions will include: conversion from single family to medium density multi-family with proper sound insulation; high and medium density apartments plus airport-related business uses; an expanded service complex for the sponsor's other services; and manufacturing and industrial uses.

(3) Reinforcement Areas. These deal with land areas and neighborhoods that are to be retained in their existing use and character. Noise remedy programs will be established and implemented. These include but are not limited to:

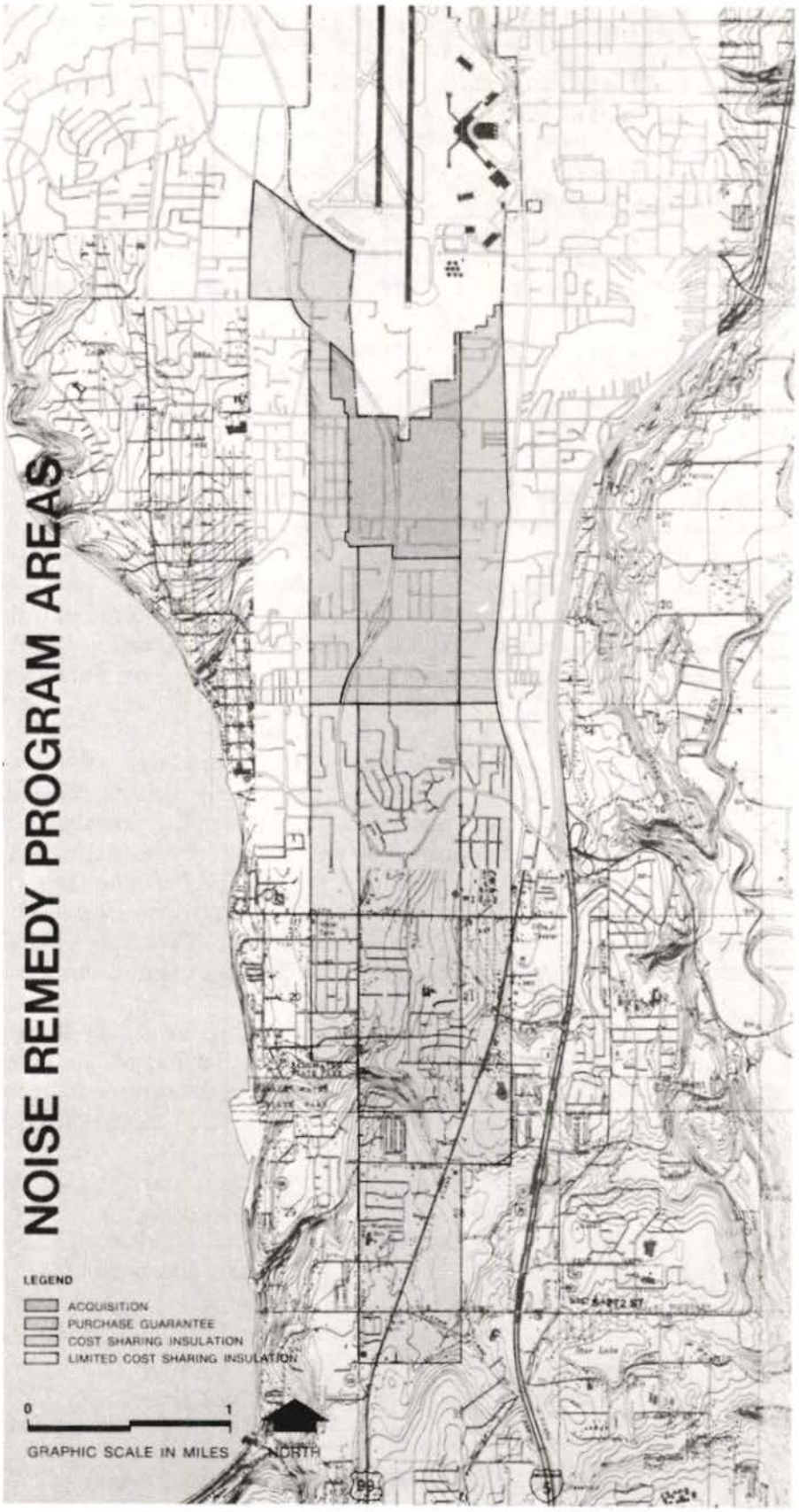
(a) Establishment of an ongoing noise monitoring program.

(b) Utilization of new locations for engine maintenance run-ups to minimize off-airport exposure patterns.

(c) Enforcement of stricter curfews on nighttime maintenance run-ups.

(d) Outright acquisition of severely impacted properties.

(e) Purchase assurance or guarantee for impacted property owners.


NOISE REMEDY PROGRAM AREAS
LEGEND
ACQUISITION
PURCHASE GUARANTEE
COST SHARING INSULATION
LIMITED COST SHARING INSULATION
0
1
GRAPHIC SCALE IN MILES
NORTH

(f) Acquisition of appropriate avigation easements.

(g) Cost sharing and limited cost sharing insulation programs for noise affected structures.

(h) Development controls by public agencies.

(i) Property advisory services.

3. DALLAS-FORT WORTH REGIONAL AIRPORT.

a. The Airport. The Dallas-Fort Worth Regional Airport, which was opened in 1974, is situated on 17,520 acres between Dallas and Fort Worth, a large hub. The activity statistics for Fiscal Year 1976 are as follows:

(1) Total operations: 351,426 (air carrier: 291,956).

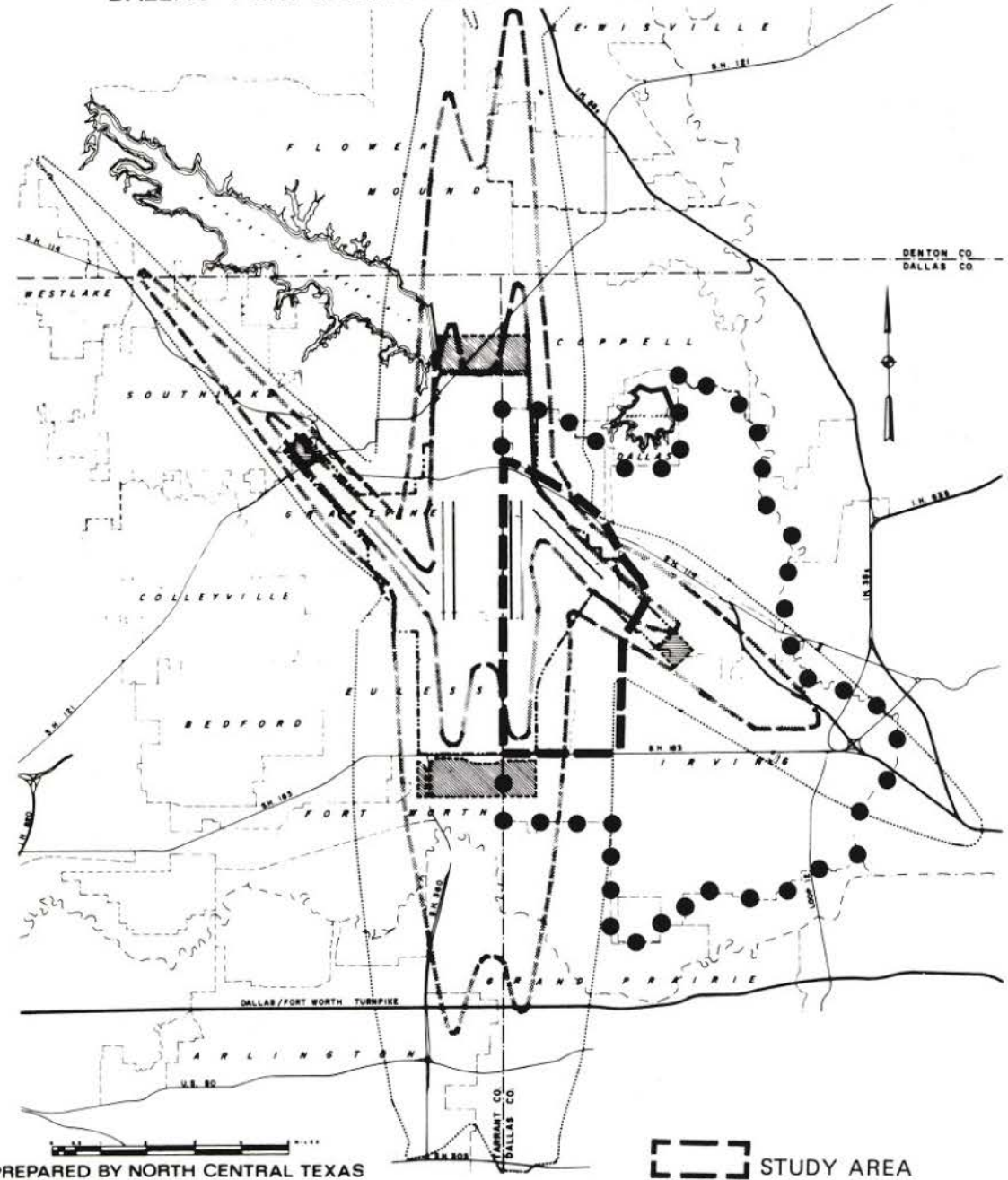
(2) Enplanements: 7.71 million.

