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# Airport Land Use Planning Handbook

## - A Reference and Guide for Local Agencies -

prepared for the California Department of Transportation
Division of Aeronautics

by the

Metropolitan Transportation Commission

and the

Association of Bay Area Governments

July 1983

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July 1983

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# I. INTRODUCTION

Under California law, each county with a public use airport served by a certificated air carrier has an agency called an airport land use commission. These commissions exist to provide for the orderly development of the public use airports and to promote public health, welfare and safety through land use planning actions of the commissions and local governments, including airport operators.

ALUCs were created under State law enacted in 1967. The ALUC statutes have been amended several times in the intervening years, but the most significant alterations occurred in 1982 with enactment of AB 2920 (Chapter 1041, Statutes of 1982). Appendix A presents the text of the current airport land use law.

AB 2920 established a more clearly articulated purpose for ALUC activities, and established a process for achieving consistency between ALUC plans and the general plans and implementing ordinances and regulations of cities and counties. Detailed methods for achieving this consistency were not described in the new legislation, which was purposely drafted to be general in nature. Implementation methods for achieving this consistency were left up to the local governments--the ALUCs and cities and counties--to provide maximum flexibility in dealing with local situations. The law did, however, spell out a general "process" for achieving consistency--starting with the ALUC plans.

This handbook has been prepared by staff of the Metropolitan Transportation Commission and the Association of Bay Area Governments under a contract with the California Department of Transportation's Division of Aeronautics, administering a grant from the Federal Aviation Administration. The handbook was prepared to provide technical assistance and other guidance to ALUCs for improving plans and to cities and counties in achieving consistency between the ALUC plans and their own general plans.

Under the old ALUC statutes, State and regional agencies were not required to review the local airport land use plans. AB 2920 did not prescribe any new role for these agencies. Therefore the handbook should be read as advisory to cities and counties and ALUCs in implementing the new statute. It does not function as guidelines for local planning. The Office of Planning and Research's "General Plan Guidelines" provide statutorily required guidance for the preparation and maintenance of local general plans. This handbook is meant to be read and used in conjunction with the OPR guidelines, and to provide more technical information on AB 2920 provisions than the guidelines contain.

As mentioned above, the process of achieving consistency of local general plans and ALUC plans begins with an airport land use plan prepared by an ALUC. Section 21675 of the Public Utilities Code

describes the required content of an airport land use plan:

> ...a comprehensive land use plan [shall be formulated] that will provide for the orderly growth of each public airport and the area surrounding the airport....[The plan shall] safeguard the general welfare of the inhabitants within the vicinity of the airport and the public in general. The commission plan shall include a long-range master plan that reflects the anticipated growth of the airport during at least the next 20 years. In formulating a land use plan, the commission may develop height restrictions, may specify use of land, and may determine building standards, including soundproofing adjacent to airports, within the planning area.

A significant provision of the ALUC law--not changed by AB 2920--is that the ALUCs have no authority over the **operation** of an airport. The commissions deal with the relationships between airport development and land uses of surrounding territory. ALUC land use recommendations are directed to areas around public airports **to the extent such areas are not already devoted to incompatible uses.** This provision is significant because of the large amount of development around many airports in the state.

Few instances exist where an ALUC has been able to start its planning with a clean slate. Around the State's busiest airports, high land costs and other development pressures intensify land use conflicts. Competing interests for the use of land in urban areas include the expansion of commercial and industrial areas (with their accompanying contributions to an improved fiscal base) and residential developments to provide increased housing opportunities and comply with other provisions of State law relating to addressing housing needs. Thus an airport land use commission may be involved in the decision-making process related to proposals for the construction of a tall building near an airport or a large residential development nearby.

The development conditions around major California airports vary. The handbook does not attempt to prescribe minimum standards for either ALUC or local general plans. Its suggestions are made to stimulate awareness of alternative planning techniques and to summarize how other ALUC plans deal with similar problems. Local agencies can adopt the handbook suggestions or modify them to reflect local conditions, while fulfilling the purposes of the airport land use planning statutes.

The handbook addresses three critical land use planning concerns:

- Compatibility of surrounding land uses with respect to airport noise levels.
- Compatibility of surrounding land uses in terms of exposure of persons on the ground to crash hazards associated with aircraft.
- The need for appropriate height restrictions to protect the airspace used by aircraft.

Existing ALUC land use plans were obtained from most ALUCs in the State, and were reviewed to determine how the commissions deal with each of the areas listed above. This review suggested that a variety of approaches can be taken to address noise and safety problems in and around airports.

The review of existing plans indicated specific suggestions could be made to improve the current planning process. The handbook highlights information and techniques that seem particularly useful in addressing critical problems. The extent to which local ALUCs use these suggestions will, of course, depend on the nature of specific local problems and on the opportunities--political and financial--for revising existing plans.

An attempt has been made in each chapter of the handbook to present several levels of information. These include summaries of existing ALUC plans, basic information required for a working understanding of major planning concerns, special planning considerations that have posed problems in the past, and suggestions for improving existing plans. The handbook discusses planning problems associated with air carrier, general aviation and military airports and heliports. It discusses the process of adoption of plan revisions and actions of cities and counties to override recommendations of ALUCs and still achieve plan consistency. It also discusses potential ways to reduce liability of local agencies and airport operators for noise damages. References are provided for more detailed information in specific areas.

Chapter II of the handbook describes the airport land use planning requirements and implementation schedule in more detail, and summarizes in tabular form the existing ALUC plans in California. Chapter III discusses noise compatibility planning. Chapter IV describes methods for protecting safety of persons on the ground.

Chapter V summarizes issues relating to the development of building height restrictions near airports. Chapter VI discusses the use of planning boundaries, and Chapter VII deals with airport master plans.

Chapter VIII discusses implementation of AB 2920 through plan revisions. Chapter IX discusses the use of specific findings to achieve consistency between local general plans and implementing regulations and the ALUC plans.

The appendices contain a complete text of state law regarding airport land use planning, related technical material, model ordinances, other sample regulatory agreements, an airport land use planning glossary, and references.

## II. GENERAL DESCRIPTION OF AIRPORT LAND USE PLANNING LAW AND TABULAR SUMMARY OF EXISTING ALUC PLANS

As stated briefly in the introductory chapter, California law regarding land use planning around airports was revised by enactment of AB 2920 in 1982. Since 1968 state law has required an airport land use commission in each county containing one or more public use airports served by a certificated air carrier.

The basic requirements for the airport land use commissions and their activities are contained in Article 3.5 of Division 1, Part 1, commencing with Section 21670, of the Public Utilities Code.

The law spells out the powers and duties of the commission [Section 21674] as follows:

> (a) To assist local agencies in ensuring compatible land uses in the vicinity of all new airports and in the vicinity of existing airports to the extent that the land in the vicinity of such airports is not already devoted to incompatible uses.
>
> (b) To coordinate planning among state, regional and local agencies to provide for the orderly development of air transportation while at the same time protecting public health, safety and welfare.
>
> (c) To prepare and adopt an airport land use plan [Section 21675].
>
> (d) To review the plans, regulations and other actions of local agencies and airport operators [Section 21676].

Subdivision (e) of Section 21674 specifies that the commissions exercise no regulatory authority over the operation of an airport. This limitation was include in the old law.

AB 2920 made one other important change. The previous Section 21674, which also spelled out the commissions' powers and duties, declared that the commissions were "to achieve by zoning compatible land uses" in and around airports. Previous law did not, however, grant to the commissions any authority to exercise the zoning power. The implied powers of ALUCs to zone land were deleted by the new Section 21674.

Previous law was equally vague with respect to the extent of other ALUC authority--particularly the relationship between the ALUC plans and the general planning and zoning authority of cities and counties with

jurisdiction around airports. Implementation of the old law was, therefore, markedly varied throughout the State. In addition, prior to enactment of AB 2920, cities and counties could override ALUC recommendations with respect to land use proposals, simply by exercising a four-fifths vote of the board of supervisors or city council. No specific findings prior to the action to override were required.

AB 2920 imposes new requirements with respect to land use planning around airports, and with respect to how local governments and other agencies--specifically airport operators--are to consider actions of the airport land use commissions. These are discussed in more detail below.

Requirements for Plan Consistency

No detailed regulations or guidelines exist for the content of airport land use commission plans. As will be seen, however, in the tabular summary presented later in this section, most existing ALUC plans contain similar information in a number of areas, such as:

- referral or planning areas.
- noise compatibility.
- safety to persons on the ground.
- height restrictions for air safety.

In addition, the plans commonly describe existing and proposed airport facilities, current and projected aircraft operations, present land uses, policies and standards for land use and development within the area around airports, and specific measures for coordination with city and county land use planning and development regulations.

The descriptions of airport facilities and operations, as well as identification of safety zones and noise contours, is usually obtained from airport master plans, where such plans exist. Current State law does not require public airports to have master plans. Other information available to the airport land use commission may serve as a surrogate for what would normally be included in an airport master plan. This information is identified at appropriate places in the chapters to follow.

AB 2920 requires city and county general plans to be consistent with applicable airport land use plans developed by ALUCs. This requirement is spelled out in Section 65302.3 of the Government Code, which provides that by December 31, 1983, local agencies shall amend the general plan and any applicable specific plan to be consistent with the ALUC plan.

After January 1, 1984, within 180 days of an amendment to the ALUC plan,

cities and counties must amend any applicable specific plan and the general plan to ensure consistency.

The Legislature in AB 2920 provided cities and counties with two ways to make the ALUC and general plans consistent. The first way is to incorporporate or otherwise reflect the content of the airport land use commission plan in the general plan and applicable implementation regulations, such as zoning ordinances and building codes. Alternatively, if a city or county does not agree with specific provisions of the ALUC plan, and wishes to adopt a different provision within the general plan (or, again, implementing regulations), it may do so and still achieve consistency with the ALUC plan by adopting specific findings that the change enacted is consistent with the stated purposes of the ALUC law.

Schedule for Achieving Plan Consistency

AB 2920 contains a schedule for local governments to make existing plans consistent, and for ensuring consistency thereafter.

Each city and county whose general plan covers territory also covered by an airport land use plan must submit its general plan and any affected specific plans to the airport land use commission. This submittal was to occur by July 1, 1983.

By August 31, 1983, each ALUC is to review the submitted plans and find them consistent or inconsistent with the existing ALUC plans, as such plans provide on July 1. If a finding of inconsistency is made by an ALUC, the local agency is to be notified. In such a case, the local agency is required to have another hearing to reconsider its plan. The local agency may overrule the ALUC finding by adopting specific findings that the actions in the general plan are consistent with the purposes of the ALUC statute.

In a similar way, a city or county proposing to amend the general or specific plan, or to adopt or approve a zoning ordinance or building regulation, must first refer the proposal to the commission. The same requirements are applied to public agencies owning airports; prior to modification of airport master plans, the proposed modification must be referred to the applicable ALUC for review and a finding of consistency or inconsistency. The law provides that a commission is required to make its findings within 60 days from the date of referral of the proposed action. If a finding is not specifically made within that period, Section 21676 provides that the proposed action "shall be deemed consistent with the commission's plan." Previous law contained no time limit by which an ALUC had to act on a proposed action. The new law does not prevent an ALUC from adopting a policy that it will act on proposals more quickly than 60 days.

## Adoption of Findings

As stated previously, the old ALUC law permitted local agencies to override ALUC findings or actions by a four-fifths vote. Under specific provisions of AB 2920, however, local agencies are no longer permitted merely to vote to override an ALUC plan provision or finding for whatever reason. They are instead required to adopt specific findings that such actions to override are nonetheless consistent with the stated purposes of the law. These purposes are set forth in Section 21670 of the Public Utilities Code:

> 1. To **provide for the orderly development of each public use airport** in this state and the area surrounding such airports in such a manner, among other things, to **promote the overall goals and objectives of the California airport noise standards,** and **prevent the creation of new noise and safety problems.**
>
> 2. To **protect public health, safety and welfare** by ensuring orderly expansion of airports and the adoption of land use measures that **minimize the public's exposure to excessive noise and safety hazards** within areas around public airports **to the extent that such areas are not already devoted to incompatible uses.**

The extent to which ALUC plans themselves fulfill these purposes will, in large part, determine how local governments will address the issues in making general plan changes to ensure the required consistency.

## Tabular Summary

The table that concludes this chapter summarizes the existing airport land use plans in California. The table consists of a summary of the airport land use commission plans and documents used in preparing them. These other documents include Air Installation Compatible Use Zone (AICUZ) studies (prepared for military airports), Vicinity Area Plans, and Airport Noise Control and Land Use Compatibility (ANCLUC) studies. Some of the ALUC planning documents are comprehensive land use plans for individual public airports, as the term "comprehensive" is defined in Section 21675 of the Public Utilities Code. Most plans are general policy plans, while several ALUC plans are very detailed and specific, including recommendations for land use zoning.

The major topics covered in the summary tables are referral areas and how they are defined, noise compatibility comparisons, safety on the ground, and safety in the air.

REFERRAL AREAS AND PLANNING BOUNDARIES

| ALUC | Defined by Streets and Geographic Features - includes Noise and and Safety Impact Areas | Defined by Noise Contours | Defined by FAA Part 77 Approach Surfaces* | Defined by FAA Part 77 Horizontal & Conical Surfaces* | Other/Comments |
|---|---|---|---|---|---|
| 1. Alameda County | RA | | | | |
| 2. San Mateo County | | R | R | R | Project must be referred if located in noise, safety,or height restriction zones |
| 3. Santa Clara County | RA (General Aviation) | RA (San Jose Airport) | | | |
| 4. San Jose Airport Vicinity Area Plan | | RA | | | |
| 5. Sonoma County | RA (Primary Referral Area) | | | RA (Secondary Referral Area) | |
| 6. Orange County | | RA | | RA | |
| 7. Sacramento County | | | | PB | |
| 8. San Diego County | RA | | | | |
| 9. Riverside County (Palm Springs) | | | | | Plan is a specific area plan for City of Palm Springs |
| 10. Riverside County (Hemit-Ryan) | | | PB (Area II) | PB (Area III) | Boundaries include flight paths modified by streets and geographic features |
| 11. San Joaquin County | PB | | | | |

REFERRAL AREAS AND PLANNING BOUNDARIES con't.

| ALUC | Defined by Streets and Geographic Features - includes Noise and and Safety Impact Areas | Defined by Noise Contours | Defined by FAA Part 77 Approach Surfaces* | Defined by FAA Part 77 Horizontal & Conical Surfaces* | Other/Comments |
|---|---|---|---|---|---|
| 12. Kern County | | PB | | | |
| 13. Stanislaus County | PB (Crows Landing NALF) | | | PB (other airports) | |
| 14. Tuolumne County | RA (Primary Referral Area) | | | RA (Secondary Height Referral Area) | |
| 15. Santa Barbara County | | PB | PB | PB | Planning boundary includes areas defined by noise, safety, and height restriction zones |
| 16. Marin County | | PB | | | |
| 17. Imperial County | PB (El Centro NAF) | | | PB (Other Airports) | |
| 18. Contra Costa County | | | | PB | |
| 19. Monterey County (Salinas Airport) | PB | | | | Plan is a specific area plan |
| 20. Monterey Airport ANCLUC Study | PB | | | | |
| 21. Shasta County (Redding Airport) | | PB | | | 55 CNEL boundary modified to reflect local planning issues - Plan is a specfic area plan |
| 22. Fresno County | RA (Primary Review Area) | | | RA (Secondary Height Review Area) | |
| 23. San Bernardino County (Cable Airport) | | | | PB | Plan prepared by West Valley Airport Land Use Commission |

REFERRAL AREAS AND PLANNING BOUNDARIES con't.

| ALUC | Defined by Streets and Geographic Features - includes Noise and and Safety Impact Areas | Defined by Noise Contours | Defined by FAA Part 77 Approach Surfaces* | Defined by FAA Part 77 Horizontal & Conical Surfaces* | Other/Comments |
|---|---|---|---|---|---|
| 24. San Luis Obispo County (Oceano County Airport) | | | | PB | |
| 25. Military AICUZ studies | | PB | PB | PB | Planning boundary includes areas defined by noise, safety, and height restriction zones |

Legend:

RA - Referral Area; R - Project to be referred if it is located in one of the indicated zones; PB - Planning Boundary /Airport Influence Area

*Federal Aviation Regulations Part 77 "Objects Affecting the Navigable Airspace" - Imaginary Surfaces for Civil Airports (see Section V.).

## NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 1. Alameda County | - 60 CNEL for general aviation airports (P)<br>- 65 CNEL "Line of Demarcation" for Oakland Airport (*)<br><br>*Compromise between several projected contours | "Land Use Compatibility Chart for Aircraft Noise" Paul S. Veneklasen and Associates, December 1972 | - Maximum interior noise level for intermittent noise<br><br>- Information included in plan on noise insulation characteristics of common construction techniques and materials | Not recognized as means of rendering land use compatible but required for some approvals | - Uses "Normalized CNEL" scale to evaluate compatibility of projects. Normalized scale takes into account ambient noise level of area surrounding airport<br>- Recommends local jurisdictions adopt procedures to ensure prospective property owners in noise exposure areas above 60 CNEL be informed of land use restrictions<br>- Recommends local adoption of sound insulation standards consistent with those in ALUC plan |
| 2. San Mateo County | - 60 CNEL for general aviation airports (P)<br>- 65 CNEL for San Francisco Int'l Airport (E) | "Airport Noise/Land Compatibility Standards" - source not identified<br>For general aviation:<br><br>- noise analysis required in 55-60 CNEL area<br>- no residential permitted above 60 CNEL<br><br>For San Francisco Int'l.:<br><br>- no insulation required in areas less than 65 CNEL<br>- insulation required for 65-70 CNEL<br>- no residential above 70 CNEL | - Noise insulation recommendations from acoustical report must be included in project design<br><br>- Provides separate section on "Noise Insulation Guidelines" | It is not policy of ALUC to require easements | Plan contains special policies for:<br><br>- Infill (development of vacant parcels in areas that are already substantially developed with uses not permitted by the plan)<br>- Replacement of non-conforming uses destroyed by fire or natural disaster<br>- Minor additions, borderline cases |
| 3. Santa Clara County | - 60 CNEL for general aviation airports (P)<br>- 65 CNEL for San Jose Municipal Airport (P) | "Land Use Compatibility Chart for Aircraft Noise" - source not identified<br><br>- no residential or educational facilities (schools, libraries, churches) permitted in areas above 65 CNEL<br><br>San Jose Municipal Airport: | - Maximum interior noise level for intermittent noise<br>- Required noise reduction based on slant distance from aircraft (San Jose Airport)<br>- Information included in plan | Required for approval | - Land uses that exceed recommended CNEL subject to case by case review<br>- Single event noise levels utilizing dBA scale shall also be used as one factor in determining land uses near airports<br>- Normalized CNEL is also to be considered in evaluating compatibility |

Note: (P) - a projected noise contour is used for noise impact boundary
(E) - a contour for existing levels of activity is used for noise impact boundary

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 3. Santa Clara County (continued) | | - no insulation required for areas below 65 CNEL<br><br>General aviation airports:<br><br>-60-65 CNEL: residential allowed with normal construction, windows sealed, forced air ventilation | on noise insulation characteristics of common construction techniques and materials | | |
| 4. San Jose Airport Vicinity Area Plan | 65 CNEL (P) | - Exterior noise levels below 65 CNEL deemed acceptable to any land use<br>- New schools and residences in 65-70 CNEL are permitted if insulation provides interior level of 45 CNEL<br>- An interior level of 55 CNEL is acceptable for industrial and commercial use<br>- New public and quasi-public facilities are discouraged in the vicinity area | - Recommends standard construction methods be identified versus relying on sound meter testing for each project | Does not recommend exclusive reliance on easements for compliance with state noise standards | |
| 5. Sonoma County | 60 CNEL for general aviation airports (P) | "Airport Land Use Noise Compatibility Criteria" - source not identified<br><br>- medium to high density residential acceptable in 55-60 CNEL areas<br>- all residential in areas more than 60 CNEL is marginally acceptable or normally unacceptable and acoustical insulation required<br>- mobile homes unacceptable in areas above 55 CNEL | - Maximum interior noise level for intermittent noise | | If noise monitoring shows levels less then shown in plan, the lower exposure level may be used at the discretion of the Commission |

## NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 6. Orange County | 60 CNEL for general aviation, military, and air carrier airports (E) | "Land Use Guidelines" - source not identified<br><br>Noise Impact Zone 1 (more than 65 CNEL):<br><br>- all residential units unacceptable unless sound insulated to achieve 45 CNEL indoor and sufficiently oriented to indoor living<br>- schools, hospitals, libraries normally unacceptable<br><br>Noise Impact Zone 2 (60-65 CNEL):<br><br>- sound insulation required (single events may create serious disturbance to many inhabitants) | - California Noise Insulation Standard (45 CNEL indoor) | | |
| 7. Sacramento County | 65 CNEL (P) | - No residences within 65 CNEL contour<br>- Recognizes some homes east of airport may fall within 65 CNEL contour after January 1, 1986 (Sacramento Executive Airport)<br>- Land Use Compatibility Chart - Paul S. Veneklasen & Associates (Yolo County Airport) | | | - Land Use Compatibility Chart is provided for Yolo County Airport Source: Paul S. Veneklasen & Associates, December 1972<br>- Plan incorporates operational and noise abatement procedures for Executive Airport in policy section; any ordinance which results in increased noise restrictions is consistent with ALUC policy and would not require ALUC review |
| 8. San Diego County | 60 CNEL (P) | HUD "Aircraft Noise Impact Planning Guidelines for Local Agencies" 1972<br>-residential prohibited above 65 CNEL<br>-residential, and other forms of housing in areas above 60 CNEL require acoustical analysis | - California Noise Insulation Standard (45 CNEL indoor) | | - Recommends steps be taken to rezone vacant land to a compatible use<br>- Recommends ordinance be adopted applying California Noise Insulation Standards (Title 25) to single family detached residences<br>- Recommends all potential property owners be informed when properties affected by noise above 60 CNEL |

## NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 9. Riverside County (Palm Springs Airport) | 60 CNEL (P) | 60-65 CNEL:<br>-new residences must be soundproofed<br>-noise easements required<br><br>above 65 CNEL:<br>-new residential construction prohibited with certain specific exceptions; exceptions must provide avigation easements and be sound insulated | California Noise Insulation Standard (45 CNEL indoor) | Required | -Plan is a specific area plan<br>-Airport operational restrictions included in plan<br>-Explicitly states that plan does not include consideration of any new runways or runway extensions<br>-County requested to adopt compatible zoning as well |
| 10. Riverside County (Hemet-Ryan Airport) | 55 Ldn (P) | -new housing to be constructed in 55 Ldn contour shall be soundproofed to achieve 45 Ldn interior sound levels | -Interior noise standards recommended by HUD | Required for all land uses in 55 Ldn contour | |
| 11. San Joaquin County | 60 CNEL | HUD "Aircraft Noise Impact: Planning Guidelines for Local Agencies", 1972<br>Above 65 CNEL:<br>-residential, churches, theaters and auditoriums not permitted<br>-most other land uses permitted if sound insulation provided<br>60 - 65 CNEL:<br>-residential permitted<br>-schools, churches, theaters, and auditoriums not permitted<br>-most other land uses permitted with insulation | -Residential permitted if 45db interior (35 db in sleeping areas) can be achieved | | |

NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 12. Kern County | 60 CNEL(P) | "Land Use Compatibility for Community Noise Environments" State Office of Noise Control.<br><br>-ALUC uses four land use zones for compatibility purposes:<br>Zone I - 60-65 CNEL<br>Zone II - 65-70<br>Zone III - 70-75<br>Zone IV-75 CNEL and above<br>-Normally unacceptable uses should not be permitted except with noise insulation | -noise insulation standards for multiple occupancy dwellings in California Noise Insulation Standards | | -recommendations for noise compatibility should be used in conjunction with on-site monitoring to determine ambient noise levels |
| 13. Stanislaus County | 60 CNEL(P) | "Airport Land Use Compatibility Listing"-source not identified<br>FAR Part 77 - Approach and Transitional Surface:<br>-most residential prohibited<br>-rural residential (10 acre parcels) conditionally acceptable<br>-no mobile home parks, schools, hospitals, or churches permitted<br>Horizontal Surface:<br>-schools and residential compatible<br>-sound insulation for schools may be required | -Refers to California Noise Insulation Standards | | Encourages affected jurisdictions to adopt noise attenuation plan for impact area |

NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 14. Tuolumne County | 55 CNEL (P) | Adapted from "Guidelines for the Preparation and Content of Noise Elements of the General Plan" - State Office of Noise Control<br>-residential in areas above 55 CNEL is conditionally unacceptable; 60-65 is normally acceptable; and above 65 CNEL is clearly unacceptable<br>-normally unacceptable and conditionally acceptable designation require noise reduction be included in plans | -Maximum interior noise level for intermittent noise<br>-Guidelines for noise reduction techniques available through county | Required for approval | |
| 15. Santa Barbara County | 60 CNEL (P) | Above 60 CNEL:<br>-residential may be subject to acoustical analysis showing interior noise levels will be below 45 CNEL<br>Above 65 CNEL:<br>-multi-family residential may be permitted subject to acoustic analysis as above<br>-institutional uses not permitted (schools, hospitals, etc.) | - California Noise Insulation Standard (45 CNEL indoor)<br>- Plan contains recommended building requirements for a 25 dB noise level reduction | | |
| 16. Marin County (Interim Plan) | 55 CNEL | 55-60 CNEL:<br>-acoustical analysis required<br>Above 60 CNEL:<br>-avoid residential and other sensitive uses; where alternative land uses cannot be found, residential may be approved with sound insulation | Maximum interior noise level for intermittent noise | | Infilling may be approved within partially developed areas without imposing noise reduction conditions; purchasers will be required to acknowledge formally these noise conditions |
| 17. Imperial County | 60 CNEL | "Land Use Compatibility for Community Noise Environments" - State Office of Noise Control | California Noise Insulation Standard (45 CNEL indoor | | |

NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 17. Imperial County con't. | | -discourage further residential development within 65 CNEL contour around El Centro NAF and 70 CNEL contour around Imperial Co. Airport<br>-prohibit new residences unless sound insulated to achieve 45 CNEL interior<br>-discourage further land division<br>-prohibit all "very sensitive uses" and discourage "sensitive" uses within the 60 CNEL contour | | | |
| 18. Contra Costa County | 65 CNEL | State Office of Noise Control | - Recommends cities require acoustic studies for all projects within FAA Part 77 horizontal surface<br>- Studies should include measurements of aircraft noise at project site and estimated maximum interior noise levels | -Recommends local agency require statement in all legal instruments for property that property is subject to overflight and activity is expected to increase | Commission will monitor allocation of aircraft operations between runways, mix of aircraft, distribution of daily operations, and noise mitigation actions of airport (Buchanan Field) |
| 19. Monterey County (Salinas Airport) | 55 CNEL (E) | Salinas Airport Land Use Plan is a specific area plan with recommended zoning for all parcels in airport area of influence | -Acoustical analysis required for all residental development inside 60 CNEL contour | Required | Incorporates airport's Noise Abatement Program and Procedures in plan |
| 20. Monterey ANCLUC Study | 55 CNEL (P) | Adapted from "Airport Noise Impact: Planning Guidelines for Local Agencies" HUD, 1972<br>Above 70 CNEL:<br>-no new residential<br>65-70 CNEL:<br>-require adequate sound insulation<br>55-65 CNEL: | California Noise Insulation Standards - 45 CNEL interior | Required | -Disclose aircraft noise and annoyance levels<br>-For annoyance noise, concentrate on aircraft operations procedures<br>-Obtain avigation easements and soundproof existing residences, schools, and noise sensitive public facilities in 65-75 CNEL contour<br>-provides noise maps down to |

NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 20. Monterey ANCLUC Study con't. | | -require acoustical studies and sound insulation if necessary | | | 55 CNEL due to the low background noise levels typical of the Monterey Peninsula |
| 21. Shasta County | 55 CNEL (E) | "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise, June 1980<br>- designate land within the 65 CNEL contour for non-residential use<br>- minimize residential use within the 60 CNEL contour | California Noise Insulation Standards (45 CNEL indoor) | Required within 60 CNEL contour and within Traffic Pattern Zone | - Plan comments that noise insulation standards do not take into consideration regional climatic conditions that cause residents either to open windows for ventilation or close windows to rely on air conditioning<br>- Notify owners of property within 65 CNEL contour of City of Redding's willingness to purchase property subject to availability of funds |
| 22. Fresno County | 55 CNEL (P) | "Airport Land Use Noise Compatibility Criteria" - source not identified<br>55-60 CNEL:<br>- single family and duplexes marginally acceptable<br>- multi-family and transient lodgings normally acceptable<br>- mobile homes unacceptable<br>60-65 CNEL:<br>- multi-family and transient lodgings marginally acceptable<br>- single family, duplexes, and mobile homes normally unacceptable | - Maximum interior noise level for intermittent noise<br>- Also CNEL shall not exceed 45dBA with windows closed in any residential dwelling<br>- Acoustical analysis required for "marginally acceptable" and "normally unacceptable" uses; building must be able to reduce noise to acceptable level to be approved | Required within Airport's Primary Review Area | - If noise monitoring indicates noise is less than CNEL shown in adopted plan, ALUC may use lower exposure level if desired<br>- Commission encourages local governments to establish a "buyer notification statement" within Primary Review Area |

NOISE COMPATIBILITY

| ALUC | CNEL STANDARD FOR PLANNING BOUNDARY | LAND USE COMPATIBILITY GUIDELINES | SOUND INSULATION STANDARD | NOISE EASEMENTS | OTHER |
|---|---|---|---|---|---|
| 23. San Bernardino (Cable Airport) | 65 CNEL (P) | Above 65 CNEL:<br><br>- all new residential units are unacceptable in this area<br><br>60-65 CNEL:<br><br>- residential units unacceptable unless conclusively shown they can be sound insulated to achieve 45dB CNEL interior noise levels | Plan notes significance of single events as they affect schools and hospitals | | Encourage development of airport noise abatement program to reduce existing noise problems<br><br>Schools, hospitals, and libraries unacceptable in areas exposed to more than 65 CNEL and must have adequate sound insulation for construction in 60-65 CNEL noise exposure area |
| 24. San Luis Obispo County (Oceano Airport) | Not specified - approach and climbout zones define areas of noise concern | Ocean side of airport: all residential conditionally acceptable (i.e., requires sound insulation)<br>Inland side of airport: all but rural residential (5 acres or more) unacceptable | | Required | On ocean side, land has been previously subdivided and ALUC believes that it would be unreasonable to impose conditions similar to those for inland side of airport |
| 25. Military AICUZ Studies | 65 CNEL | "Aircraft Noise Impact: Planning Guidelines for Local Agencies" HUD, 1972<br><br>-All uses except auditoriums, concert halls normally acceptable in areas below 65 CNEL<br>-65-75 CNEL: residential, schools, sports arenas, playgrounds and parks normally unacceptable; motels normally unacceptable above 70 CNEL<br>-75 CNEL: most uses discouraged; motels, golf courses, office buildings, manufacturing also normally unacceptable | DOD manual for construction criteria describes types of military facilities that can be built in noise zones on base. Sound insulation off base left to local authorities | | -Department of Defense has adopted Ldn as standard for AICUZ studies, except where state or local laws require other descriptor<br><br>-AICUZ studies usually address actions military operators can take to reduce community noise, e.g. limit ground runups, provide hush kits for engine test cells, relocate training activity, etc. |

## SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 1. Alameda County | Aircraft up to 12,500 lbs: 1500' x 3500'<br>Aircraft over 12,500 lbs and all jets: 1500' x 5300' | First 1320 ft. (1/4 mi):<br>- no more than 25 ppa at any time<br>Beyond 1320 ft (1/4 mi):<br>- any use resulting in more than 25 ppa for 24 hrs. or more than 50 ppa for 2 hrs. | No permanent structures or objects above primary surface<br>Suggested uses: agriculture, open space, warehouses, non-intensive industry, equipment storage. | Alignment shall reflect flight tracks | If local governments find mitigation not available, airport operations should also be reviewed to mitigate crash hazards |
| 2. San Mateo County | General aviation airports: 1000' x 2000' | Non-structural uses must not exceed a concentration of 10 ppa on a regular basis | -Policy is to keep approach zones free of structures<br>-Motor vehicle parking and open storage generally permissible | Along extended runway centerline | |
| 3. Santa Clara County | -Single engine aircraft weighing less than 5,000 lbs: 1500' x 2000'<br>-Twin engine aircraft weighing less than 12,500 lbs: 1500' x 3500'<br>-Aircraft weighing more than 12,500 lbs and jet aircraft: 1500' x 5000' | Initial Area (about 1500' in length):<br>- no people allowed<br>Secondary Area:<br>- no more than 10 persons on an annual average basis or more than 25 persons at any one time on each net acre | No object to be erected or grow above the primary surface of the runway<br>Suggested uses:<br>- agriculture, parks, storage, parking for cars, single story warehousing | Along extended runway centerline | |
| 4. San Jose Airport Vicinity Area Plan | Not discussed | | | | |
| 5. Sonoma County | Clear zones (per FAA)<br>Inner approach zones:<br>- 7500' long for existing or planned precision approach<br>-5100' long for existing or planned non-precision approach<br>-3000' long for visual approach<br>Outer approach zones and beneath flight track<br>Horizontal and Conical zones | No more than 25 ppa at any one time<br>Low density residential (1 du per 3 acres)<br>No more than 25 ppa at any time in structures; maximum structural coverage 25% with 30% of area open<br>No more than 50 ppa at any time for uses not in structures<br>No more than 4 du per acre; maximum structural coverage same as above<br>No limitations | Residential uses and structures prohibited | Along extended runway centerline | |

Note:
ppa = persons per acre

## SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 6. Orange County | -Based on AICUZ methodolcgy Accident Potential Zone A (Extreme Crash Hazard): generally 1600' x 3000' including clear zone and beneath flight track | No more than 10 persons over long periods in area or structure | Only open space and agriculture normally acceptable | Zones for El Toro NAS follow flight tracks | -El Toro NAS Accident Potential Zones defined in AICUZ study<br>-Orange County-limited data led Commission to conclude no Accident Potential Zones were justified<br>-Fullerton Airport-Accident Potential Zone extends 500' from runway on all sides |
| | Accident Potential Zone B (considerable crash hazard): area beyond APZ A and within standard approach fan; may extend up to 10,000' from runway | No more than 25 persons over long periods; lot coverage must be less than 50% | High density residential and regional commercial uses normally unacceptable | | |
| | Accident Potential Zone C (Limited Crash Hazard): less critical than APZ B; may be applied up to 500' above ground within "flight shadow" | No more than 50 persons over long periods; lot coverage must be less than 75% | High density residential and commercial uses normally unacceptable; industrial uses acceptable provided they adhere to density and intensity restrictions | | |
| 7. Sacramento County | Approach Zone 1 (FAA Clear Zone) | No more than 10 ppa at any time | No structures or storage of flammable or explosive materials | Along runway centerline | Allowable densities are for Sacramento Executive Airport; densities are somewhat lower (2 du per acre) for Yolo County, Rio Linda, and Phoenix Field in Zones 2 and 3 |
| | Approach Zones 2 and 3 (Approach and Climbout Zones)<br>-same as Part 77 approach surfaces; division between zones 2 & 3 determined by 100' height | Zone 2:<br>-No residential in excess of 4 du per gross acre; no multi-family or group quarters<br>-Industrial/manufacturing OK if less than 50 ppa at one time<br>-Commercial OK if less than 50 ppa at one time and lot coverage less than 20% | - Storage of flammable or explosive material prohibited<br>- Structures over 25 ft. high prohibited<br>- No hotels or large public gathering facilities<br>- Public and quasi-public facilities prohibited | | |
| | | Zone 3:<br>-Residential same as Zone 2<br>-Industrial and commercial generally OK | Similar to above; except some government service and health facilities would be permitted | | |
| | Overflight Zone (Horizontal Surface as defined in Part 77) | | Schools, stadiums, auditoriums and outdoor amphitheaters prohibited | | |
| 8a. San Diego County (Oceanside, Montgomery, and Brown Fields) | Flight Activity Zones (Same as FAA Clear Zones) | | -Permitted uses are natural recreational or habitat preservation areas, public rights of way, agriculture, and land uses with a low number of employees or customers per square foot<br>-Storage of flammable and explosive material not permitted | Along runway centerline | Recommends recording address information on accidents within Airport Influence Area for better planning of safety zones |

## SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 8b. (Palomar, Gillespie Fields) | Hazard Zones<br>- Extreme Hazard | | No major construction | Along flight tracks | -Recommends airport control of land through restrictive use easements<br>-Hazard zones based on probability of aircraft accidents |
| | - Considerable Hazard | | No residential construction or large assemblages of people | | |
| | - Limited Hazard | | No residential construction except at low densities or large assemblages of people at times when aircraft in operation | | |
| 8c. NAS Miramar | AICUZ Safety Zones (See AICUZ Studies) | | | | |
| 9. Riverside County (Palm Springs) | Not Discussed | | | | |
| 10. Riverside County (Hemet-Ryan Airport) | Area I (FAA Approach Surfaces) | -Inappropriate for housing<br>-Some residential (2 1/2 acre lot and larger) permitted in western 5000' of zone due to existing development | Prohibited uses are places of assembly, large retail outlets, high patronage services, flammables | Along runway centerline | |
| | Area II (boundaries include flight paths as they diverge from approach surfaces) | Minimum lot size of 2 1/2 acres required | Commercial, industrial and agriculture are acceptable uses | Along flight tracks | |
| 11. San Joaquin County | FAA Part 77 Approach Surfaces | | -No land use which would result in a large concentration of people (residential, hotels, churches, theaters, auditoriums, shopping centers, athletic fields)<br>-schools should be located away from flight tracks | Along runway centerline | |
| 12. Kern County | 1/2 mile from runway end and 500 ft. from runway centerline | | No new construction resulting in large concentrations of people | Along runway centerline | |

## SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 13. Stanislaus County | FAA Part 77 Approach Surfaces | | -Most residential, schools, hospitals, hotels, shopping centers, theaters and auditoriums prohibited<br>-Flammable liquid underground | Along runway centerline | |
| | FAA Part 77 Horizontal Surface | | -Schools located out of flight areas | | |
| 14. Tuolumne County | Primary Safety Zone (runway clear zone, Part 77 approach and transitional surfaces) | Clear Zone:<br>- No more than 25 ppa at any time | Permanent structures and residential uses prohibited | Along runway centerline | |
| | Secondary Safety Zone (portions of referral area not included in Primary Safety Zone) | Primary and Secondary Safety Zones:<br>- no more than 25 ppa over a 24 hour period; or 50 ppa over a 2 hour period<br>- no multi-family residential; no single family residential with more than 2 du per 3 acres | Shopping centers, restuarants, schools, hospitals and arenas prohibited | | |
| 15. Santa Barbara County | Safety Area 1 - FAA Clear Zone | Concentration of people must be below 25 ppa | No above grade gas or oil pipelines; no transmission lines | Along runway centerline | |
| | Safety Area 2 - FAA Approach Surface | -Single family dwelling acceptable if below 2 du per acre within one mile of airport; no "large concentrations" of people i.e., 25 ppa or more than 4 du per acre | Within one mile of airport, no<br>-multi family<br>-retail merchandising or food establishment<br>-eating or drinking places<br>-auditoriums<br>-public or quasi-public service<br>Some of the above may be considered if more than one mile from airport | | |
| | Safety Area 3 - FAA Horizontal Surface | Review of "large concentrations" per above definition generally required, particularly under downwind and base legs of traffic pattern | -Schools, hospitals, apartments, shopping centers would be incompatible | | |
| 16. Marin County | Not defined | | | | |

SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 17. Imperial County | El Centro NAF:<br>- standard AICUZ Safety Zones<br>Other Airports:<br>- Part 77 Approach Surfaces | Plan indicates concentrations of people should not occur in crash hazard zones nor should residential uses above a very low density | | | 60 CNEL contour is considered increased crash hazard area due to density of aircraft flight operations |
| 18. Contra Costa County | Rectangular Clear Area plus FAA Approach Surface | 30 persons per acre or 1 person per 500 sq. ft. of building floor area, whichever is less | Prohibited:<br>- single family and multi-family residential<br>- shopping centers<br>- schools, hospitals<br>- arenas<br>- other places of public assem-assembly<br>- any use including toxic or flammable material<br>Suggested:<br>Open space, agricultural, warehousing, light industry, auto parking, public uses | Along runway centerline | Requests safety zone land use policies be incorporated in all general plans |
| 19. Monterey County (Salinas County) | Not specified - indicates main concern is under flight patterns and within one mile of airport | | -Preferred uses are low occupancy<br>-Residential uses generally discouraged | | |
| 20. Monterey Airport ANCLUC Study | Approach Zone: 2500' x 5000'<br>Approach Zone includes an extended safety area 500' wide by 1000' long which contains no buildings or other obstructions | | | Along runway centerline | Approach zone land use controls involve a combination of acquisition, easements, limitations on structures and limitations on assemblages of people |
| 21. Shasta County | Clear zones (per FAA) | No uses involving more than 10 ppa | | Along runway centerline | -No parcel smaller than 5 acres should be created in Inner Approach Zone and no non-residential parcels smaller than 5 acres should be created in Outer Approach Zone<br>-Designates Safety Corridors 600 ft. wide within Inner Approach Zones of various runways and designates |
| | Inner Approach Zone (FAA imaginary approach surface beyond clear zone):<br>- Zones extend to 5000', 3500', or 2000' depending on type of runway | Residential:<br>- no more than 1 du per 5 acres; at least 20% of area open<br>Other uses in structures:<br>- no more than 10 ppa; at least 20% of area open<br>Other uses not in structures:<br>- no uses involving more than 25 ppa | No schools, hospitals, nursing homes, or similar uses | | |

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 21. Shasta County (continued) | Outer Approach Zone (remainder of FAA imaginary approach surface):<br>- Zones extend to 10,000', 8,000', or 5,000' depending on type of runway | Residential:<br>- no more than 3 du per acre; at least 20% of area open<br>Other Uses in Structures:<br>-at least 20% of area open | | | these areas as potential acquisition areas<br>-20% open space shall be computed on basis of configuration of Assessor's parcels in existence at the time of adoption of the plan |
| | Traffic Pattern Zone (rectangular):<br>- 10,000' x 20,000' | Same as Above | | | |
| 22. Fresno County | Same as Shasta County above except no Traffic Pattern Zone | Essentially same as above except residential limited to 1 du per 3 acres in Inner Approach Zone and 4 du per acre in Outer Approach Zone | Same as above | Along runway centerline | - For agricultural areas, attention should be given to types of crops that attract birds |
| 23. San Bernardino County (Cable Airport) | Clear Zones (per FAA) | | No permanent structures; only open space and agricultural | | - Encourage provision of open space corridors along extended centerline of airport runway |
| | Safety Area 1:<br>- West end safety area (beyond clear zone); trapezoidal area expanding in width from 700' to 750' and 2000' in length<br>- East end safety area; trapezoidal area expandind in width from 450' to 750' and 1000' in length | No more than 100 persons for any land use | No oil or gas storage<br>No structure within 75' of runway centerline | | |
| | Safety Area 2 - area beneath horizontal surface | | No structures exceeding Part 77 height limit | | |
| 24. San Luis Obispo County (Oceano Airport) | FAA Imaginary Approach Surfaces | - Residential acceptable on oceanside but parcels must be 5 acres or more on inland side of airport | Prohibited uses include:<br>- schools and hospitals<br>- athletic fields<br>- shopping centers<br>- theaters and auditoriums<br>- all bulk storage of flammable materials should be underground | Along runway centerline | For commercial and industrial uses in safety zones, plan recommends number of persons be kept to a minimum |
| | Overflight Zone | | - chools conditionally ceptable | | |

SAFETY ON THE GROUND

| ALUC | DIMENSIONS OF SAFETY ZONES | ALLOWABLE DENSITIES | SPECIFICALLY PROHIBITED OR SUGGESTED USES | ORIENTATION OF SAFETY ZONES | OTHER |
|---|---|---|---|---|---|
| 25. Military AICUZ Studies | Clear Zone:<br>- Inner width 1500'; outer width 2284'; length 3000' | The following can make a normally unacceptable use an acceptable use from a safety standpoint: | -All uses except open space clearly unacceptable | Along runway centerline | |
| | Accident Potential Zone I:<br>(Normally provided under flight paths with more than 5000 annual operations)<br>- 3000' wide x 5000' long | Occupancy of single building not to exceed 100 people; lot coverage of 20%, not including parking area | -All residential and public and quasi-public uses are clearly unacceptable | Follows flight path | |
| | Accident Potential Zone II<br>(normally provided whenever APZ I is required)<br>- 3000' wide x 5000' long<br><br>(These zones apply to Class B runways--i.e., heavier aircraft) | Occupancy of single building not to exceed 200 people; single family/duplex units permitted at 1 du per acre (Some increase permitted under Planned Unit Development where there is 80% open space); lot coverage 50%, not including parking | -Some commercial/manufacturing with high ratio of area to people acceptable<br><br>-Residential, motels, eating and dining places, and cultural activities normally unacceptable; large assemblages of people are unacceptable | Follows flight path | |

SAFETY IN THE AIR

| ALUC | HEIGHT STANDARDS USED | SPECIAL CONSIDERATIONS | HEIGHT EASEMENTS | OTHER |
|---|---|---|---|---|
| 1. Alameda County | FAR Part 77 | | | Recommends local jurisdictions adopt height restrictions conforming to Part 77 |
| 2. San Mateo County | FAR Part 77<br>- Structures penetrating Part 77 are prohibited | General aviation airports:<br>-Imaginary approach surfaces established to protect for possible non-precision approach<br>San Francisco Int'l Airport:<br>-structures penetrating TERPS criteria subject to case by case review | | |
| 3. Santa Clara County | FAR Part 77 as modified by TERPS | Specifically prohibits erection of objects that would raise weather "minimums" at an airport | Required - all easements start at height of Part 77 | |
| 4. San Jose Airport Vicinity Area Plan | FAR Part 77 | Airspace standards may be relaxed only if Aeronautical Study performed by FAA shows project<br>- would not require revision of existing or planned IFR procedure<br>- would not conflict with airspace required to conduct normal VFR traffic<br>- would not penetrate altitude used for VFR enroute navigation<br>- would not be a "hazard" to air navigation | | |
| 5. Sonoma County | FAR Part 77 | No structure, tree, or other object permitted to exceed height limits unless<br>- "shielded" by existing structures or terrain<br>- FAA has determined object would not be a hazard<br>- object is exempted from Part 77<br>No object shall be erected that would degrade ceiling or visibility criteria for an existing or proposed instrument approach.<br>An object within the horizontal or conical surfa[illegible] co[illegible]onal[illegible] cept[illegible] if | | Copy of FAA "Notice of Proposed Construction or Alteration" shall be submitted to ALUC for their review |

| ALUC | HEIGHT STANDARDS USED | SPECIAL CONSIDERATIONS | HEIGHT EASEMENTS | OTHER |
|---|---|---|---|---|
| 6. Orange County | FAR Part 77 | If structure or object unacceptable to FAA, it is unacceptable to ALUC | | -Plan includes FAR Part 77 Notice Requirements for Notice of Proposed Construction or Alteration<br>-Commission may adopt criteria more restrictive than that contained in Part 77 |
| 7. Sacramento County | -FAR Part 77<br>-ALUC shall restrict objects which penetrate the established height restriction areas | | | Sacramento City Zoning ordinance conforms to Part 77 |
| 8. San Diego County | FAR Part 77 | | | |
| 9. Riverside County (Palm Springs Airport) | FAR Part 77 | | | Palm Springs zoning ordinance used to enforce height limits |
| 10. Riverside County (Hemet-Ryan Airport) | FAR Part 77 (in Area III) | | Required - from runway elevation within 5000' of runway and from 150' above ground elsewhere | |
| 11. San Joaquin County | FAR Part 77 | | | |
| 12. Kern County | FAR Part 77 - Local agency must file request for approval from ALUC if structure or object exceeds Part 77 | | | Zoning ordinances of county and several cities conform to Part 77 |
| 13. Stanislaus County | FAR Part 77 | | Required | |
| 14. Tuolumne County | FAR Part 77 | | | County has adopted "Airports Zoning Ordinance" which establishes height limits consistent with Part 77 |
| 15. Santa Barbara County | FAR Part 77 | Policy is to restrict development which penetrates FAR Part 77 and to review any specific projects which may intrude into airspace | | Santa Barbara Co., Santa Maria, and Lompoc have approach zone overlays that apply more rigorous height standards than Part 77 |
| 16. Marin County | FAR Part 77 | | | |

| ALUC | HEIGHT STANDARDS USED | SPECIAL CONSIDERATIONS | HEIGHT EASEMENTS | OTHER |
|---|---|---|---|---|
| 17. Imperial County | FAR Part 77 | | | |
| 18. Contra Costa County | FAR Part 77 | Main runways protected with 50:1 imaginary surface in consideration of ultimate instrumentation potential (Buchanan Field) | | |
| 19. Monterey County | FAR Part 77 | | | City of Salinas and County have "Airport Approaches Zoning Ordinance" |
| 20. Monterey Airport ANCLUC Study | FAR Part 77 | | | |
| 21. Shasta County | Not discussed | | | Height generally limited to 40 feet in airport environs as recommended in local zoning ordinances |
| 22. Fresno County | FAA Part 77 | No structure, tree, or object may exceed Part 77 unless<br>- substantially shielded by existing structure<br>- FAA has determined obstruction would not be a hazard<br>- obstruction is otherwise exempted<br>No object shall be permitted which would increase the minimum ceiling or visibility criteria for an existing or proposed instrument approach | Required but would start above 35 feet. | - An object penetrating the horizontal or conical surface shall be considered conditionally acceptable if less than 35 feet above the ground (i.e., acceptable under county zoning ordinance)<br>- Copy of FAA Notice of Construction or Alteration shall concurrently be submitted to ALUC regardless of where proposed project is located<br>- Within secondary review area, only projects that exceed height limits need to be referred to ALUC |
| 23. San Bernadino County | FAA Part 77 | -Recommends no structure be erected or object placed that would protrude into surfaces established by Part 77 | | |
| 24. San Luis Obispo County (Oceano Airport) | Height restrictions not specified | | | |
| 25. Military [illegible] | FAR Part 77 military imaginary surfaces | | | |

# III. NOISE COMPATIBILITY PLANNING

## Reasons for Noise Compatibility Planning

Many communities are affected to some degree by noise from air carrier, general aviation, and military airports. At lower levels, airport noise can interfere with sleep, conversation, or relaxation. It may also disrupt school and work activities. At higher levels, airport noise may make outdoor activities impossible and may begin to raise health concerns. The current noise problem has resulted in part from the introduction of jet aircraft in the early 1960s, rapid growth in aviation activity, poor land use planning, and increased efforts in many communities to protect and enhance their community environment. Despite major efforts to combat noise problems, citizens and communities continue to demand that more be done.

Actions to improve airport noise conditions fall into four institutional categories: what the federal government can do, what the state government can do, what the airport proprietor can do, and what local communities can do. First, it is necessary to review the underlying reasons for all the attention to airport noise --that is how noise affects individuals living and working around airports.

The sound level associated with a single aircraft operation can be roughly compared to sound levels of events encountered in daily life as shown in Figure III-1. General annoyance caused by airport noise is the most widespread planning concern. Annoyance is usually related to interference with personal activities such as sleeping, relaxing, watching TV or conversing (see Figure III-2). While individual responses to noise are quite varied, methods have been developed to correlate noise level with community reaction. For any given noise exposure level, some of the community will be highly annoyed, some will be mildly annoyed and some will not be annoyed at all. Figure III-3 shows the percentage of individuals found to be highly annoyed at various noise exposure levels (Reference 1). For land use planning purposes it is important to know when annoyance results in community action and how much action. The way community response relates to noise exposure level is illustrated in Figure III-4. (Note that the day-night average sound level (Ldn) shown in that figure is essentially equivalent to the Community Noise Equivalent Level (CNEL) scale.) The Environmental Protection Agency has determined that undue interference with activity and annoyance will not occur in residential areas at outdoor noise levels below 55 Ldn (Reference 2).

So far the discussion has concerned general annoyance. What about the physiological effects such as hearing loss and stress-related health problems? In the context of airport noise, hearing damage has not been found to be a problem for nearby neighbors. This is because noise levels are simply not of sufficient intensity to cause hearing damage, except for line crew members.

Medical studies are inconclusive on a cause-and-effect relationship for non-auditory health concerns near airports. Some research has been thought to show adverse effects of noise on cardiovascular systems. A more general conclusion is that in disease states, such as anxieties, ulcers, and "tension ills," noise may have some additive effect for some people.

As a result of pressures to control airport noise, the federal government has established noise standards for jet aircraft and small propeller driven planes