b. The Problem. When the airport was sited at the west edge of Irving, Texas, it was recognized that in spite of the airport's huge size and extensive buffer areas, there would still be significant noise impacts outside the airport (see Illustration 4-D-1). A number of different strategies were utilized to assure long-term compatibility within these noise impact areas. This example discusses one of these techniques and illustrates the constructive use of planning and zoning to benefit land owners, local tax rolls, and the airport as well as assuring compatibility. The City of Irving's existing master plan had designated residential development for the area to be impacted. Development under that plan would have been incompatible with the projected levels of aircraft noise.

c. The Compatibility Plan. A compatible land use study was commissioned for the impacted area. After reviewing the various alternatives it was found that the impacted land had high potential as an airport related industrial park. The study recommended zoning designed to produce such an industrial park. The park would not only be fully compatible but would also compliment the adjacent airport and enhance the city's tax base.

d. Implementation Strategy. A new zoning district, Industrial Park - Airport Related (see Illustration 4-D-2), was written and incorporated into the city's existing Zoning Ordinance. Illustration 4-D-3 shows how existing districts within the ordinance were used to round out the compatibility zoning within the impacted area. The compatibility plan has now been fully implemented.

AIRCRAFT SOUND EXPOSURE: DALLAS - FORT WORTH REGIONAL AIRPORT AND ENVIRONS



PREPARED BY NORTH CENTRAL TEXAS
COUNCIL OF GOVERNMENTS
ARLINGTON, TEXAS - OCTOBER 14, 1971
BASED UPON TECHNICAL DATA
FURNISHED BY FAA

Insofar as FAA participation is concerned, the data upon which this presentation was based was prepared solely for planning purposes with respect to future land use. The FAA has no expertise as to the effect of aircraft noise on the valuation of property. Accordingly, this presentation is not intended to, and does not reflect the views of the FAA on the relationship, if any, between aircraft noise and the valuation of such property as may be comprehended by this presentation.

ILLUSTRATION 4-D-1

SECTION 52-30 I.P.A.R. INDUSTRIAL PARK-AIRPORT RELATED

In the I.P.A.R. district no land shall be used and no buildings shall be erected for or converted to any use other than the following and all such uses permitted in the I.P.A.R. district must meet the requirements set forth in Section 52-35, "Performance Standards", of this Ordinance, as well as those established in the Airport Zoning Ordinance:

A. PRINCIPAL USES:

The following uses shall be permitted as principal uses:

1. Any manufacturing, research, wholesale or storage uses except those operations such as saw and planing mills, manufacturing uses involving primary production or storage of wood, metal or chemical products from raw materials, construction materials, batching yard, foundary type operations, material or auto salvage and/or wrecking operations or other industrial operations not listed, provided that such uses shall be contained within an enclosed building
2. All uses as listed under the provisions of "P-O" (professional office district) regulations with the exception of public institutions and non-profit institutions of an educational, religious or cultural type, but excluding corrective institutions and hospitals; public utility uses; schools and studios for art, dancing, drama, music, photography, interior decorating or reducing
3. All uses listed under the provisions of "C-OU-2" (commercial outdoor) uses to be included with the exception of (a) motion picture and (b) drive-in restaurants
4. Air Freight forwarders
5. Air terminals, passenger
6. Aircraft assembly plants
7. Aircraft sales
8. Aircraft storage hangers
9. Aircraft repair services
10. Athletic fields - excluding stadiums
11. Auto service and repair
12. Aviation ground schools - excluding any aircraft or helicopter inflight training
13. Agricultural uses, including: dairy farming, distribution and pasteurization of products
14. Freight terminals and facilities for: air cargo, truck cargo, and railroad cargo
15. Nursery stocks, including: landscaping, sales and supplies
16. Hotels and motels
17. Petroleum products: aviation fuel-retail and wholesale outlets; automotive fuels- retail and wholesale outlets; bulk storage - aviation and automotive fuels; pipe lines and pump stations. All petroleum storage in this district shall be in accordance with separate ordinances.
18. Recreational facilities that will not be affected by, or impose a hazard to aircraft. Bowling alleys, golf courses, public parks, playgrounds and picnic areas
19. Warehousing

B. ACCESSORY USES

The following uses shall be permitted as accessory uses elsewhere than within a front building setback and no nearer than thirty (30) feet to any street right-of-way.

1. Mechanical equipment no nearer than 120 feet to any principal building used for residence within an "R" district.
2. Provisions for the parking of automobiles provided that such provisions within sixty (60) feet of a developed lot in an "R" district shall be separated from said lot by a blind fence or wall at least six (6) feet high.
3. Garbage storage no nearer than thirty (30) feet to a developed lot in an "R" district used for dwelling purposes.
4. Employee facilities, including employee cafeteria.
5. Outside storage, provided that such storage shall be completely encompassed by a blind fence or wall at least seven (7) feet high and provided that materials stored shall be stacked no higher than one (1) foot below the top of the fence or wall.
6. Railroad yards, provided that such yards shall be completely encompassed, except for points of ingress and egress, by a blind fence or wall at least six (6) feet high.

C. PARKING REGULATIONS

Off street parking shall be provided in accordance with the provisions of this ordinance and other applicable ordinances of the City, providing their locations are such that communications and navigation equipment of aircraft operating under Instrument Flight Rules (IFR) will not be distorted by reflection from parked vehicles.

D. AREA REGULATIONS

The following minimums shall be required

1.	Depth of front building setback.....	50 feet
2.	Depth of rear setback.....	15 feet
3.	Width of side setback.....	15 feet
4.	Width of lot.....	80 feet
5.	Depth of lot.....	150 feet
6.	Distance between detached buildings.....	30 feet
7.	Lot area.....	12,000 sq ft.
8.	Maximum lot coverage by buildings, driveways, and parking.....	70 percent
9.	Within front building setback area.....	35 percent

of the land area within front building setback shall not be used for buildings, driveways or parking. This area will be landscaped with natural vegetation or synthetic materials. This area will be accepted as meeting part of the thirty (30) percent open space required under maximum lot coverage. This condition shall apply to only one frontage, in situations for a corner lot.

E. HEIGHT REGULATIONS

The following maximum height regulations shall be observed.

No structure may be erected to a height in excess of that permitted by the Airport Zoning Ordinance which may exist at the time and whose regulations apply to the area in which the structure is being erected.

F. LOCATION OF DISTRICTS

An I.P.A.R. district may only be established in one of the following areas:

1. Immediately abutting an established airport.
2. Contiguous to an existing I.P.A.R. district, except that a railroad right-of-way or public right-of-way may intervene.

G. INTERPRETATION, PURPOSE AND CONFLICT

In interpreting and applying the provisions of this District, they shall be held to be the minimum requirements for the promotion of the public safety, health, convenience, comfort and prosperity of general welfare. It is not intended by the imposition of these regulations of this district to interfere with, abrogate or annul any easements, covenants or other agreements between parties; providing however, that where these regulations impose a greater restriction upon the use of buildings, premises or height of buildings or requires larger open spaces than those imposed by other ordinances, rules, regulations, easements, covenants or agreements, the provisions of these regulations shall govern.

CITY OF IRVING, TEXAS
ZONING DISTRICT: INDUSTRIAL PARK—AIRPORT RELATED

ILLUSTRATION 4-D-2

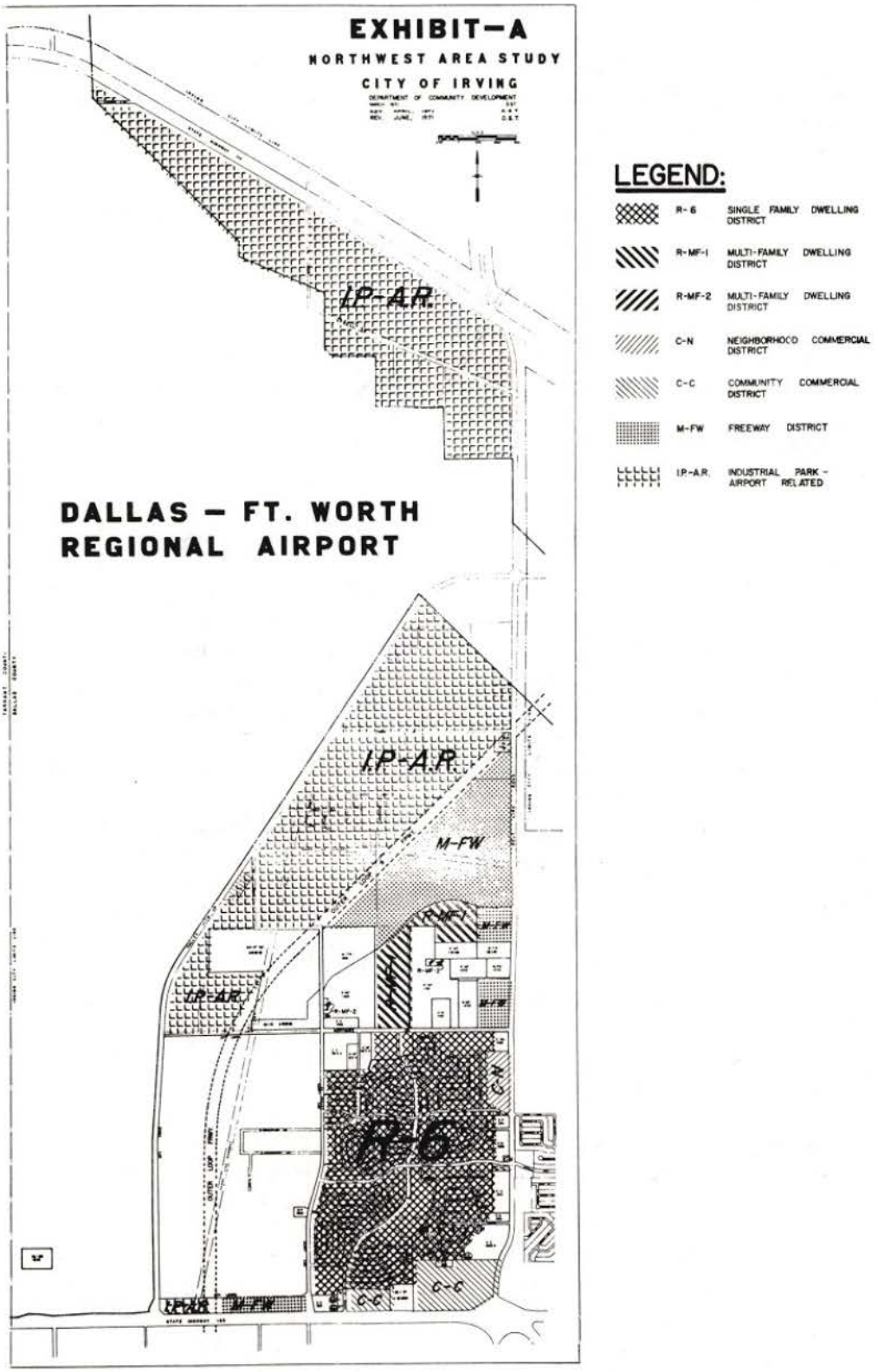


ILLUSTRATION 4-D-3

4. HUNTSVILLE-MADISON COUNTY JETPORT.

a. The Airport. Huntsville-Madison County Jetport, serving the Huntsville-Madison County small hub in Alabama, was built in 1967 and covers 2,630 acres. The activity statistics for Fiscal Year 1976 are as follows:

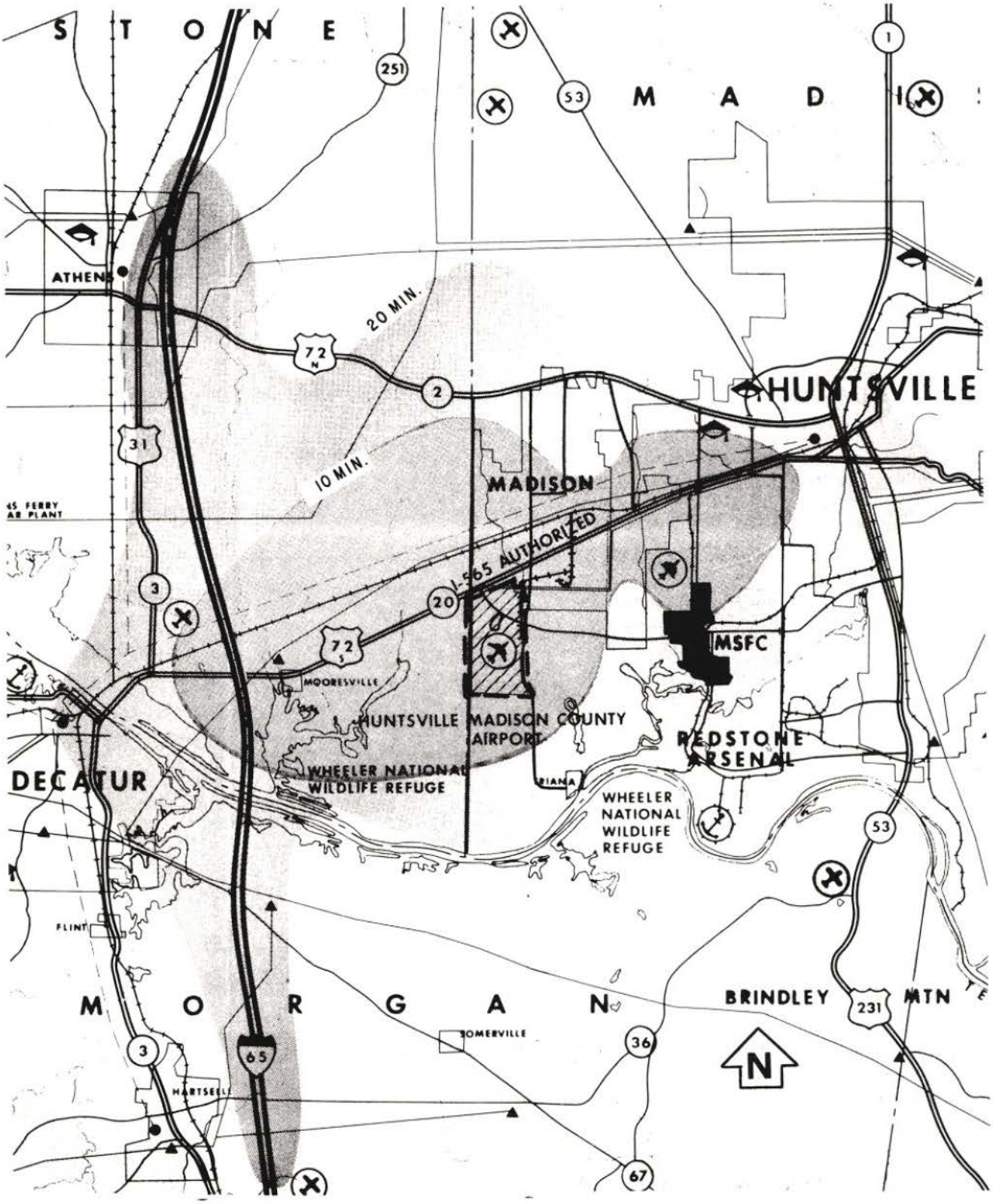
(1) Total operations: 102,760 (air carrier: 17,601).