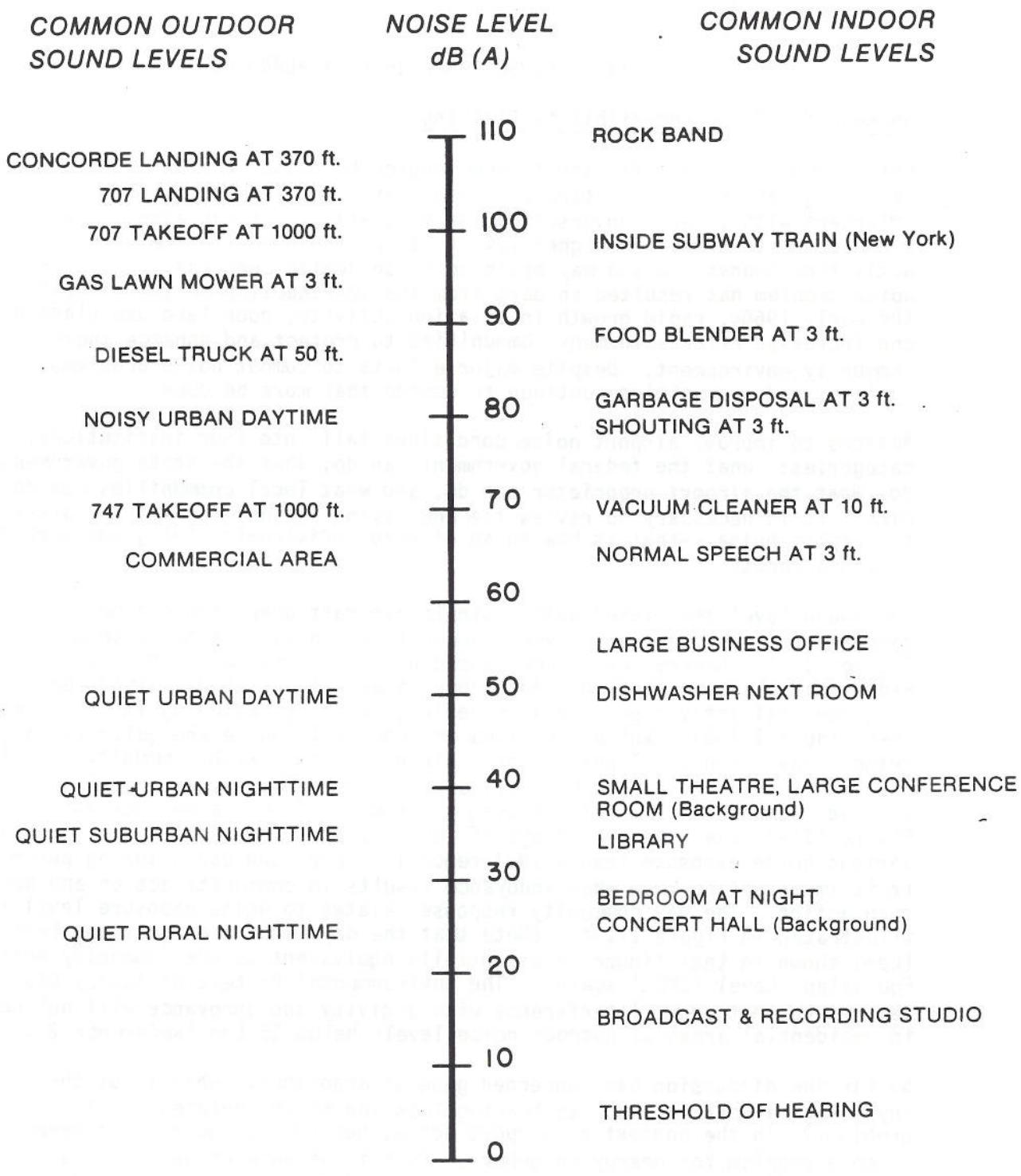
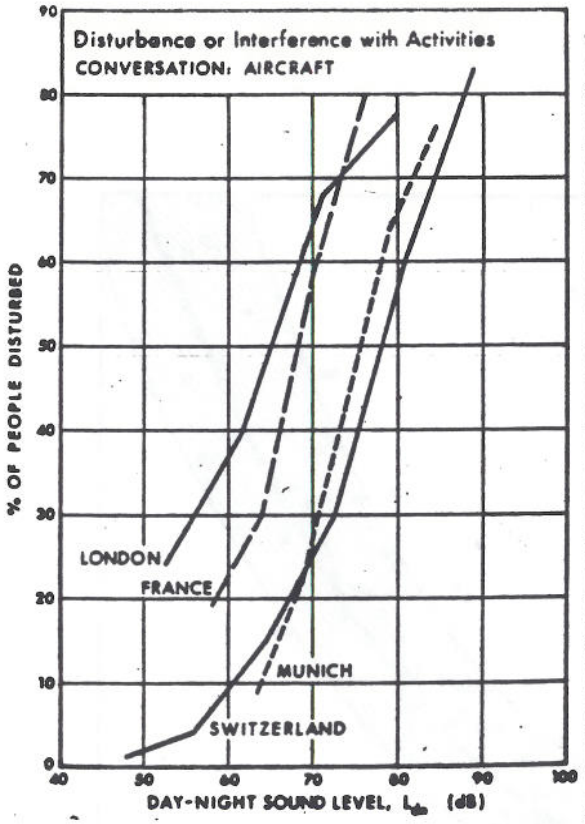
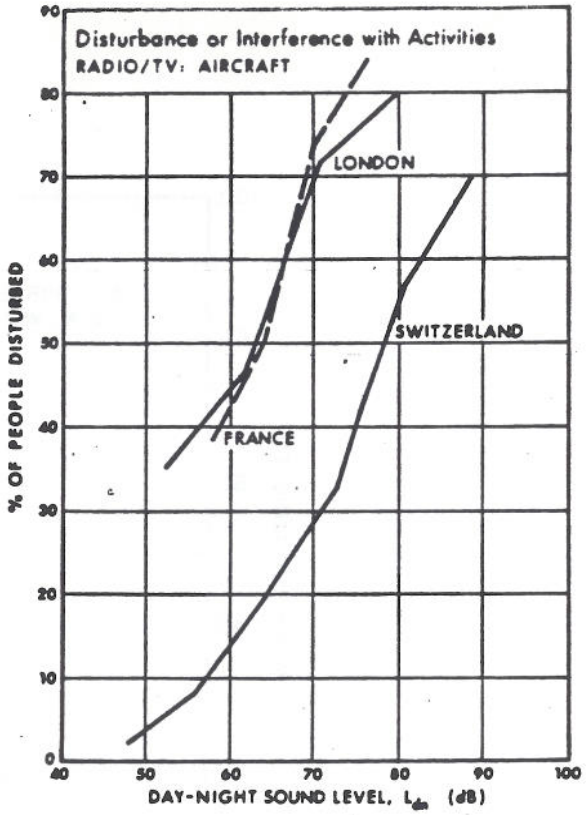



**Figure III - 1**

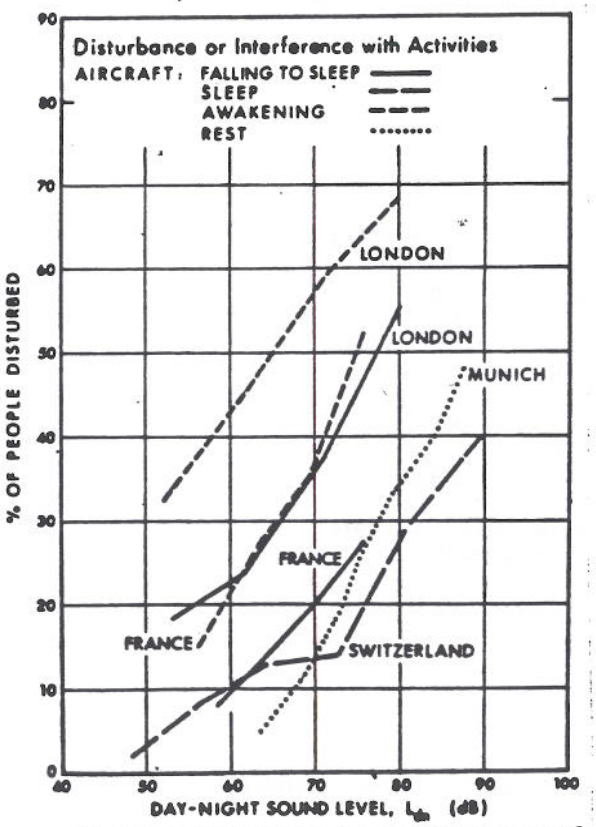
**COMMON SOUND LEVELS**




Interference by aircraft noise with conversation.




Interference with radio or television listening by aircraft noise.




Interference with sleep by aircraft noise.

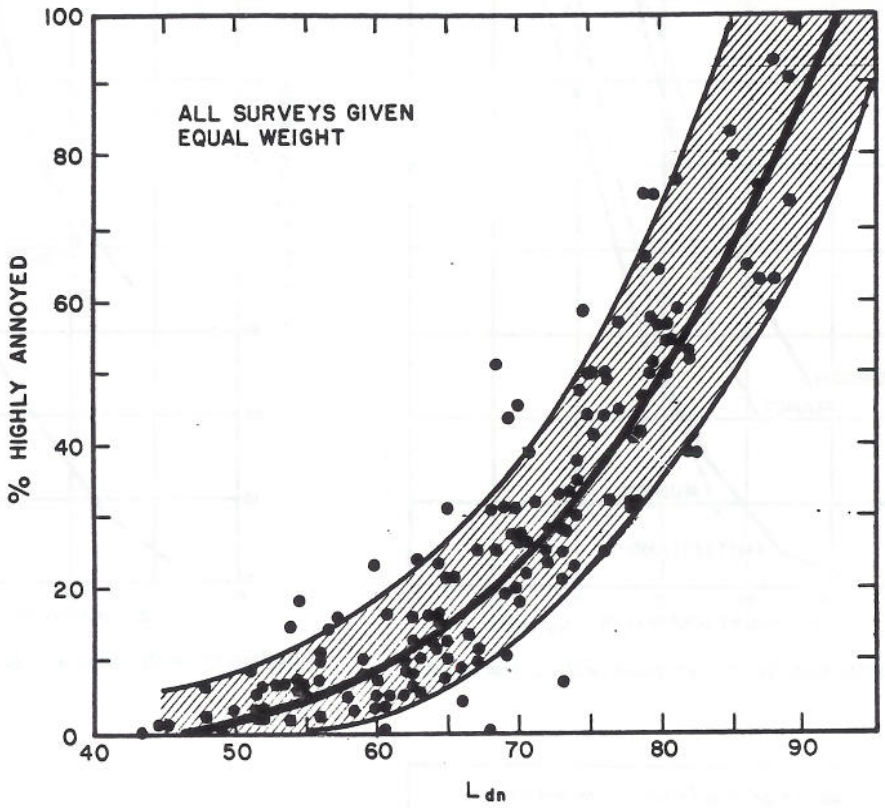
NOTE:

Differences in amount of interference reported are related to how individual surveys defined interference. London counted mild disturbance, France moderate disturbance, and Munich and Switzerland great disturbances.

Reference 1

Figure III - 2

**INTERFERENCE BY AIRCRAFT NOISE WITH VARIOUS TYPES OF ACTIVITIES**




CLUSTERING SURVERY/DATE

Swedish Aircraft 1972
Swiss Aircraft 1973
French Aircraft 1966
Second Heathrow Aircraft 1967
First Heathrow Aircraft 1961
Munich Aircraft 1969
French Railroad 1973
Paris Street Traffic 1969
Swiss Road Traffic 1972
Los Angeles Street Traffic 1974
London Street Traffic 1972

**Figure III - 3**

**PERCENTAGE OF PERSONS HIGHLY ANNOYED**

**Reference 1**

Reference 3

COMMUNITY REACTION

Vigorous community action

Several threats of legal action; or strong appeals to local officials to stop noise

Widespread complaints or single threat of legal action

Sporadic complaints

No reaction, although noise is generally noticeable

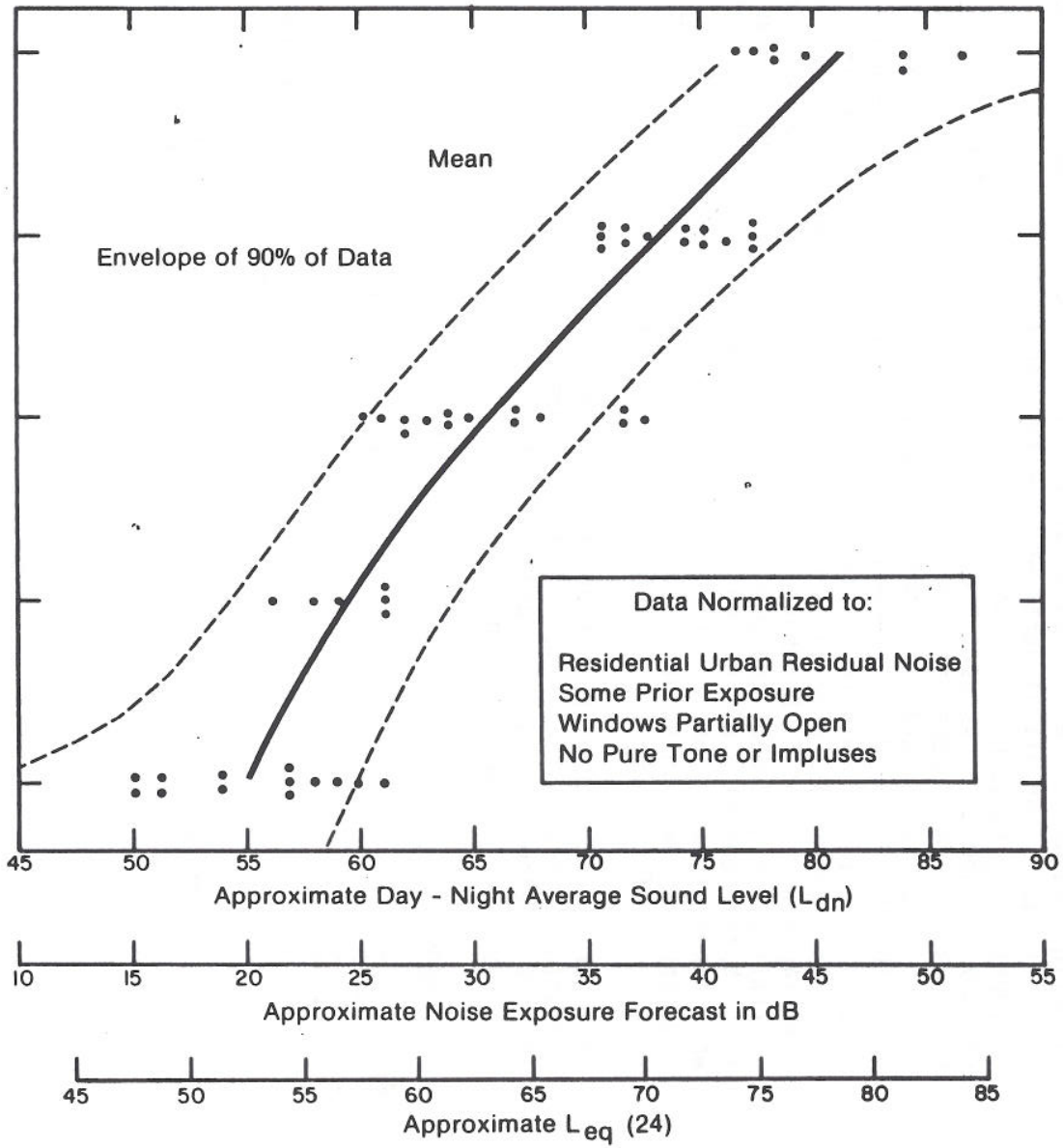



**Figure III - 4**

**COMMUNITY REACTION TO INTRUSIVE NOISES**

(Federal Aviation Regulations Part 36, Noise Standards: Aircraft Type and Airworthiness Certification, 1969, as amended). The State has prescribed noise standards for all airports which establish criteria for noise in residential areas as being 70 CNEL as of January 1, 1981 and 65 CNEL as of January 1, 1986. The airport proprietor may develop airport noise control programs and enact operational restrictions to control and reduce noise levels in the community (Federal Aviation Regulations Part 150 - Airport Noise Compatibility Planning). Proposed restrictions will be reviewed by the Federal Aviation Administration to ensure that they are not unjustly discriminatory or place an undue burden on interstate commerce. Last, and most important for this handbook, is the responsibility of local governments to limit the exposure of the population to excessive airport noise levels through the general plan and zoning process. Each community must determine what types of land uses it will permit within the airport noise impact boundary and how much noise insulation will be required for new construction. A key role of the ALUC is to advise local governments on these matters.

An important fact to bear in mind when working in the noise field is that dramatic changes in the airport noise environment are difficult to come by. The table below is helpful in understanding the subjective response of individuals to changes in sound level.

| Change in Sound | Change in Perceived Loudness |
|---|---|
| ± 1 dB | Requires close attention to notice |
| ± 3 dB | Barely perceptible |
| ± 5 dB | Quite noticeable |
| ± 10 dB | Dramatic; twice or half as loud |
| ± 20 dB | Striking, fourfold change |

Stated another way, it takes a 10db reduction in noise for people to judge a sound as being half as loud, but to achieve that change requires the removal of 90% of the sound energy.

## Determining the Airport Noise Impact Boundary

ALUCs usually do not have to prepare noise contours for airports; these contours are typically prepared by others as part of an airport master plan, Airport Noise Control and Land Use Compatibility (ANCLUC) study, FAR Part 150 noise control program, or Air Installation Compatible Use Zone (AICUZ) study. ALUCs do, however, need to understand how noise contours around different types of airports--air carrier, general aviation, and military-- can change in the future, since changes in the noise impact boundary will affect the compatibility of undeveloped land and requirements for sound insulation. The state airport noise standards (California Administrative Code, Title 21, Sections 5000 et. seq.-- see Appendix B) establish noise criteria in residential areas as shown below.

| Criterion | Effective Date |
|---|---|
| 70 CNEL | January 1, 1981 |
| 65 CNEL* | January 1, 1986 |

*the 65 CNEL criterion is effective immediately for new airports and for vacated military airports converted to civilian use

These noise exposure levels are therefore of prime importance to ALUCs in defining the noise impact boundary for an airport. They have been chosen for reasonable persons residing in urban residential areas where homes are of typical California construction and may have windows partially open.

The two indices used to calculate community noise exposure are the Community Noise Equivalent Level (CNEL) and the Day-Night Average Sound Level (Ldn). CNEL is the established noise metric in California while federal agencies have selected Ldn for airports. (California may convert to Ldn at some future date, but there is very little difference between the two measureing systems--calculations of CNEL and Ldn from the same monitoring data generally result in less than a .7db difference.) These noise equations can be expressed as follows:

$$Ldn = \overline{SEL} + 10 \text{ LOG } (N_D + 10N_N) - 49.4$$

$$CNEL = \overline{SENEL} + 10 \text{ LOG } (N_D + 3N_E + 10N_N) - 49.4$$

where, $N_D$= number of daytime operations (7:00 am to 7:00 pm for CNEL equation and 7:00 am to 10:00 pm for Ldn equation)

$N_E$= number of evening operations (7:00 pm to 10:00 pm)

$N_N$= number of night operations (the remainder of the 24 hour period

$\overline{SEL}$, $\overline{SENEL}$= average single event noise levels during the 24 hour period

The most critical assumptions involved in the preparation of noise contours are the following (This discussion concerns CNEL but it applies equally to Ldn):

1. Aircraft fleet mix. Aircraft fleet mix means the types of aircraft using an airport. The fleet mix determines the average single event levels in the CNEL equation. Changes in CNEL are directly related to changes in the aircraft single event levels.

2. Number of operations. The number of operations means the average daily takeoffs and landings over a point. Inclusion of the number of operations in the CNEL and Ldn equations reflects the fact that communities react to the number of flights as well as the average noise level of these flights.

3. Distribution of operations by time of day. This means the number of operations in the day, evening, and night periods above. The CNEL equation adds a 4.8 dB penalty for each evening operation (7:00 pm to 10:00 pm) and a 10 dB penalty for each night operation (10:00 pm to 7:00 am) to account for the greater sensitivity of persons to noise at night.

4. Distribution of operations by flight track. The percentage of the time each flight track is used affects how much noise different areas surrounding the airport will receive.