(2) Enplanements: 223,789 million.

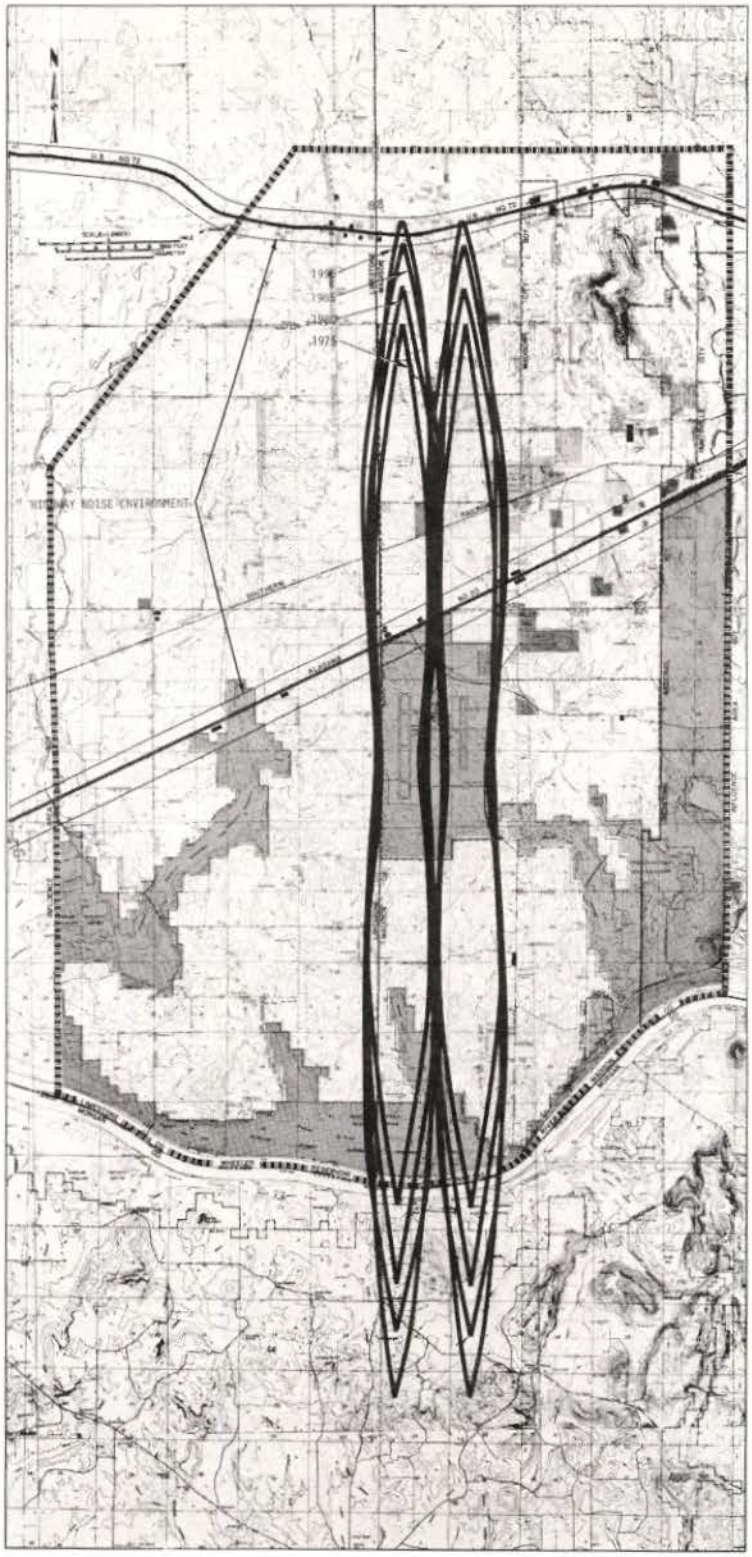
b. The Problem. The airport, having been built in the open countryside, is essentially free of noise compatibility problems (see Illustration 4-H-1). The primary objective of the planning study was to preserve that state of compatibility in the face of growing pressures for urbanization and to foster environs which would be both complimentary to the airport and an economic asset to the area.

c. The Compatibility Plan. The configuration of the airport, including both existing and future runways, was established prior to initiating the land use plan. The only variables remaining were control of new development and operational procedures. Runway alignments, prevailing winds, and existing urbanization patterns all favored a linear operations scheme in which larger, noisier aircraft would remain essentially on the extended runway centerlines whenever they were below noise critical altitudes (see Illustration 4-H-2). Such a scheme also minimized the total land area exposed to high levels of aircraft noise and, hence, the total land area needing protection. Multiple modes of transportation, including rail and water as well as air and an interstate highway, favored industrial-commercial development to the north, northeast, and southeast of the airport. An extensive area of flood plain lying east and south of the airport discouraged development of these areas. An extensive area along the Tennessee River south and southeast of the airport is occupied by the Wheeler National Wildlife Refuge, thus precluding further development in those locations. The remainder of the land within the noise impact areas was recommended for compatible agricultural uses.

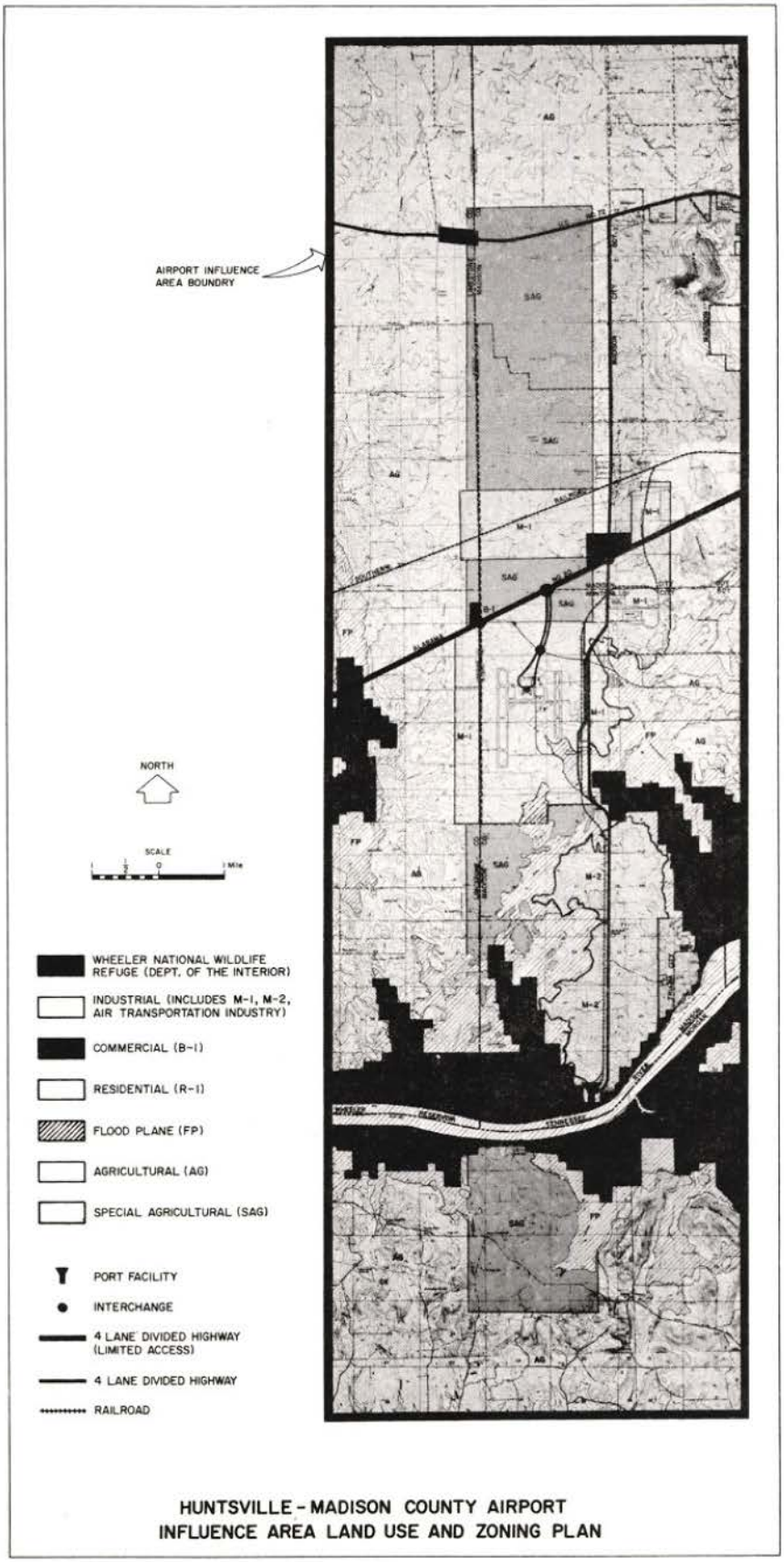
d. Implementation Strategy. Implementation involves principally two sets of controls - controls over new development and airport area operational controls. The new development is to be controlled by a series of land use and development controls (zoning, etc.) designed to both protect the noise impact areas from intrusion by unprotected noise sensitive uses and to encourage development of noise tolerant commercial and industrial uses (see Illustration 4-H-3). These controls (ordinances) are being adopted by the local jurisdictions. The airport area operational controls are designed



HUNTSVILLE-MADISON COUNTY JETPORT
LOCATION AND TRAVEL TIMES
ILLUSTRATION 4-H-1

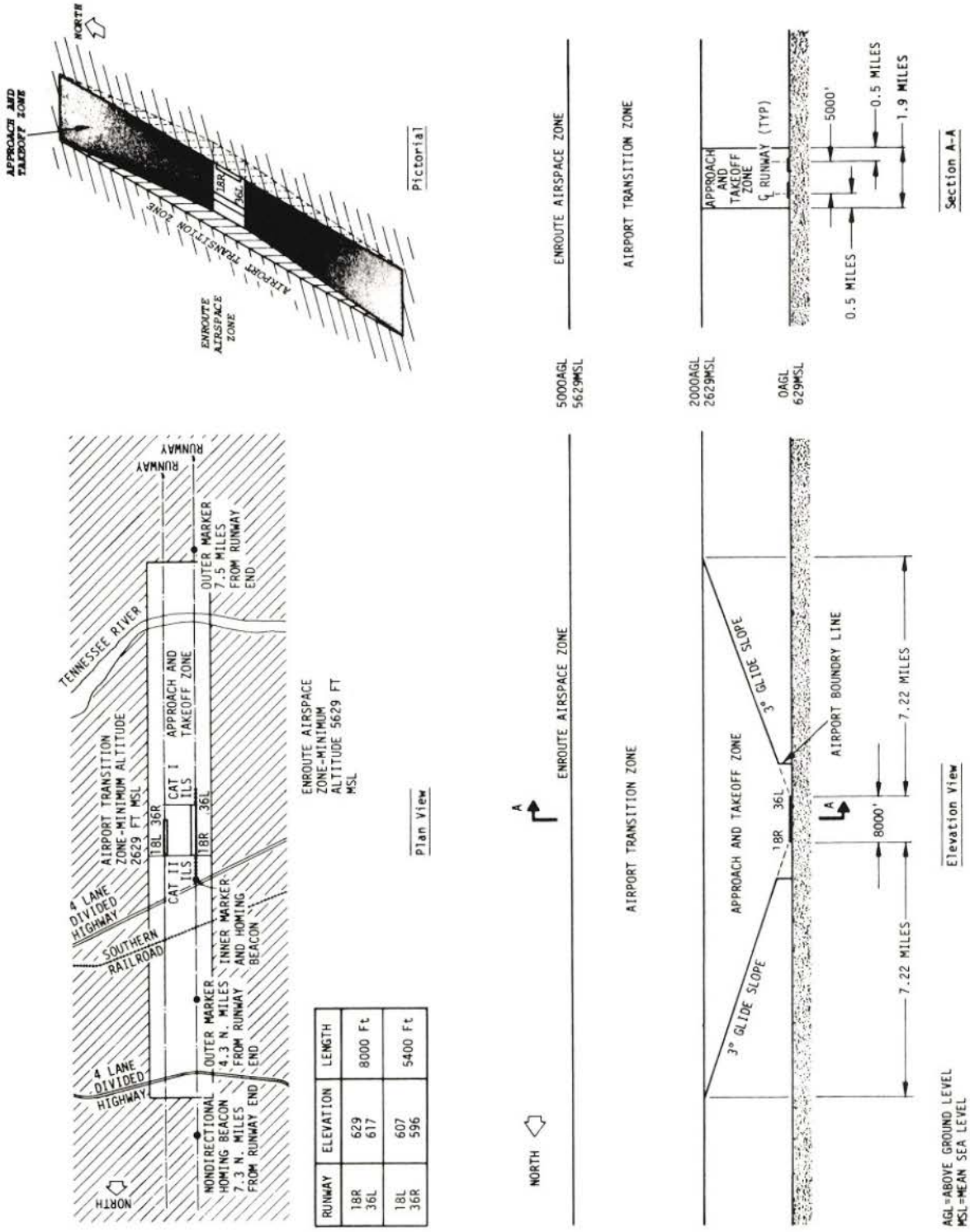


HUNTSVILLE-MADISON COUNTY AIRPORT
NOISE EXPOSURE
ILLUSTRATION 4-H-2



HUNTSVILLE - MADISON COUNTY AIRPORT
INFLUENCE AREA LAND USE AND ZONING PLAN

to keep jet aircraft over the designated noise impact areas when they are below noise critical altitudes (see Illustration 4-H-4). The FAA has agreed to initiate procedures to conduct air traffic for compatibility with the land use plan once the land use controls have been adopted by each of the local jurisdictions. The execution of the plan is progressing at a reasonable pace.



RUNWAY	ELEVATION	LENGTH
18R 36L	629 617	8000 Ft
18L 36R	607 596	5400 Ft

HUNTSVILLE–MADISON COUNTY JETPORT

ILLUSTRATION 4-H-4

5. PHOENIX SKY HARBOR INTERNATIONAL AIRPORT.

a. The Airport. Phoenix Sky Harbor International Airport serves the Phoenix large hub. The airport is situated on 1,650 acres. The activity statistics for Fiscal Year 1976 are as follows:

(1) Total operations: 425,773 (air carrier: 91,054).