Airport noise levels will be influenced by actions of the airport proprietor, FAA, airlines, and general aviation pilots as these actions will have a direct effect on the factors above. The noise impact boundaries for airports served by airlines using jet aircraft are generally much larger than those for general aviation airports (about three to five times larger in area). This is because the single event levels of passenger jet aircraft are significantly louder than those for general aviation aircraft, and there is a greater contribution from operations in the evening and night periods. For some general aviation airports, the 65 CNEL impact boundary may be totally contained within the airport property. It is difficult to generalize how noise impact areas will change in the future at individual airports, however the following discussion may provide some insight.

o Large Air Carrier Airports. The noise impact boundary for large air carrier airports should decrease in the future due to the federally mandated schedule for replacing or retrofiting commercial passenger jets that do not meet FAR Part 36 aircraft noise certification requirements. Newer technology aircraft--such as the B-757, B-767, DC-9-80, and DC-8-70--have already had and will continue to have a major impact on reducing airport noise levels. The FAA currently estimates that 86% of the domestic airline fleet will meet Part 36 noise levels by January 1, 1985. (There are certain exemptions granted for 2-engine aircraft). Referring to the CNEL equation, this trend towards lower airport noise can occur because the reduction in average single event noise levels exceeds the contribution due to increased aircraft operations. Figure III-5 illustrates the so-called Stage 1, Stage 2, and Stage 3 noise levels contained in FAR Part 36 (Reference 4). Appendix C contains takeoff noise levels for aircraft certificated under FAR Part 36 as well as noise levels for aircraft not certificated to Part 36.

o Smaller Air Carrier Airports. At small air carrier airports (airports serving primarily general aviation but having limited air carrier service), a large increase in air carrier jet operations over a small base could drive the noise levels higher. The effect on the noise contours would depend heavily on the number of current operations by air carriers and the type of aircraft they are using. Since the passage of the Airline Deregulation Act in 1978--which provided greater freedom to airlines to initiate or abandon service and set fares--airlines have withdrawn jet service from a number of California airports, and the future level of jet service will be more difficult to predict at these airports. In these instances it may be prudent to develop projected noise contours based on the type of air service the community desires rather than current service patterns which typically involve smaller propeller-driven passenger aircraft.

o General Aviation Airports. Major factors influencing general aviation airport noise contours include the number of operations, types of aircraft using or projected to use the airport and the capability of the airport to handle nighttime operations (i.e, whether or not the runways are lighted). Where activity levels at general aviation airports are forecast to increase, future noise contours are usually larger than the current ones. This is because noise levels generated by single and twin engine propeller-driven general aviation aircraft are not expected to become significantly lower in future, hence a larger number of operations produces a larger noise impact area. Currently business jet aircraft are not a large part of the fleet mix at most general aviation airports; however, their operations can have a significant impact on the noise contours. Business jets are likely to become quieter in the future due to competitive pressures within the industry to

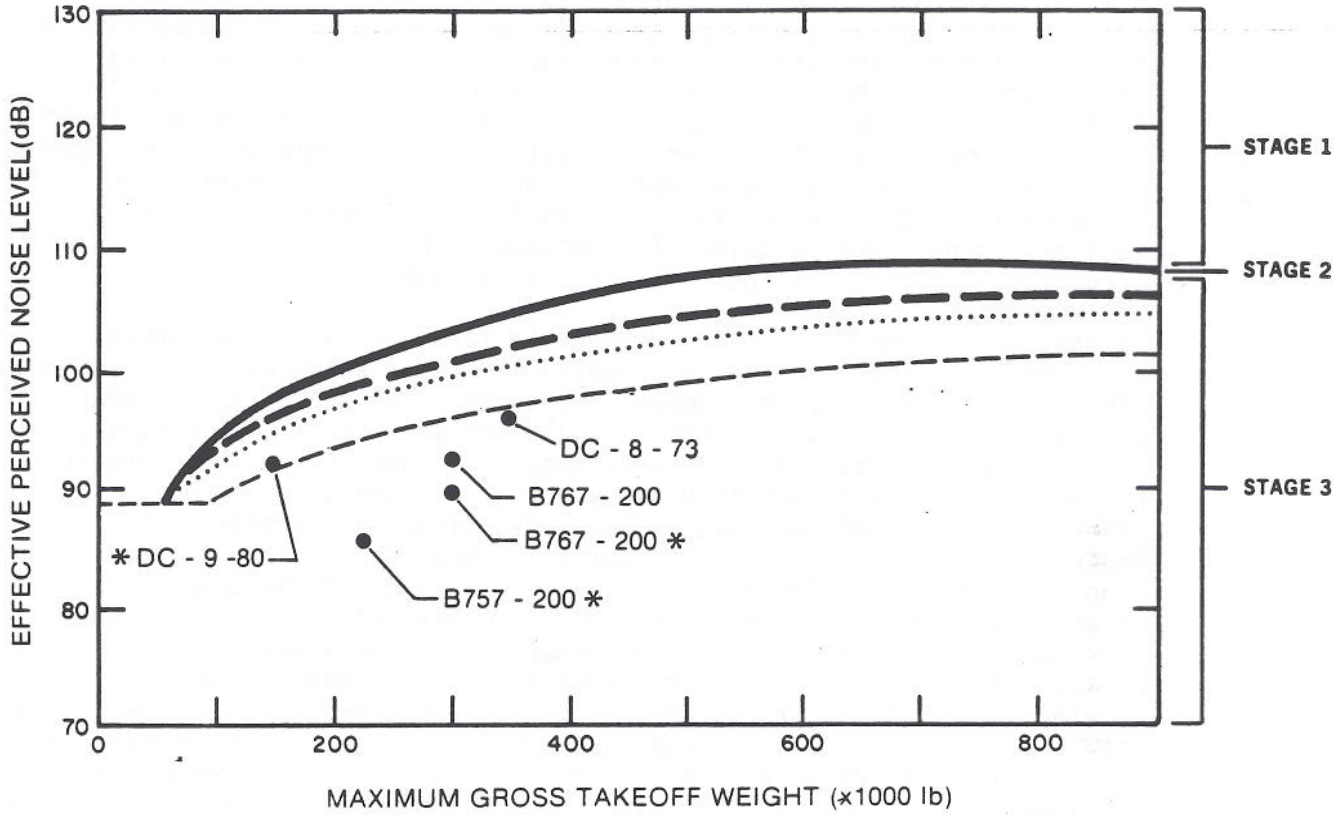



**Figure III - 5**

**FAR PART 36 TAKEOFF NOISE LEVELS**

Reference 4

produce aircraft that will be acceptable to communities. Again, the specific effect of business jet operations on projected noise contours would depend on the forecasted activity and noise levels assumed for future business jet aircraft. Table III-1 shows takeoff noise levels for propeller-driven and turbojet/turbofan aircraft in the current general aviation fleet.

• Military Airports. Noise contours in most Air Installation Compatible Use Zone (AICUZ) studies are based on existing levels of activity and assume that future military aircraft will not be noisier than existing aircraft. As a cautionary note, these studies usually indicate that any military conflict could result in a major increase in activity for an indeterminant length of time. The most reasonable course of action is to assume peacetime levels of activity will continue and to monitor the plans of the Department of Defense for each facility. These plans may result in the determination that a facility is no longer required for defense purposes or that the mission of the airport will be significantly reduced or expanded.

To develop recommendations for compatible land uses around airports, it is necessary to define the threshold noise levels at which airport noise produces some form of individual or community response. Noise contours prepared for air carrier and military airports should include the 60 CNEL contour, while those for general aviation airports should include the 55 CNEL contour. The 60 CNEL contour is recommended because the California Noise Insulation Standards (California Administrative Code, Title 25, Section 28 -- see Appendix B) require acoustical reports for new residential construction other than detached single family dwellings in this area and because it is the area in which some responses from individuals to aircraft overflights can be expected. The 55 CNEL contour for general aviation airports is recommended because of the potential for annoyance within this contour, especially in quieter communities where background noise levels are low. Figures III-6 and III-7 show examples of noise contours around air carrier and general aviation airports. If it can be afforded, various sensitivity runs should be performed, involving different assumptions concerning airport activity levels and aircraft mix, to determine the range of possible noise exposure areas.

Most noise planning boundaries have been selected by adopting the larger of the existing or projected noise contour for an airport. These contours should be reviewed periodically and revised when conditions warrant. Because of the need for continuity in land use planning and zoning, it is desirable not to alter the contours too frequently. Changes in the noise planning boundaries would not normally need to be considered unless there is at least a 3 dB reduction or increase in the airport noise levels. This approach guards against reacting too quickly to annual fluctuations of noise (remember that the noise monitoring systems are only accurate to $\pm$ 1.5 dB); also information on the subjective responses of individuals to changes in noise suggests that a 3 dB change in noise is "barely perceptable."

## Comparison of Noise Compatibility Standards

One of the most important elements of all ALUC plans is the selection of land use compatibility standards for noise planning. The purpose behind these standards is to encourage the best use of land consistent with other community planning objectives and simultaneously prevent exposure of the public to

Table III-1

Takeoff Noise Levels of Representative General Aviation Aircraft

| No. of Engines | Engine Type | Manufacturer/ Model | Gross Weight(lb) | Flyover Noise M/Est. dBA | Flyover Noise Part 36 dBA | Source |
|---|---|---|---|---|---|---|
| 1 | Piston | Cessna 150D | 1,600 | 67.0 | 69.7 | 1 |
| | | Cessna 152 | 1,670 | 65.0 | 71.8 | 1 |
| | | Cessna 172 | 2,300 | 72.0 | 74.0 | 1 |
| | | Mooney 201 (M20E) | 2,575 | 74.0 | 75.6 | 1 |
| | | Beech Sierra (C24R) | 2,750 | 71.2 | 77.0 | 2 |
| | | Piper Arrow IV (PA-28-201T) | 2,900 | 68.8 | 77.9 | 2 |
| | | Beech Bonanza (V35B) | 3,400 | 78.0 | 80.6 | 1 |
| | | Cessna Centurion (P210N) | 4,000 | 77.7 | 82.0 | 2 |
| 2 | Piston | Beech Baron (B55) | 5,100 | 84.0 | 82.0 | 2 |
| | | Piper Aerostar (PA600A) | 5,500 | 80.0 | -- | 3 |
| | | Cessna 340 | 5,975 | 83.0 | 82.0 | 1 |
| | | Cessna Golden Eagle (CE 414) | 6,350 | 82.0 | 82.0 | 1 |
| | | Piper Navajo (PA31) | 6,500 | 81.0 | 82.0 | 1 |
| | | Piper Navajo (PA-31-310) | 6,500 | 75.4 | -- | 3 |
| | | Piper Chieftan (PA-31-350) | 7,000 | 87.0 | 82.0 | 1 |
| 2 | Turboprop | Piper Cheyenne I | 8,700 | 75.0 | -- | 3 |
| | | Piper Cheyenne II | 9,000 | 72.2 | -- | 3 |
| | | Cessna Conquest (CE-441) | 9,850 | 74.0 | -- | 3 |
| | | Gulfstream American Commander 900 | 10,700 | 71.5 | -- | 3 |
| | | Gulfstream American Commander 1000 | 11,200 | 71.8 | -- | 3 |
| | | Piper Cheyenne III | 11,200 | 76.8 | -- | 3 |
| | | Beech King Air (B100) | 11,800 | 77.3 | 82.0 | 2 |
| | | Swearingen Merlin IIIC | 12,500 | 72.8 | -- | 3 |

Note: General aviation aircraft noise limits for propeller-driven aircraft are established for flyovers at 1,000 ft. altitude, adjusted for aircraft climb performance.

Table III-1 con't.

| No. of Engines | Engine Type | Manufacturer/ Model | Gross Weight(lb) | Takeoff Noise Measured EPNdB | Takeoff Noise Part 36 EPNdB | Source |
|---|---|---|---|---|---|---|
| 2 | Turbojet/ Turbofan | Cessna Citation I (CE-500) | 11,500 | 77.7 | 89.0 | 2 |
| | | Cessna Citation II | 13,300 | 80.1 | " | 3 |
| | | Gates Learjet 25C | 15,000 | 94.0 | " | 2 |
| | | 25D | 15,000 | 90.1 | " | 3 |
| | | 35 | 17,000 | 84.0 | " | 2 |
| | | 36 | 17,000 | 84.0 | " | 2 |
| | | 55 | 19,500 | 85.2 | " | 3 |
| | | Rockwell Int'l Sabre 60 | 20,000 | 95.0 | " | 2 |
| | | Sabre 75A | 23,000 | 90.7 | " | 2 |
| | | Dessault Breguet Falcon 10 | 18,700 | 79.6 | " | 2 |
| | | Falcon 20 | 28,600 | 90.0 | " | 2 |
| | | Israel Aircraft Westwind 1 (IA-1124) | 22,850 | 84.2 | " | 2 |
| | | Canadair Challenger (CL-601) | 41,650 | 80.3 | " | 3 |
| | | Grumman American Gulfstream II | 62,000 | 90.9 | " | 2 |
| | | Gulfstream III | 68,200 | 91.3 | " | 3 |

Source:

1. FAA Advisory Circular 36-2A "Measured or Estimated (Uncertificated) Airplane Noise Levels" 2/6/78

2. FAA Advisory Circular 36-1B "Certificated Airplane Noise Levels" 12/5/77

3. Business and Commercial Aviation 1982 Purchasing and Planning Handbook, April 1982, pp 70-89

-- Part 36 noise levels not obtained.

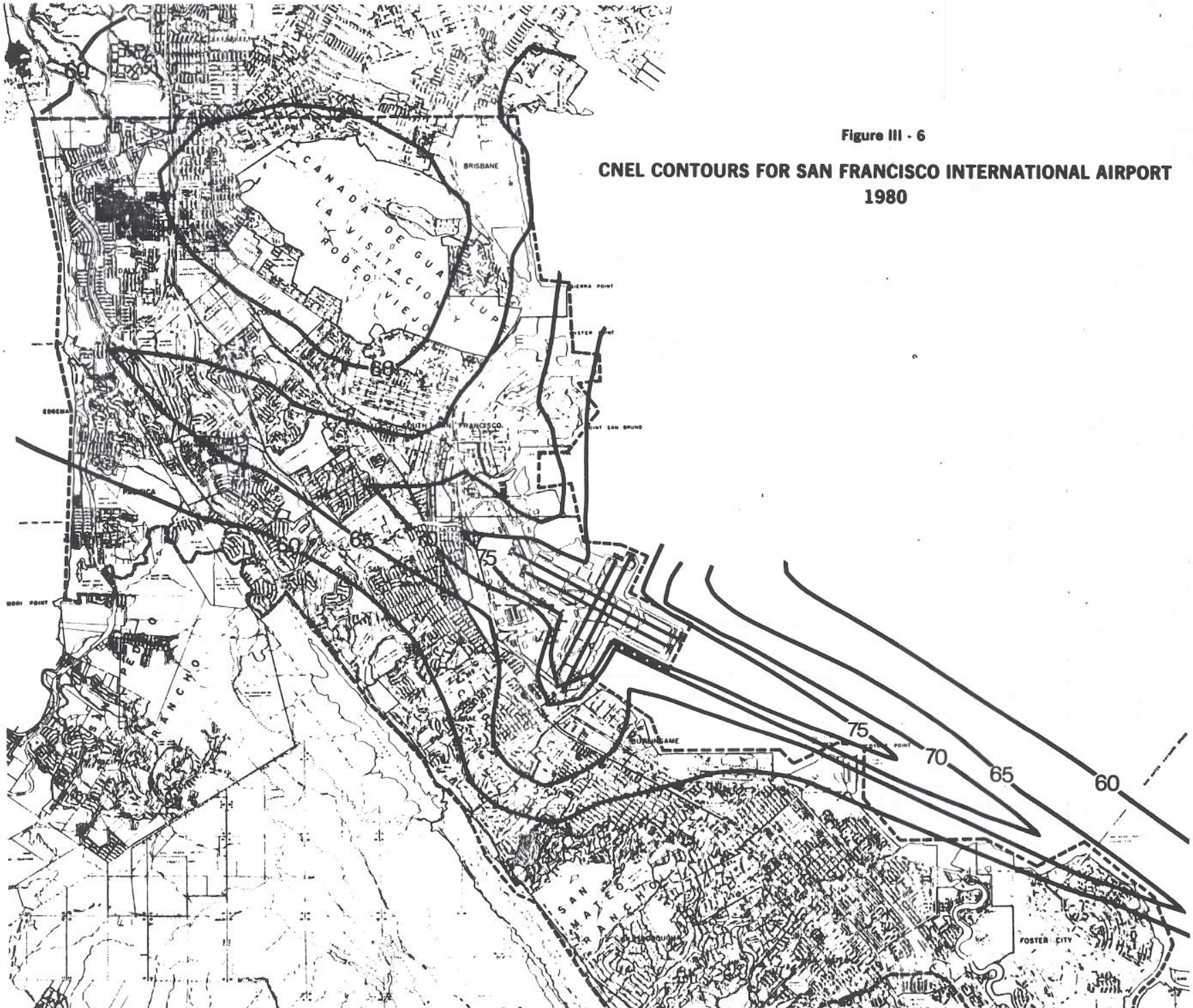



**Figure III - 6**

**CNEL CONTOURS FOR SAN FRANCISCO INTERNATIONAL AIRPORT**
**1980**

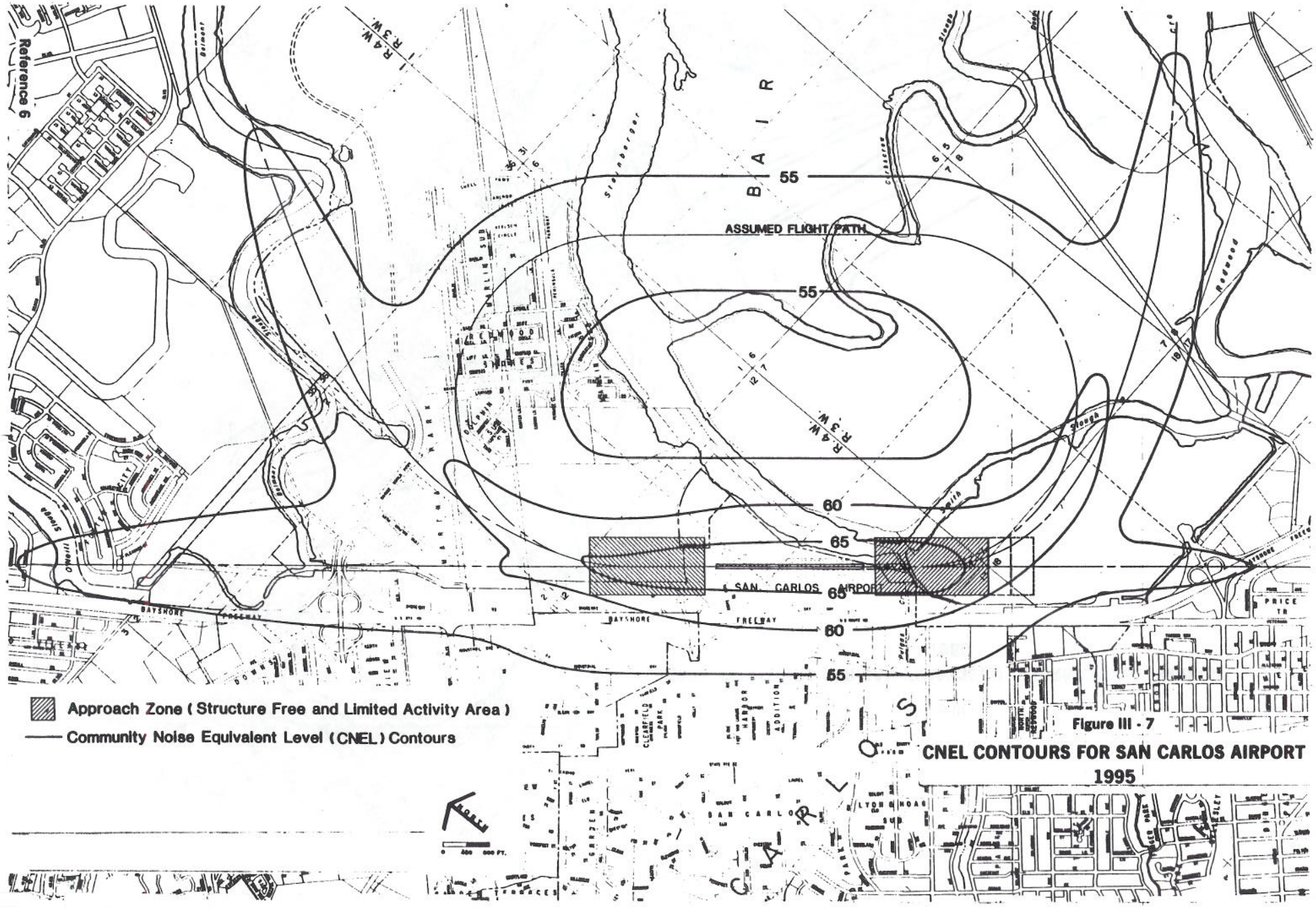



Figure III - 7

**CNEL CONTOURS FOR SAN CARLOS AIRPORT**

**1995**

excessive noise levels. ALUCs have used or adapted one of three sets of standards:

1) State - "Guidelines for the Preparation and Content of Noise Elements of the General Plan," Office of Noise Control, California Department of Health, February 1976 (Reference 7).
2) Federal - Department of Housing and Urban Development (HUD), "Aircraft Noise Impact; Planning Guidelines for Local Agencies," by Wilsey & Ham and Bolt, Beranek and Newman, 1972 (Reference 8). These compatability guidelines are frequently used in military AICUZ studies.
3) Federal - Federal Aviation Regulations Part 150. These standards are generally derived from the document "Guidelines for Considering Noise in Land Use Planning and Control," Federal Interagency Committee on Urban Noise, June 1980 (Reference 9).