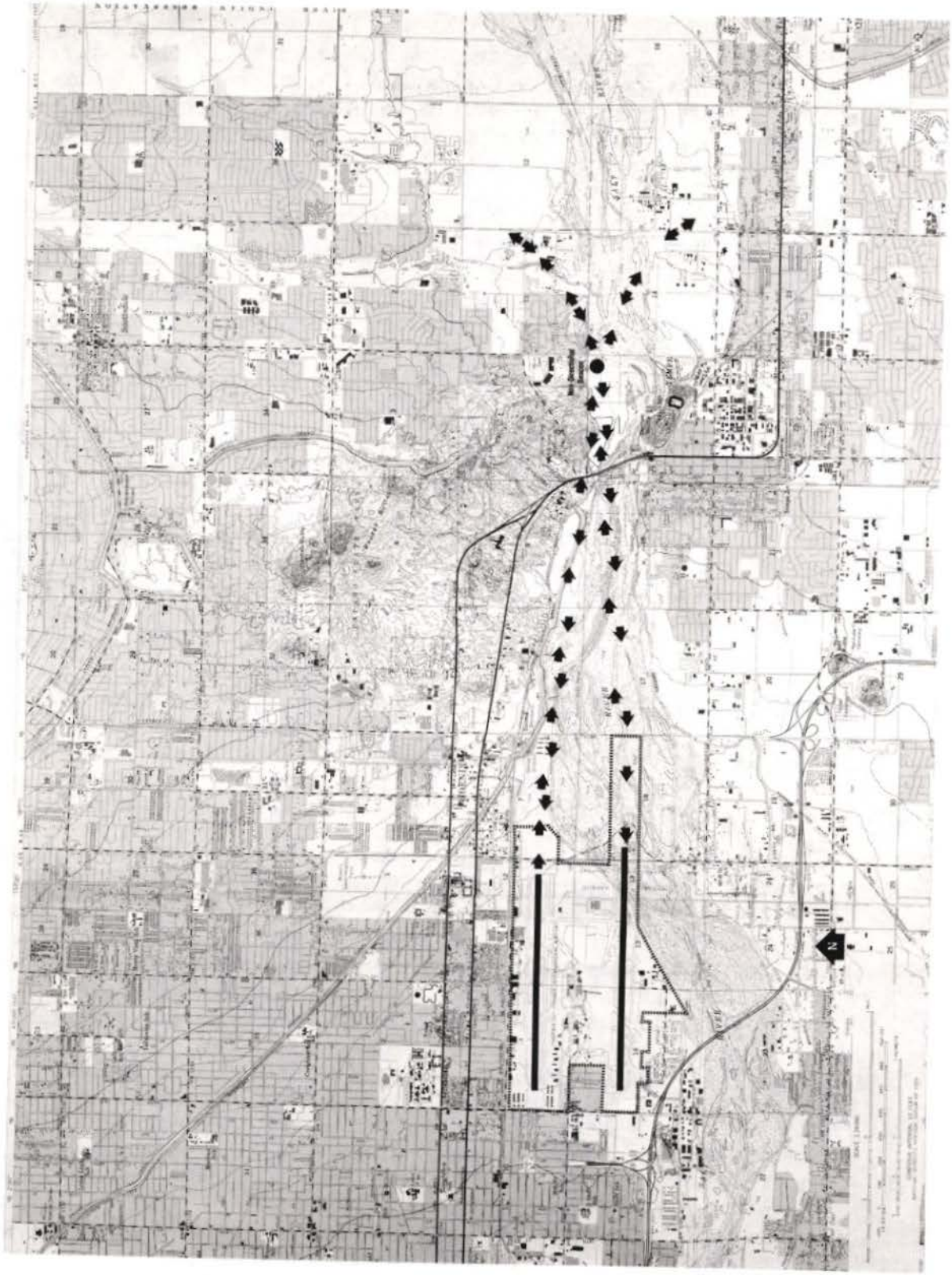
(2) Enplanements: 2.20 million.

b. The Problem. Urbanization had gradually closed in upon the eastern approaches to the airport (see Illustration 4-P-1). The Salt River Channel, a dry riverbed, runs in an east-west direction on essentially the extended centerline of the principal runway. Because of periodic flooding, residential development has remained a good distance back from the channel. This presented the possibility of using the river and its floodway as a noise impact corridor relatively free of existing incompatibilities and relatively secure from future intrusions. Use of this corridor had been informally agreed upon by airport management, aircraft operators, and the FAA as a noise abatement procedure. However, publication of a draft environmental impact statement for a needed runway extension indicating that both existing and future noise impacts would be limited to the flood plain brought many protests that jet aircraft deviated widely from this corridor and could be expected to do so in the future.

c. The Compatibility Plan. The planners, in cooperation with the FAA, utilized time-lapse photography of the airport's ARTS III radar display to plot actual flight tracks of approaching and departing aircraft. Since the operation of large aircraft is subject to numerous variables such as wind and weather conditions, air turbulence, and other air traffic, the flight path more properly can be described as a flight corridor. This corridor represents the range of normal day-to-day variations in a pilot's ability to adhere to prescribed paths and is reasonably represented by such noise impact measurement techniques as the NEF. Aircraft flight tracks falling outside the corridor can then be considered major deviations for which corrective action is both desirable and possible. The radar survey indicated a high level of major deviations with 57 percent of the observed arrivals and 67 percent of the observed departures operating outside the desired flight corridor. An action program consisting of the following elements was developed to deal with the problem.

(1) Revision of existing aircraft approach and departure procedures to eliminate pilot misunderstandings.

(2) Development of new air traffic controller procedures and installation of additional navigational aids to provide more positive aircraft direction.



PHOENIX SKY HARBOR INTERNATIONAL AIRPORT
EAST END ARRIVAL AND DEPARTURE ROUTES
ILLUSTRATION 4-P-1

(3) Education of airline industry representatives to the nature of the noise problem at Sky Harbor and formation of an airport/airline working group to aid in development of the action program steps thus insuring their cooperation in making the procedural revisions effective.

(4) Evaluation of the benefits of additional improvements in Sky Harbor navigational aid facilities.

(5) Formulation of a continuing airport/community communication channel in the form of a Sky Harbor Noise Abatement Committee.

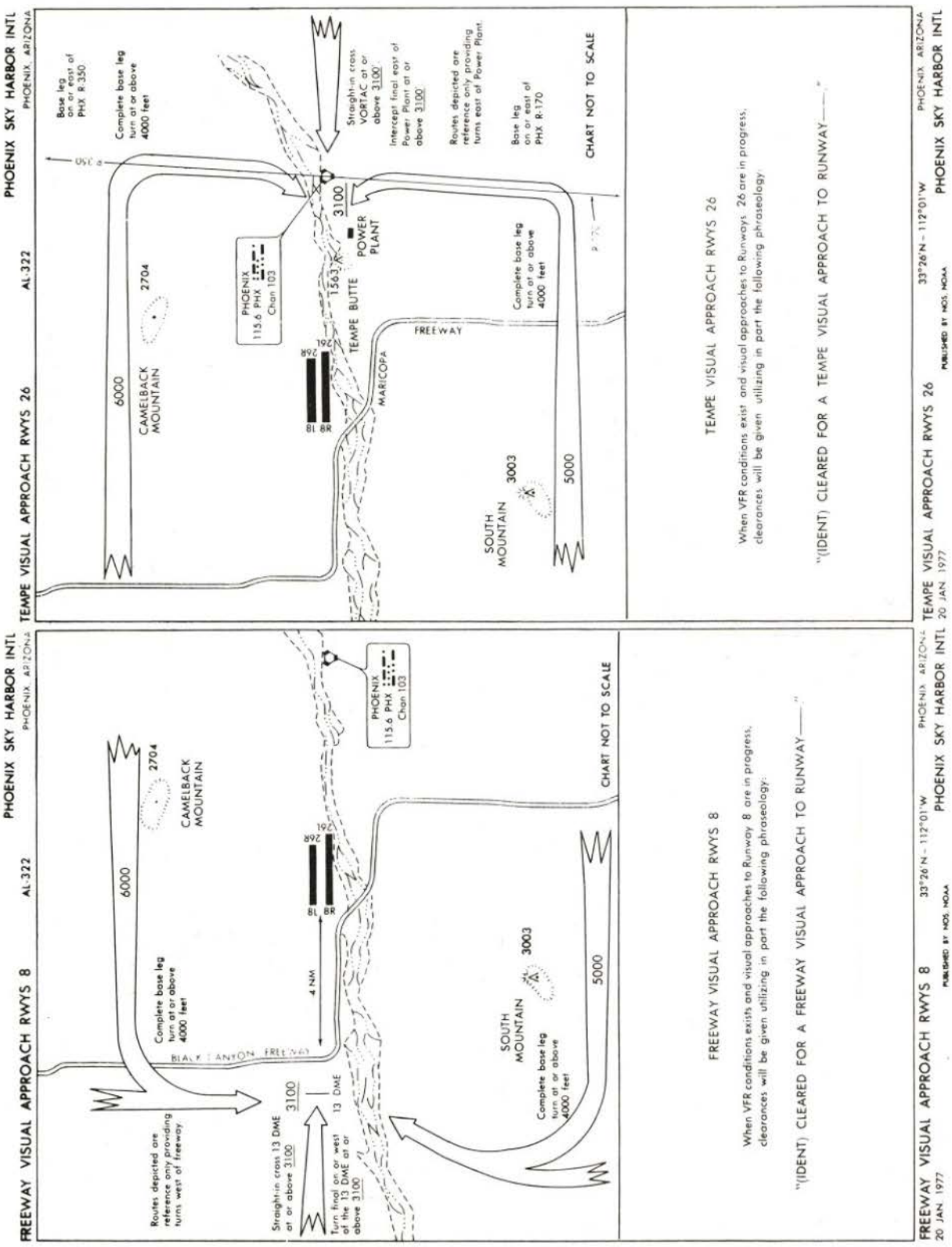
d. Implementation Strategy.

(1) Approach Procedures. The instrument approach procedures in use were already contributing to the compatibility effort by providing positive guidance to aircraft. Adoption of air traffic procedures is primarily for safe and expeditious handling of air traffic coordinated with the airport proprietor's noise abatement request. Working within this context, revised visual approach procedures were adopted and visual approach charts (see Illustration 4-P-2) were published. These procedures help significantly in keeping visual approaches within the corridor.

(2) Standard Instrument Departure. Standard instrument procedures are primarily for the purpose of establishing safe and expeditious flow of air traffic. Within this constraint, they also take into account noise sensitive areas. A standard instrument departure procedure was published (see Illustration 4-P-3). The departure procedure formalizes the Salt River Channel departure corridor making use of a non-directional radio beacon as a guide for departing aircraft in the Scottsdale-Tempe area. The City of Phoenix acquired a site for this navigational aid and the FAA installed the equipment. Formal publication of these revised pilot aids and installation of the beacon should insure that pilots using the airport are knowledgeable of these procedures and thus eliminate misunderstandings and unfamiliarity.

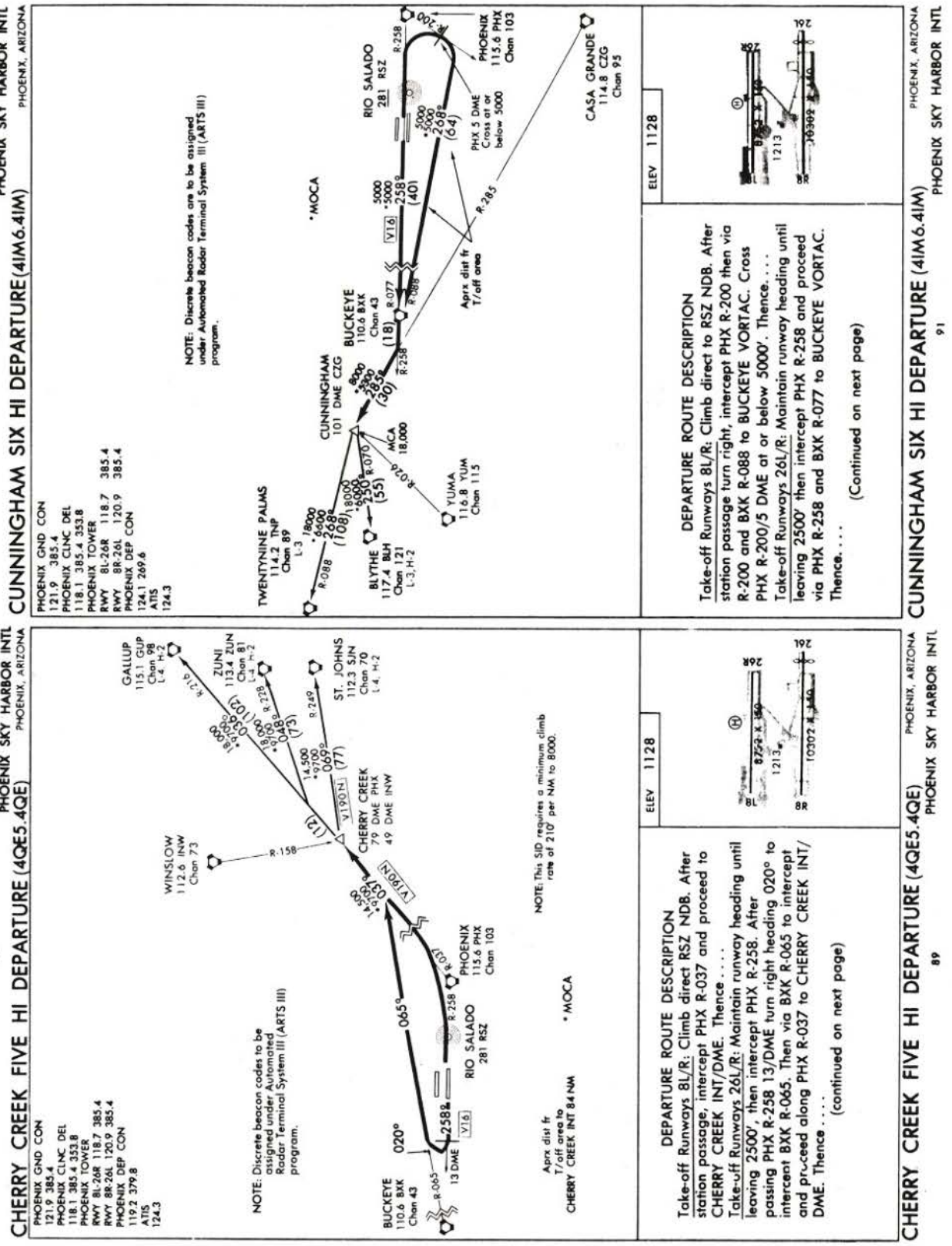
(3) Controller Procedures. The air traffic controller procedural revisions involved adjustment in directional information provided pilots arriving and departing the terminal area airspace. Verbal communication provided the pilot by the controller is of value in insuring positive aircraft guidance and adherence to the prescribed flight tracks.