Tables III-2 compares the compatability criteria provided in each of these sources. The information contained in this table can be paraphrased as follows:

Residential and Lodgings

| | | |
|---|---|---|
| 55-65 CNEL | - | little potential for interference with indoor or outdoor activities |
| 60-65 CNEL | - | potential for annoyance exists |
| | - | acousical studies should be performed, and noise insulation should be included if appropriate |
| | - | all forms of housing can generally be accommodated |
| 65-70 CNEL | - | the potential for annoyance is significantly more severe |
| | - | acoustical studies are required in all cases |
| | - | noise reduction levels of 25 db, minimum, should be incorporated in the design |
| | - | mobile homes should be discouraged due to their poor sound insulation characteristics |
| | - | communities should consider precluding new housing from this area, particularly if the population is oriented to outdoor activities |
| 70-75 CNEL | - | noise reduction levels of 30db, minimum, should be incorporated in the design |
| | - | outdoor activities will be severely affected by noise |
| | - | communities should strongly consider prohibiting any new development in these areas |
| 75-80 CNEL | - | insulation of homes would be extremely expensive (35dB reduction) |
| | - | the outdoor environment would be intolerable |
| | - | hotels and motels may still be constructed in this area with proper sound insulation |

Public/Institutional

| | | |
|---|---|---|
| | - | most public use facilities and institutions require a quiet interior environment |
| | - | it is preferable that new facilities and buildings be located outside the 65 CNEL contour; however, if no reasonable alternatives exist, sound reduction levels of 25-30 db should be incorporated in the design |

Recreation/Open Space

| | | |
|---|---|---|
| | - | many outdoor activities are not as sensitive to noise as |

Table III-2
Comparison Of Noise Compatibility Guidelines
(See Legend on Following Page)

| Land Use | CNEL RANGE 55-60 | | | 60-65 | | | 65-70 | | | 70-75 | | | 75-80 | | | 80+ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ONC | HUD | FAA | ONC | HUD | FAA | ONC | HUD | FAA | ONC | HUD | FAA | ONC | HUD | FAA | ONC | HUD | FAA |
| **Residential/Lodgings** | | | | | | | | | | | | | | | | | | |
| Single Family | NA | CA | Y | CA | NA | Y | CA | NU | N[1] | NU | NU | N[1] | CU | CU | N | CU | CU | N |
| Duplex | NA | CA | Y | CA | NA | Y | CA | NU | N[1] | NU | NU | N[1] | CU | CU | N | CU | CU | N |
| Multi-Family | NA | CA | Y | NA/CA | NA | Y | CA | NU | N[1] | NU | NU | N[1] | CU | CU | N | CU | CU | N |
| Mobile Homes | NA | CA | Y | CA | NA | Y | CA | NU | N | NU | NU | N | CU | CU | N | CU | CU | N |
| Hotels & Motels | NA | CA | Y | NA/CA | CA | Y | CA | NA | N[1] | NU | NU | N[1] | NU | NU | N[1] | CU | CU | N |
| **Public/Institutional** | | | | | | | | | | | | | | | | | | |
| Schools & Hospitals | NA | CA | Y | NA/CA | NA | Y | NA/CA | NU | 25 | NU | NU | 30 | NU | CU | N | CU | CU | N |
| Churches & Libraries | NA | CA | Y | NA/CA | NA | Y | NA/CA | NU | 25 | NU | NU | 30 | NU | CU | N | CU | CU | N |
| Auditoriums & Concert Halls | CA | NA | Y | CA | NU | Y | CA/CU | NU | 25 | CU | CU | 30 | CU | CU | N | CU | CU | N |
| **Recreation/Open Space** | | | | | | | | | | | | | | | | | | |
| Playgrounds & Parks | NA | NA | Y | NA | NA | Y | NA/NU | NU | Y | NU/CU | NU | Y | CU | CU | N | CU | CU | N |
| Outdoor Sports Arena & Spectator Sports | CA | CA | Y | CA | NA | Y | CA | NU | Y[5] | CA/CU | NU | Y[5] | CU | CU | N | CU | CU | N |
| Outdoor Music Shells & Amphitheaters | | | Y | | | Y | | | N | | | N | | | N | | | N |
| Golf Courses & Riding Stables | NA | CA | Y | NA | NA | Y | NA | NA | Y | NA/NU | NU | 25 | NU | NU | 30 | CU | CU | N |
| Nature Areas & Zoos | | CA | Y | | NA | Y | | NA | Y | | NA | N | | NU | N | | NU | N |
| Agricultural | NA | CA | Y | NA | CA | Y | NA | CA | Y[6] | NA/CA | CA | Y[7] | CA/NU | NA | Y[8] | NU | NA | Y[8] |
| **Commercial** | | | | | | | | | | | | | | | | | | |
| Offices | NA | CA | Y | NA | CA | Y | NA/CA | NA | Y | CA | NA | 25 | CA/CU | NU | 30 | CU | CU | N |
| Retail-general | NA | CA | Y | NA | CA | Y | NA/CA | NA | Y | CA | NA | 25 | CA/CU | NU | 30 | CU | CU | N |
| **Manufacturing** | | | | | | | | | | | | | | | | | | |
| Manufacturing-general | NA | CA | Y | NA | CA | Y | NA | CA | Y | NA/CA | NA | Y[2] | CA/NU | NA | Y[3] | NU | NU | Y[4] |
| Photographic & Optical | | | Y | | | Y | | | Y | | | 25 | | | 30 | | | N |

Legend for Table III-2

State Office of Noise Control (ONC)

NA: NORMALLY ACCEPTABLE
Specified land use is satisfactory based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements.

CA: CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NU: NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design.

CU: CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

HUD

CA: CLEARLY ACCEPTABLE
The noise exposure is such that the activities associated with the land use may be carried out with essentially no interference from aircraft noise. (Residential areas: both indoor and outdoor noise environments are pleasant.)

NA: NORMALLY ACCEPTABLE
The noise exposure is great enough to be of some concern, but common building construction will make the indoor environment acceptable, even for sleeping quarters.

NU: NORMALLY UNACCEPTABLE
The noise exposure is significantly more severe so that unusual and costly building construction is necessary to insure adequate performance of activities. (Residential areas: barriers must be erected between the site and prominent noise sources to make the outdoor environment tolerable.)

CU: CLEARLY UNACCEPTABLE
The noise exposure is so severe that construction costs to make the indoor environment acceptable for performance of activities would be prohibitive. (Residential areas: the outdoor environment would be intolerable for normal residential use.)

FAA

Y (Yes) - Land use and related structures compatible without restrictions
N (No) - Land use and related structures are not compatible and should be prohibited
25 30 or 35 Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of structure.

1. Where the community determines that residential uses must be allowed, measures to achieve outdoor to indoor Noise Level Reduction (NLR) of at least 25dB and 30dB should be incorporated into building codes and be considered in individual approvals. Normal construction can be expected to provide a NLR of 20dB, thus, the reduction requirements are often stated as 5, 10, or 15dB over standard construction and normally assume mechanical ventilation and closed windows year round.
2. Measures to achieve NLR of 25 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal level is low.
3. Measures to achieve NLR of 30 must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise sensitive areas or where the normal noise level is low.
4. Measures to achieve NLR of 35 must be incorporated into the design and construction portions of these buildings where the public is received, office areas, noise sensitive areas or where normal noise levels are low.
5. Land use compatible provided special sound reinforcement systems are installed.
6. Residential buildings require an NLR of 25.
7. Residential buildings require an NLR of 30.
8. Residential buildings not permitted.

Recreation/Open Space continued

the residential and institutional uses above (an exception is outdoor amphitheater and music shells for theatrical, musical, and other performances)
- playgrounds, parks, and outdoor sports facilities should not be permitted in areas above 75 CNEL, and strong consideration should be given to precluding these uses from areas exposed to 70-75 CNEL as well
- agricultural uses (except livestock breeding) would not normally be affected by noise; however, residences should be insulated
- nature areas and zoos would be normally acceptable up to 70 CNEL, but because of the potential disturbance to wildlife by aircraft noise, would not be an acceptable use above 70 CNEL

Commercial

- some commercial uses could be located in areas exposed to noise levels up to 80 CNEL, due to the greater noise reduction properties of some types of office and commercial construction; sound insulation would still be required in office areas where persons work and converse

Manufacturing

- manufacturing activities can produce noise levels that render outside aircraft noise unobtrusive, resulting in the potential for location of certain manufacturing activities in areas up to 85 CNEL
- measures to achieve noise reduction levels of 25-30 dB must still be incorporated in the design and construction of portions of these buildings used for office areas, to receive the public, or where there is a need for low noise levels

The state law establishing noise standards for airports contains somewhat different compatibility standards than shown in Table II-2. Section 5014 of the California Administrative Code indicates that for the purpose of determining whether an airport is in compliance with state law the following land uses are deemed compatible within the noise impact boundary:

- agricultural
- all airport property
- all industrial property
- all commercial property
- zoned open space
- high rise apartments where an interior noise level of 45 CNEL can be maintained in all habitable rooms
- dwelling units existing as of December 1, 1972 which have been noise insulated to provide an acceptable indoor environment
- property subject to an avigation easement for noise

These standards, written for the specific purpose of administering the airport noise regulation law, should not be confused with prudent land use planning standards. For instance, obtaining a noise easement over a piece of property has no impact on actual interior or exterior noise levels or on livability of the property. Also under these standards high rise apartments are deemed compatible if interior noise levels can be maintained to 45 CNEL.

Redevelopment of areas beneath airport flight patterns for multi-family dwellings may increase safety hazards and should be reviewed together with the safety suggestions in this handbook.

## Suggested Land Use Compatibility Guidelines

The suggested land use criteria in Table III-3 were developed after reviewing all available plans and considering the merits of individual approaches. The key suggestions involve residential and institutional uses. For air carrier and military airports it is strongly recommended that there be no new residential development in areas exposed to noise above 70 CNEL, and single family units are discouraged in the 65-70 CNEL noise impact area. All mobile homes should be prohibited above 65 CNEL. No institutional uses should be constructed in areas above 70 CNEL and such uses should be discouraged in the 65-70 CNEL noise impact area.

While it is recognized that overriding community considerations may result in decisions to permit new residential development in areas above 65 CNEL, such development would constitute an incompatible use as defined in Section 5014 above pertaining to the California airport noise standards. Sound insulation alone would not achieve technical compliance with these standards unless applied to existing dwellings constructed prior to December 1, 1972. For this reason, and because the Legislature has defined the duties of the ALUC in Section 21670(1) of the Public Utilities Code as, among other things, promoting the "overall goals and objectives of the California airport noise standards," noise easements should be required for all residential uses above 65 CNEL. Noise easements are discussed in greater detail in Chapter VIII.

For general aviation airports the same land use compatibility recommendations apply, but for a lower CNEL range. New residential development should not be undertaken above 65 CNEL, and single family units are discouraged in the 60-65 CNEL noise impact area. Differences in land use criteria for general aviation airports result from the fact that the 65 CNEL noise contour for most general aviation airports lies fairly close to the airport boundary and does not sufficiently explain the annoyance area. The frequency of operations from some airports, visibility of aircraft at low altitudes and typically lower background noise levels around many general aviation airports are all believed to create a heightened awareness of general aviation activity and hence, potential for annoyance outside of the 65 CNEL contour.

## Special Considerations in Noise Compatibility Plans

- Noise Complaints. Noise complaints can originate considerably outside the 60 and 65 CNEL contours for an airport and hence are particularly troublesome from a land use planning standpoint. The vast majority of these complaints are related to single aircraft flyovers and not airport operations in general. There are several possible explanations for complaints received from areas beyond the 60 and 65 CNEL contours. Several factors act together to determine an individual's response to aircraft noise events: the loudness, the duration, the time of occurrence, the number of repeat occurrences, prior history of the event, and individual sensitivity. The CNEL methodology considers all of these factors to provide a penalty weighted descriptor of

Table III-3

Suggested Land Use Criteria For Noise Compatibility

| TYPE OF AIRPORT/ LAND USE | CNEL Range 55-60 | 60-65 | 65-70 | 70-75 | 75-80 |
|---|---|---|---|---|---|
| Air Carrier and Military | | | | | |
| Residential/ Lodgings | | - Potential for annoyance exists; identify high complaint areas<br>- Determine whether sound insulation requirements should be established for these areas.<br>- Require acoustical reports for all new construction.<br>- Noise easements should be required for new construction. | - Discourage new single family dwellings<br>- Prohibit mobile homes<br>- New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation is included in the design.<br>- Noise easements should be required for new construction<br>- Develop policies for "infill" | - New construction or development of residential uses should not be undertaken.<br>- New hotels and motels may be permitted after an analysis of noise reduction requirements is made and needed noise insulation is included in the design. | - New hotels and motels should be discouraged. |
| General Aviation | | | | | |
| Residential/ Lodgings | - Potential for annoyance exists; identify high complaint areas<br>- Determine whether sound insulation requirements should be established for these areas<br>- Noise easements should be required for new construction.<br>- Discourage residential use underneath the flight pattern. | - Discourage new single family dwellings<br>- Prohibit mobile homes.<br>- New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation is included in the design.<br>- Noise easements should be required.<br>- Develop policies for "infill" | - New construction or development of residential uses should not be undertaken.<br>- New hotels and motels may be permitted after an analysis of noise reduction requirements is made and needed noise insulation is included in the design. | - New hotels and motels should be discouraged. | |
| All Airports | | | | | |
| Public/ Institutional | | - Satisfactory with little noise impact and requiring no special noise insulation requirements for new construction. | - Discourage institutional uses.<br>- If no other alternative location is available, new construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation is included in the design. | - No new institutional uses should be undertaken. | |

Table III-3 (Cont.)

CNEL Range

| TYPE OF AIRPORT/ LAND USE | 65-70 | 70-75 | 75-80 | 80 + |
|---|---|---|---|---|
| Commercial | - Satisfactory, with little noise impact and requiring no special noise insulation for new construction. | - New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design. Noise reduction levels of 25-30db will be required. | - Same as 70-75 CNEL. | - New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in the construction. |
| Industrial | | - Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction. | - New construction or development should be undertaken only after an analysis of noise reduction requirements is made and needed noise insulation features included in the design.<br>- Measures to achieve noise reduction of 25-35db must be incorporated in portions of building where the public is received and in office areas. | - New construction or development should not be undertaken unless related to airport activities or services. Conventional construction will generally be inadequate and special noise insulation features should be included in the construction. |
| Recreation/ Open Space | - Satisfactory, with little noise impact and requiring no special noise insulation requirements for new construction.<br>- Outdoor music shells and amphitheater should not be permitted | - Parks, spectator sports, golf courses and agricultural generally satisfactory with little noise impact.<br>- Nature areas for wildlife and zoos should not be permitted. | - Land uses involving concentrations of people (spectator sports and some recreational facilities) or of animals (livestock farming and animal breeding) should not be permitted | |

average community noise levels over extended periods of time. Any one of the above factors can act independently to annoy individuals in the vicinity of an airport. As Figure III-3 shows, there are individuals who are "highly annoyed" at community noise levels as low as 50 and 55 Ldn; apparently some people are much more sensitive to noise than others.

If a significant number of individual complaints exist in areas outside the calculated noise impact boundary it would be important to pinpoint the specific nature of the problem. Noise problems from individual aircraft overflights (single event noise levels) can be addressed through aircraft noise limits and changes in airport operating practices and flight procedures. With increasing distance from an airport, meteorological and topographic effects can influence noise transmission and may not be totally accounted for by predictive noise models. Additional noise insulation for structures might be suggested for new residential land uses in selected areas, if in fact local topography and climate are creating a higher perception of noise as indicated by neighborhood reaction. In these special situations the sound insulation requirements would be justified based on the noise history of the neighborhood rather than on the generalized land use compatibility criteria recommended for the entire airport.

• Infill. Infill is the development of vacant parcels in areas that are already substantially developed for uses not ordinarily permitted by the plan. Infill is a significant issue that needs to be addressed in most ALUC plans due to the large amount of existing development surrounding many airports in the state. The most explicit policy on infill appears in the San Mateo County ALUC plan which permits infill in subdivided areas which are 80% developed (Reference 6). The proposed development must be: 1) a permitted use under existing zoning, and 2) consistent with the prevailing use of the area. The plan provides the following method to determine if a project qualifies as infill:

a. A circle 250 feet in radius is placed so that the subject property lies somewhere within the circle (each ALUC would need to determine an appropriate radius for such a circle based on local conditions).
b. The circle should not be drawn so as to include water areas or unsubdivided land if it is possible to draw the circle over subdivided land.
c. At least 80 percent of the parcels within the circle must be developed (each ALUC would need to determine an appropriate percentage based on local conditions).
d. Proposed development must be consistent with the prevailing use of the surrounding area.
e. Calculations for infill shall be based on the extent of development existing at the time of the adoption of the plan.