(4) Educational Measures. A meeting was held with airline industry, FAA, City of Phoenix Aviation Department, and the planners to



PHOENIX SKY HARBOR: VISUAL APPROACH PLATES

ILLUSTRATION 4-P-2



PHOENIX SKY HARBOR: DEPARTURE PLATES

ILLUSTRATION 4-P-3

inform the industry representatives of the study conclusions and the recommended action program which was evolved therefrom. This initial meeting and several subsequent sessions resulted in creation of a real awareness of the noise problem and an industry pledge of full cooperation in minimizing future occurrence of major deviations over residential areas. The positive tone of this cooperation was encouraging and an informal airport/airline working group of airline pilots, FAA air traffic control personnel, and the City of Phoenix Aviation Department staff and their consultants was established to work on the initial action program steps and to develop additional means of improving the system performance.

(5) Continuing Airport/Community Communications. In order to insure continued communication with the public and as a means of maintaining momentum in development and implementation of further actions, a permanent Sky Harbor Noise Abatement Committee was formed.

e. Evaluation of the Plan. A second radar survey was conducted in order to evaluate improvements derived from the initial action program. The results indicated that substantial improvement had been realized in the residential areas most affected by noise as a direct result of these initial actions. Departure compliance, for example, had improved to 80 percent. This progress should be enhanced in the future as the procedures become more familiar to the users.

6. LOGAN INTERNATIONAL AIRPORT.

a. The Airport. Logan International Airport serves the Boston large hub and is located on a small peninsula in Boston Harbor. The airport property consists of 2,384 acres (see Illustration 4-B-1). The activity statistics for Fiscal Year 1976 are as follows:

(1) Total operations: 300,799 (air carrier: 208,208).

(2) Enplanements: 5.17 million.

b. The Problem. The airport is at the center of a major metropolitan complex and is surrounded on three sides by noise sensitive uses. Expansion is limited by both urbanization and the harbor. It was estimated that in 1972, some 121,000 persons were exposed to aircraft noise of 30 NEF or higher. The noise impact areas involved a number of independent jurisdictions.

c. The Compatibility Plan. It was recognized that it would not be possible to eliminate all the noise conflicts without relocating the airport. Also, lengthening of runways at their inner harbor ends (to permit aircraft taking off from those ends to climb higher before overflying noise sensitive areas) was generally unacceptable to the airport's neighbors. The approach taken, therefore, was to alleviate as many of the incompatibilities as possible within the constraints of space, money, and jurisdictional problems. The implementation is via a policies plan. This is a series of policies to be adopted by the port authority, designed to guide the sponsor's future actions, and to achieve the improvements in airport-environs compatibility proposed in the compatibility scheme.

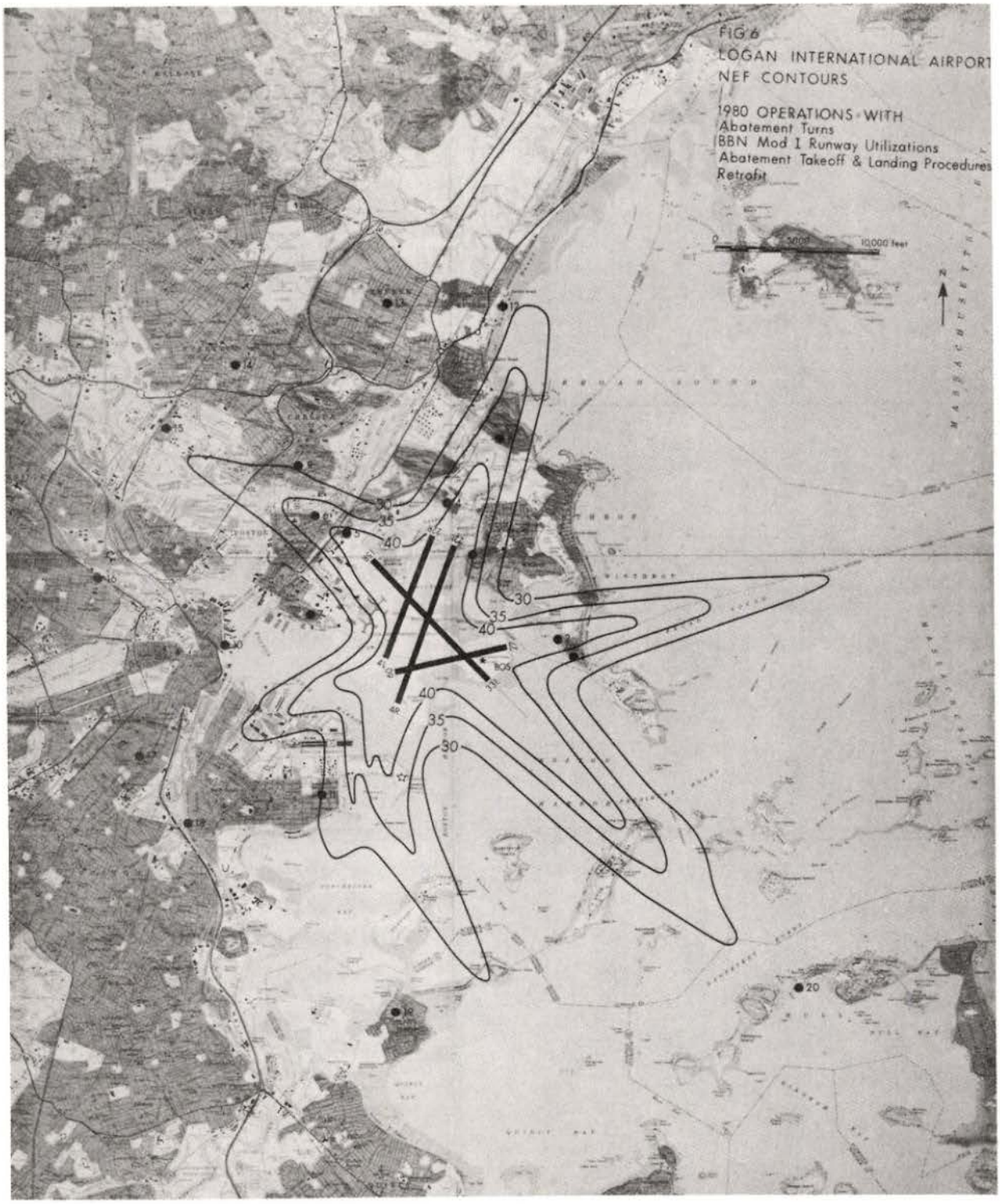
d. Implementation Strategy.

(1) Noise Forecasts. An 80 percent growth in airline passengers was forecast for the next ten years but with a slowly declining number of air carrier flights. This latter estimate was based upon increased load factors and a transition to larger capacity aircraft. From this it was concluded that the present compliment of runways could accommodate future traffic and that there would be some relief from present day noise problems. The plan also assumed air carrier replacement or retrofit of noisy aircraft through implementation of the FAA Aviation Noise Abatement Policy. Coupled with the projected decline in total number of air carrier operations, this would significantly reduce the area impacted by noise and make possible judicious use of noise control and corrective actions to minimize the remaining noise impacts.


FIG 1
LOGAN INTERNATIONAL AIRPORT
NEF CONTOURS
1975 EXISTING CONDITIONS
0
5000
10,000 feet
N
30
35
40
45
BOS

(2) Noise Controls. Logan International Airport has had an excellent history of pioneering and cooperation in utilizing operational procedures to minimize noise impacts. The plan, therefore, called for maximum utilization of preferential runways for noise abatement purposes, consistent with weather conditions and operational safety. Refinement of operational techniques would include more specific location of ground points over which noise abatement turns are to be made and guidance to pilots from tower controllers in locating these points (see Illustration 4-B-2).

(3) Corrective Actions. The proposed corrective actions center around soundproofing noise impacted schools and the purchase of heavily impacted residential properties. However, the plan also proposes reduction in the impacts of ground access upon the airport's neighbors. Trucks carrying aircraft fuel are to be replaced by a pipeline. Rental car parking lots are to be removed from surrounding neighborhoods and placed upon airport property.



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