• Normalizing CNEL Contours. The Environmental Protection Agency has determined that complaints can be expected if the intruding noise CNEL exceeds the background ambient CNEL by more than 5 dB (Reference 2). Several ALUCs have used the technique of "normalizing" CNELs to adjust the calculated value of a noise contour based on the ambient noise levels in a community or neighborhood. Airport noise would be considered more intrusive in quiet suburban or rural areas and less intrusive in busy commercial or industrial areas. For example, in a quiet residential area with background noise levels of 50 CNEL (10 dB below urban residential noise), aircraft noise of 55 CNEL

would produce the same community reaction as aircraft noise of 65 CNEL in an urban residential area. Figure III-8 shows how ambient noise levels vary in different types of communities.

Normalizing would add or subtract a 0 to 10 dB increment to the calculated noise contours before applying the land use compatibility criteria shown in Table III-3. This adjustment can be applied for all land use categories or used selectively for only those uses judged particularly sensitive or insensitive to noise. In either case, use of a normalized CNEL would call for measurement of ambient as well as airport noise levels and would require preparation of airport CNEL contours down to 55 or 60 dB for suburban and rural areas that have a low background noise level. In actual practice, several ALUCs have incorporated these adjustments directly in their land use compatibility tables without going through the separate step described above. However, adoption of a single land use compatibility standard for all airports would only be appropriate if the type's of communities and ambient noise levels were very similar throughout the ALUC's jurisdiction.

Examples of the use of normalized contours exist only where the community environment is fairly quiet. A number of plans for rural or very quiet suburban areas discourage residential use within the 55 CNEL contour for general aviation airports. No examples can be cited where a land use was made less restrictive due to high ambient noise levels. It is therefore suggested that where existing or planned land uses are determined to be extremely noise sensitive, a 5 dB increment be added to the calculated contours prior to applying the land use criteria in Table III-3 (e.g. the 60-65 CNEL contour area becomes the 65-70 CNEL contour area, and the land use compatibility guidelines for the 65-70 CNEL noise impact area are then applied). A more detailed set of correction factors is contained in several ALUC plans and is shown in Table III-4.

- Noise Caused by Low Level Overflights at General Aviation Airports. Airports whose activity consists almost entirely of general aviation aircraft do not generate the high noise levels of air carrier and military airports, but they can subject large areas to low level overflight noise. The frequency of overflight and low altitude of the aircraft can create a heightened awareness of noise, which contributes to the annoyance. The potential for such annoyance exists anywhere in the airport traffic pattern and anywhere aircraft are below 500 feet. Also pilots often follow rivers, streets, and highways when flying under visual weather conditions, and residential areas underneath these flight patterns will experience noise, particularly if the weather forces aircraft under low cloud cover.

The history of noise complaints around general aviation airports suggests that some land use measures are required under the traffic pattern and within the 55 CNEL contour. Preferred measures are those that restrict residential use within the traffic pattern. (The actual traffic pattern should be confirmed with the airport manager and FAA; these patterns can extend up to a mile from the runways and be 1/4 to 1/2 mile wide as flown by pilots.) Land use restrictions may include prohibiting residential development underneath the traffic pattern or limiting development to low density uses. Other measures that have been recommended where aircraft are below 500 feet and in the general overflight area include requirements for noise easements and notification of prospective property owners (Reference 10). These areas are shown in Figure III-9.

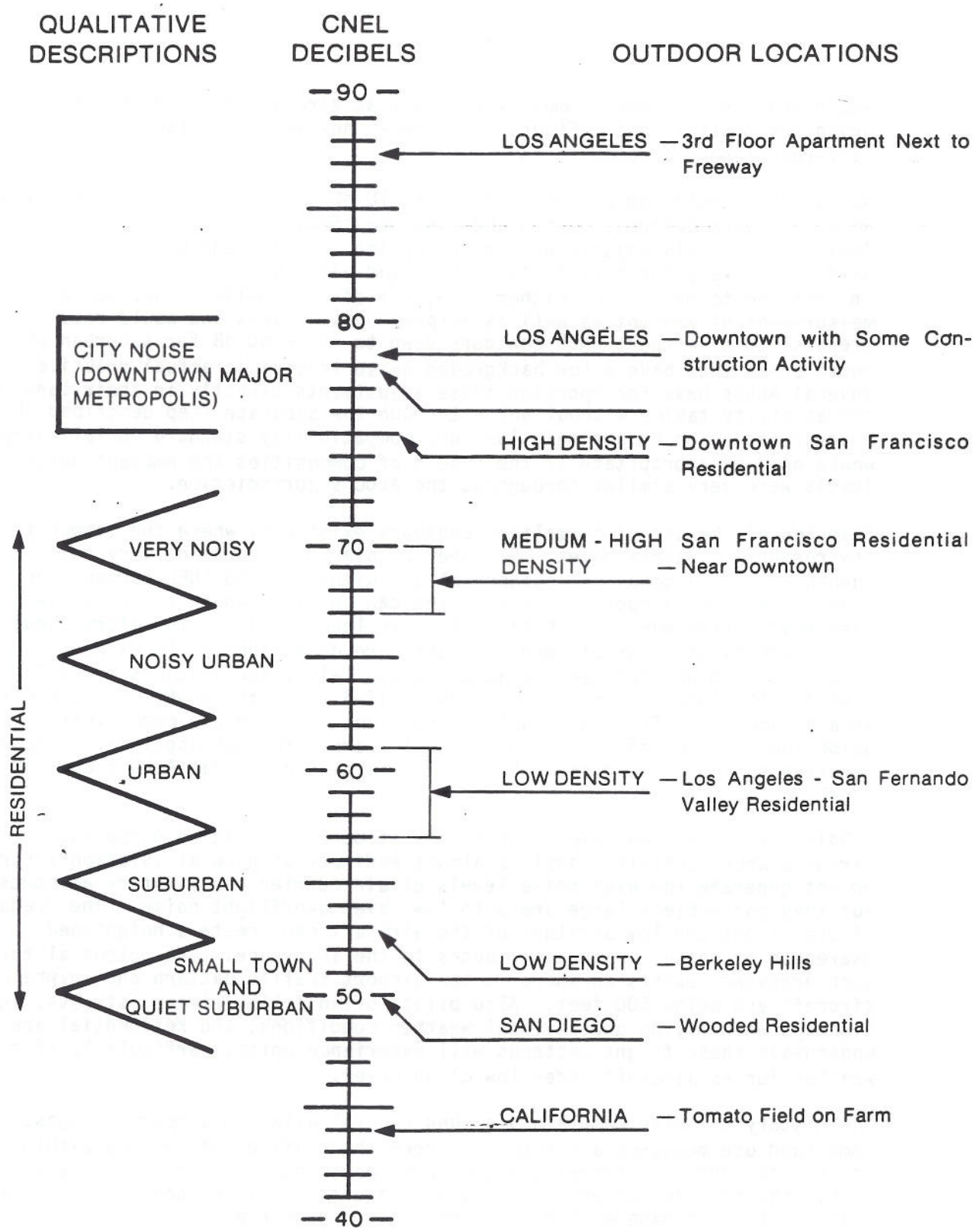



**Figure III - 8**

**COMPARATIVE CNEL VALUES AT VARIOUS LOCATIONS**

**Reference 7**

Table III-4

Adjustments to the
Measured Community Noise Equivalent Level (CNEL)
to Obtain Normalized CNEL

| Type of Correction | Description | Amount of Correction to be Added to Measured CNEL in dB |
|---|---|---|
| Seasonal Correction | Summer (or year-round operation). | 0 |
| | Winter only (or windows always closed). | -5 |
| Correction for Outdoor Residual Noise Level | Quiet suburban or rural community (remote from large cities and from industrial activity and trucking). | +10 |
| | Quiet suburban or rural community (not located near industrial activity). | +5 |
| | Urban residential community (not immediately adjacent to heavily traveled roads and industrial areas). | 0 |
| | Noisy urban residential community (near relatively busy roads or industrial areas). | -5 |
| | Very noisy urban residential community | -10 |
| Correction for Previous Exposure and Community Attitudes | No prior experience with the intruding noise. | +5 |
| | Community has had some previous exposure to intruding noise but little effort is being made to control the noise. This correction may also be applied in a situation where the community has not been exposed to noise previously, but the people are aware that bona fide efforts are being made to control the noise | 0 |
| | Community has had considerable previous exposure to the intruding noise and the noise maker's relations with the community are good. | -5 |
| | Community aware that operation causing noise is very necessary and it will not continue indefinitely. This correction can be applied for an operation of limited duration and under emergency circumstances | -10 |
| Pure Tone or Impulse | No pure tone or impulsive character. | 0 |
| | Pure tone or impulsive character present. | +5 |

Source: Reference 7

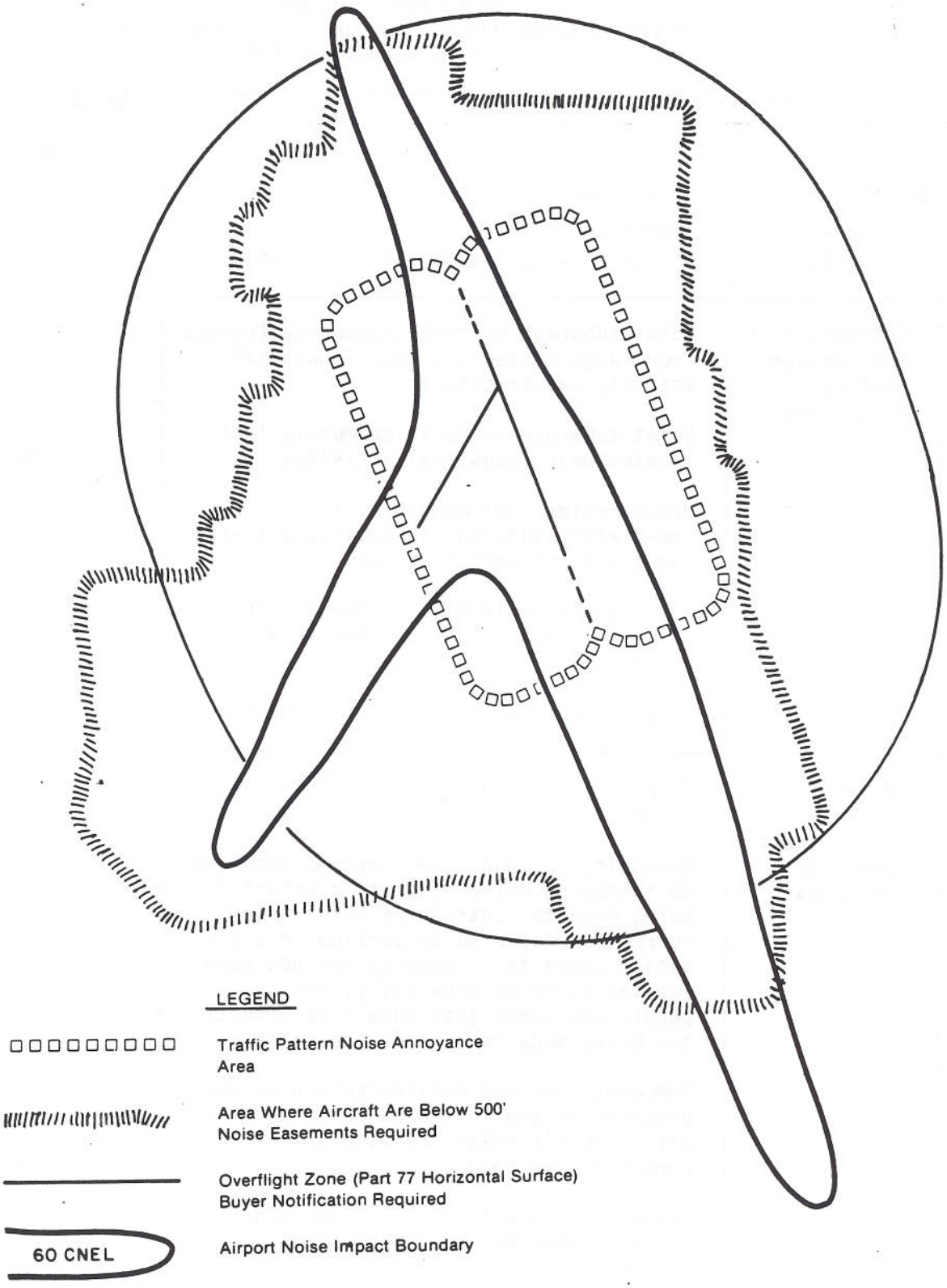



**Figure III - 9**

**NOISE ANNOYANCE ZONES FOR GENERAL AVIATION AIRPORT**

**Reference 10**

• Low frequency "rumble." Low frequency noise, or "rumble," tends to propagate for greater distances than higher frequency noise and is most commonly observed behind the tailpipe of jet aircraft during their takeoff. Some people find this type of noise very intrusive. The effect of low frequency noise may be heightened if there are hills surrounding an airport on which people live. The only practical solutions for this type of noise are shielding of the noise source by buildings and terrain. Blast fences are relatively ineffective once the aircraft has proceeded down the runway. Limited noise monitoring data for low frequency noise suggests that the sound attenuation properties of structures are somewhat less in this frequency range compared to other frequency ranges.

• Engine Test Noise. Figure III-10 shows the typical shape of noise contours produced during engine runups at a special runup area at San Francisco International Airport. These results indicate that there is a relatively small impact compared to takeoff and approach noise; this can be verified from the airport noise monitoring system.

• Helicopter Noise. Helicopter noise contains all of the components of propeller noise found in fixed wing aircraft, but with one important addition--rotor or blade slap. Rotor or blade slap is a characteristic and very distinctive sound, common only to helicopters. It is best described as a popping or "whup-whup" sound.

With the recent increased use of turbine engines in helicopters, the roar of piston engines has been eliminated, and the blade slap is, therefore, more obtrusive. Whine from the turbine engines is also noticeable. The range of helicopter noise levels varies with the size of the helicopter. Overflight noise for light helicopters at 400 feet is about 72-82 dBA; medium helicopters range from 79-87 dBA; and heavy helicopters produce about 84-92 dBA. The frequency of operations into and out of most heliports is relatively low, hence, the daily exposure to noise due to helicopters amounts to only a few minutes. Pilot techniques and helicopter operating procedures can reduce noise impacts significantly. Most of the techniques listed below are currently being used at various heliports. See Appendix D for case examples.

1. Select route into and out of heliport over least populated area
2. Follow major thoroughfares, railway roadbeds and other high ambient noise routes
3. Takeoff using a high rate-of-climb and make smooth transition to level flight
4. Fly at highest practical altitude while enroute
5. Maintain moderate cruise airspeeds, particularly over populated areas.
6. Make all turns and maneuvers smoothly
7. Reduce rotor rpm to allowable flight minimums (if helicopter is so configured) while over densely populated areas
8. Approach and land using low noise flight profiles appropriate to the particular helicopter

Few ALUCs have explicit policies for evaluation of helicopter noise impacts. One that does, the Santa Clara ALUC, has adopted the following heliport noise standards (Reference 12):

- No residential structures may be located within the 65 dB annual CNEL noise impact boundary to be generated when the heliport reaches full-scale operation.

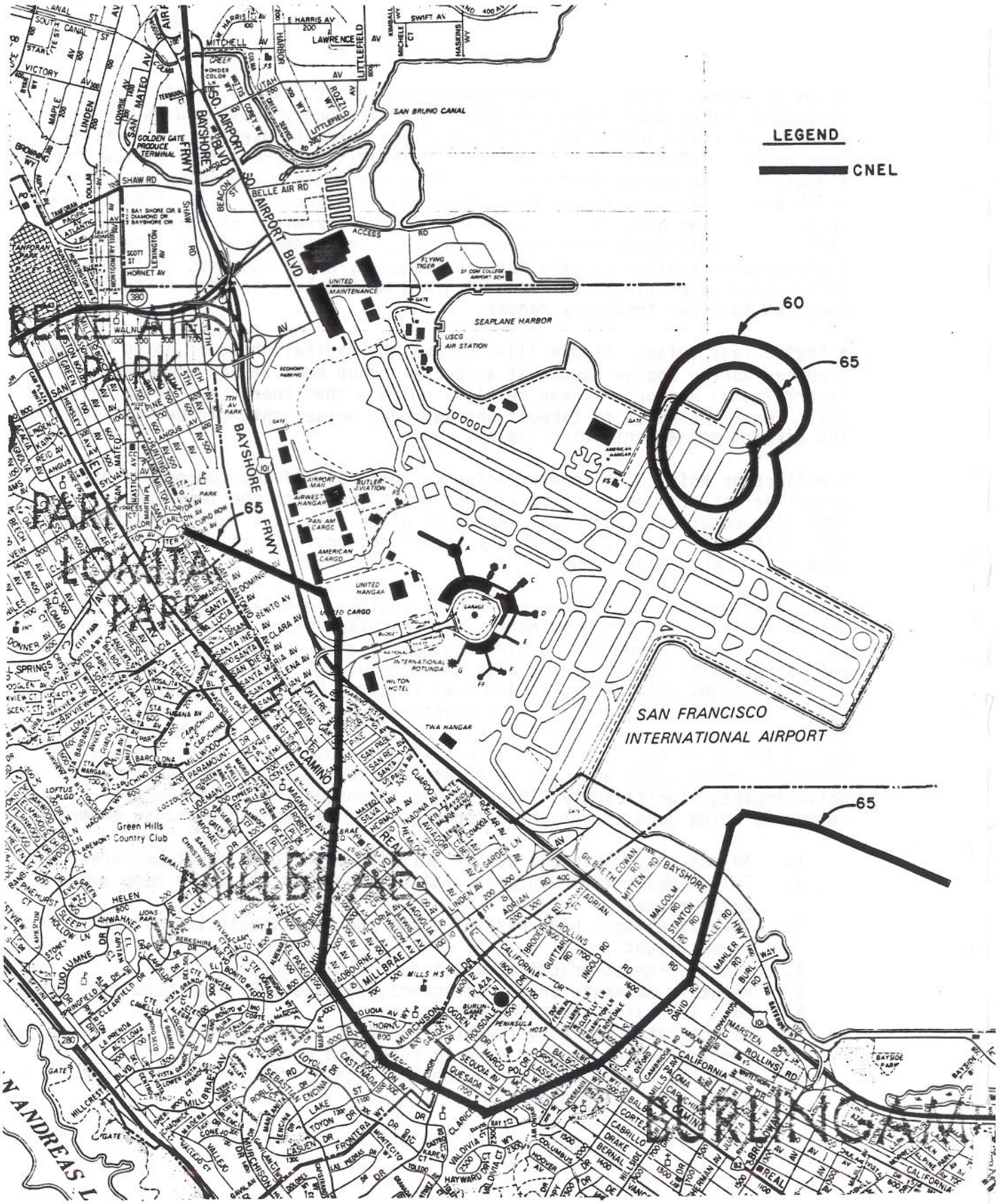



**Figure III - 10**

**CNEL CONTOURS FOR ENGINE TEST NOISE**
**1976 San Francisco International Airport**

**Reference 11**

- Interior annual CNEL with windows closed, attributable to helicopters operating from the heliport, shall not exceed a CNEL of 45dB in any habitable room of a residential structure. New residential structures to be located within an annual CNEL contour of 60 dB require an acoustical analysis showing that the structure has been designed to limit intruding noise to the prescribed allowable levels.

- The maximum noise level at the nearest residentially zoned area shall not exceed 80 dBA by reason of the heliport.

In order for ALUCs to properly evaluate heliport proposals, the project sponsor should provide a clear identification of the proposed flight paths into and out of the heliport and provide a set of projected noise contours if there is a potential for noise impacts in residential areas.

## Sound Insulation of Structures

The indoor effects of aircraft noise can be mitigated by installation of sound insulation in residential and other types of structures. The ALUC law states that ALUCs "may determine building standards, including soundproofing adjacent to airports." Determining such standards is beyond the expertise of most ALUCs; however, some commissions have chosen to seek outside consulting advice. Most ALUC plans indicate the range of noise levels where sound insulation will be required and others specify the noise reduction levels that should be obtained. Where noise reduction levels are specified, the selection of methods to achieve these reductions is left to the acoustical engineers. Few plans have attempted to provide guidelines in a form that would be useful for amending local building codes.

The following excerpt is intended to provide a brief background on the theory and practice of noise insulation of structures (Reference 13). In practice, the determination of noise reduction properties of specific residential structures should be made by a person qualified in acoustical analysis.

> We have all observed from time to time the marked reduction of outside noise as we have quickly walked into a building and shut the door. The quantitative description of this sound level reduction is called noise reduction and is expressed in decibels. The noise reduction (NR) between two areas is the numerical difference in decibels between the two areas. For example, if the outside sound level is 70 dBA and the inside is 45 dBA, the NR = 70 dBA - 45 dBA = 25 dBA. Determining the actual noise reduction for a specific construction is straight forward, but not simple. The difficulty is that sound transmission from outside to inside may involve several sound paths; for example, a door, windows and wall. The noise reduction takes into account all of these paths and is calculated from the sound transmission loss and effective area of each path, as well as an overall adjustment for the ratio of the total sound radiating area and the sound absorption of the specific room under consideration.
>
> The quantitative measure of the sound energy passing through a building material is called the sound transmission loss (TL) and is expressed in decibels. The sound transmission loss is an intrinsic property of the

building material or specific construction and must not be confused with noise reduction. The noise reduction is computed from the sound transmission loss, but they are not equivalent. Measurements of the transmission loss through a building material are generally obtained in the laboratory according to a specific standard although field measurements are also acceptable. In the laboratory, sound transmission loss is measured at a total of 16 frequencies over the frequency range of 125 to 4000 Hertz. The results of sound transmission loss tests are tabulated in a variety of references.

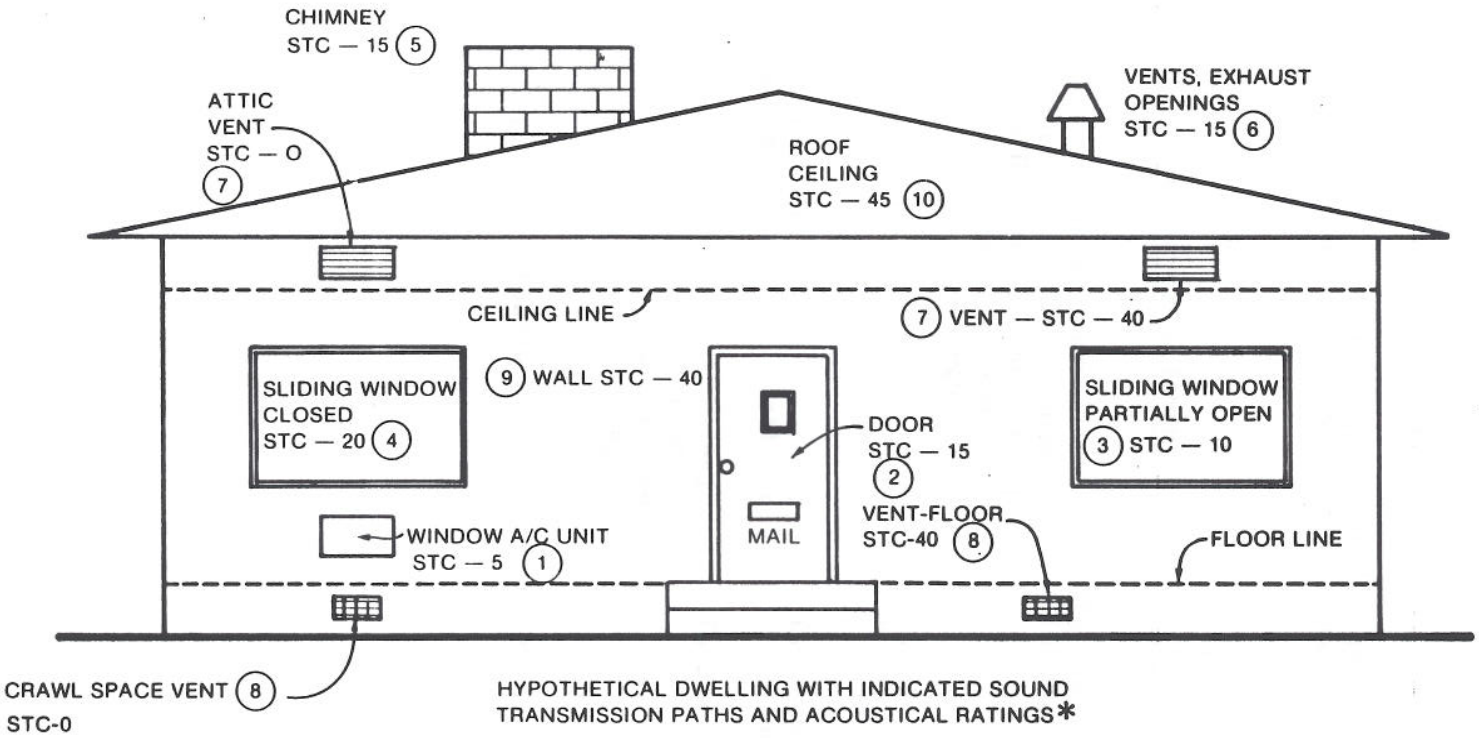
In order to provide a single number rating to describe the sound transmission loss for a specific construction, a calculation procedure to determine the sound transmission class (STC) has been devised. There are a number of shortcomings in utilizing a single number STC rating in lieu of the more complete TL description. However, since noise level reduction requirements only involve a single rating it is consistent to consider only the STC ratings for common building materials and construction. Examination of the tables clearly identify the weak links in residential construction - doors and windows. A typical exterior door provides an STC of 20. A sliding glass single strength window provides an STC of 20; however, a simple wall, with stucco on one side of wood studs and 1/2" gypsum board on the other, provides a STC of 40 (See Figure III-11). Fortunately, in most instances the noise reduction is generally higher than the STC rating of the weakest part of a composite construction, since doors and windows generally occupy only a fraction of the total wall area.

Table III-5 summarizes the composite noise reduction in dBA for common building construction, assuming that no special noise control features are employed. These results are representative and are based upon dozens of measurements on actual buildings. Note that for typical dwellings, composite noise reductions between 20 and 30 dBA are considered maximum with windows open and closed, respectively.

Windows and doors limit the reduction attained. Concrete commercial buildings with sealed windows may provide 30 to 40 dBA noise reduction, depending upon the glass area. Required noise reduction in excess of these values will necessitate special noise control methods. Practical building exterior noise control techniques are available to improve the noise reduction of typical construction by 10 to 20 dBA. The techniques generally involve one or more of the following:

(1) Utilization of heavy weatherstripped exterior doors.
(2) Fixed, sealed double windows. Forced ventilation or air conditioning will be required in rooms with sealed windows.
(3) Elimination or baffling of openings through exterior walls, including wall air conditioning units, mail slots, attic and crawl space vents, etc.
(4) Adding materials to certain wall and ceiling surfaces, especially beamed ceilings where no attics exist.

So far, the discussion has concentrated on the use of building construction to reduce the impact of the external noise environment. In some cases, particularly for new projects, an alternate approach is possible. The choice of the building site, orientation of buildings on




*— STC = SOUND TRANSMISSION CLASS
(1) — RANK ORDER OF SOUND TRANSMISSION PATH ON AN ENERGY BASIS,
(1) INDICATES THE MOST IMPORTANT PATH, ETC.

**Figure III - 11**

**HYPOTHETICAL RESIDENCE BEFORE NOISE CONTROL**

Table III-5

Noise Reduction Afforded By Common Building Construction
Assuming No Special Noise Control Provisions

| Construction Type | Typical Occupancy | General Description | Range of Noise Reduction, dBA |
|---|---|---|---|
| 1 | Residential, Commercial, Schools | Wood framing. Exterior stucco or wood sheathing. Interior drywall or plaster. Sliding glass windows. Windows partially open. | 15-20 |
| 2 | Same as 1, above | Same as 1 above, but windows closed | 25-30 |
| 3 | Commercial, Schools | Same as 1 above, but windows are fixed 1/4 inch plate glass | 30-35 |
| 4 | Commercial | Steel or concrete framing. Curtain-wall or masonry exterior wall. Fixed 1/4 inch plate glass windows | 30-40 |

The range depends upon the openness of the windows, the degree of seal and the window area involved.

Source: Reference 13

site, proximity between buildings, use of natural or constructed shields, all have the potential of reducing the exterior noise impact. Many of these approaches actually cost nothing extra, requiring only initial planning to achieve the desired result. Generally speaking: (1) trees and landscaping are not an effective means of noise control; (2) barriers are not effective unless they extend above the line of sight between the noise source and listener. Nevertheless, such alternative methods may eliminate altogether the need for exterior building noise control, or at least reduce the total requirement.

## Establishing Noise Reduction Requirements for Structures

Title 25, Section 28 of the California Administrative Code (See Appendix B) establishes uniform minimum noise insulation standards to protect persons within new hotels, motels, apartment houses, and dwellings other than detached single family dwellings. This law requires that interior noise levels with windows closed shall not exceed an annual CNEL of 45 dB in any habitable room. It also requires acoustical analysis for new residential structures located within an airport CNEL contour of 60 dB showing that the structure has been designed to limit intruding noise to allowable levels.

Two different approaches have been used in ALUC plans to establish the amount of noise reduction necessary for new construction in areas where such construction would be classified normally incompatible. The first approach is to require interior noise levels be limited to 45 CNEL in all habitable rooms as specified in the California Noise Insulation Standards. This interior standard should be required for detached single family dwellings as well as multi-family dwellings, although the California noise insulation standards clearly do not apply to single family dwellings. Exterior to interior noise reduction requirements are then determined by subtracting 45 CNEL from outside noise levels as determined from the adopted noise impact boundary map in the ALUC plan. (Note that if a project is in the 65-70 CNEL noise impact area, the noise level reduction requirement would be calculated using the higher value of 70 CNEL.)

Example

Outside Noise Level = 70 CNEL
Inside Standard = 45 CNEL
Required Noise Level Reduction= 25 CNEL

The second approach is based on defining maximum interior noise level criteria for intermittent noise (in dBA). These criteria represent the maximum intruding intermittent noise the public will accept for different land uses and types of activity. Table III-6 provides an example of the criteria adopted in several ALUC plans. In order to use this table, it is necessary to know the maximum outside noise level from aircraft overflights. This information can be obtained from on-site noise monitoring or from tables that provide maximum noise levels based on the slant distance from aircraft taking off or landing at the airport.

Although the two approaches to setting noise reduction requirements are similar in that higher maximum overflight noise is also indicative of higher outside CNELs, the use of the maximum intermittent noise criteria in Table

Table III-6

Recommended Maximum Interior Noise Level
Criteria for Intermittent Noise

| Generalized Land Use (Occupancy) | Maximum Int. Intermittent Noise - dBA | Basis for Criteria* |
|---|---|---|
| A. RESIDENTIAL - SINGLE AND TWO FAMILY DWELLINGS | | |
| 1. Living Areas | | |
| a. Daytime | 60 | Conversation - 5 ft. - normal voice |
| b. Nightime | 55 | Conversation - 10 ft. - normal voice |
| 2. Sleeping Areas | 40* | Sleeping |
| B. RESIDENTIAL | | |
| Multiple Family Apartments | Same as A. | Same as A. |
| C. EDUCATIONAL FACILITIES, ETC. | | |
| 1. Concert Hall | 25 | Intrusion of noise may spoil artistic effect |
| 2. Legitimate Theater | 30 | " " " " |
| 3. School Auditorium, | 35 | Minimize intrusion into artistic performance |
| 4. School Classroom | 55 | Speech communication - 20 ft. - raised voice |
| 5. School Laboratory | 60 | " " - 6 ft. - normal voice |
| 6. Church Sanctuaries | 45 | " " - 50 ft. - raised voice |
| 7. Library | 65 | " " - 3 ft. - normal voice |
| D. RECREATIONAL FACILITIES | | |
| 1. Motion Picture Theater | 45 | Minimize intrusion into artistic performance |
| 2. Sports Arena | 75 | Conversation - 2 ft. - raised voice |
| 3. Bowling Alley | 75 | " - 2 ft. - " " |
| E. COMMERCIAL, MISCELLANEOUS | | |
| 1. Hotel, Motel Sleeping | 40 | Sleeping |
| 2. Hospital Sleeping | 40 | " |
| 3. Executive Offices, Conf. Rooms | 55 | Speech communication - 12 ft. - normal voice |
| 4. Staff Offices | 60 | " " - 6 ft. - " " |
| 5. Sales, Secretarial | 65 | Satisfactory telephone use |
| 6. Restaurants | 65 | Conversation - 4 ft. - normal voice |
| 7. Markets, Retail Stores | 65 | " - ft. - " " |
| F. LIGHT INDUSTRIAL | | |
| 1. Office Areas | See E-3, 4, 5 | See E-3, 4, 5 |
| 2. Laboratory | 60 | Speech Communication - 6 ft. - normal voice |
| 3. Machine Shop | 75 | " " - 3 ft. - raised voice |
| 4. Assembly, Construction | 75 | " " - 2 ft. - raised voice |
| G. HEAVY INDUSTRIAL | | |
| 1. Office Areas | See E-3, 4, 5 | See E-3, 4, 5 |
| 2. Machine Shop | 75 | Speech Communication - 3 ft. - raised voice |
| 3. Assembly, Construction | 75 | " " - 2 ft. - raised voice |

* Some ALUCs have used 50 dBA for sleeping areas

Source: Reference 13

III-6 can result in fairly large noise reduction requirements in sensitive living spaces such as sleeping quarters. Studies performed for the Santa Clara County ALUC by an acoustics firm (Reference 14) are interesting in this regard. Table III-7 shows monitoring data obtained for a residence inside the 70 CNEL contour (See Figure III-12). The house provides about 30 dB of noise reduction; however, maximum intermittent interior noise levels range between 57 and 69 dB with a logarithmic mean of 64 dB. Comparison of the mean with the criteria shown in Table III-6 shows that another 10 to 25 dB of reduction would be required to meet the criterion for nighttime living areas and sleeping quarters. Such additional reductions are probably outside the realm of practical and cost effective noise insulation methods.

This data does serve to highlight two major points. First, it supports the previous recommendation (Table III-3) that new residential development not be permitted in areas exposed to noise above 70 CNEL as such noise levels pose a serious problem for indoor and outdoor residential activities. Second it indicates that ALUCs need to consider recommending more extensive sound insulation within the 65-70 CNEL contour than would be calculated from the simple formula in the example above (i.e., 70 CNEL outside -45 CNEL inside= 25 CNEL required noise reduction). This is because of the need to address, through acoustical studies, the noise environment of noise sensitive areas within homes, schools, and hospitals used for sleeping, relaxing and conversing. Fortunately there is a range of practical construction methods to achieve noise reduction levels of 25-35 dB.

Table III-8 provides the recommended noise level reductions for various land uses and range of noise levels. The recommendations for commercial and industrial uses are the same as the joint federal interagency guidelines (Reference 9) while the recommendations for residential and institutional uses are the same as discussed above.

• Model Noise Insulation Standards. Appendix E contains a set of model sound insulation standards for residences. These standards were developed by The Parry Company (December 1982) with input from contractors specializing in residential construction. They incorporate energy insulation standards adopted by the California Energy Commission. It is believed that these recommended building requirements represent the best available information on cost effective sound insulation techniques and can be incorporated in local building codes to achieve noise level reductions in residences from 25-35 dB.

The cost of noise insulation for a specific residence will vary. San Jose Municipal Airport, which has conducted a pilot residential sound insulation project, has developed the following preliminary cost estimates for remedial soundproofing of residences in the San Jose Airport vicinity (Reference 15):

| | Average Cost in 1982 Dollars |
|---|---|
| minor soundproofing (0-10 dB) | $ 5,000 |
| moderate soundproofing (10-15 dB) | $10,000 |
| major soundproofing (up to 25 dB) | $25,000 |

These cost estimates are based on a typical residential unit, with eight windows, three exterior doors, and an attic with partial insulation. The estimated costs include labor.

Table III - 7

SANTA CLARA ALUC
AIRCRAFT NOISE MEASUREMENTS
SAN JOSE MUNICIPAL
10 March 1981

| Time | Event | SINGLE EVENT NOISE EXPOSURE LEVEL (SENEL), dB | | | | | MAXIMUM SOUND LEVEL A-weighted sound pressure level, dB | | |
|---|---|---|---|---|---|---|---|---|---|
| | | RMS7 | RMS7-CMS Ext: Diff. | CMS Exterior | CMS Interior | CMS Ext.-Int. | CMS Exterior | CMS Interior | CMS Ext.-Int. |
| 07:12:11 | Air Cal. 737 | 103 | 3 | 100 | 74 | 26 | 88.5 | 61.5 | 27 |
| 07:13:30 | PSA 727 | 108 | 4 | 104 | 76 | 28 | 94.5 | 65.5 | 29 |
| 07:15:01 | Cont. 727 | 108 | 6 | 102 | 74 | 28 | 93 | 63.5 | 29.5 |
| 07:17:03 | United 727 | 111 | 8.5 | 102.5 | 74.5 | 28 | 94 | 65 | 29 |
| 07:22:14 | Air Cal. 737 | 105 | 4 | 101 | 73.5 | 27.5 | 91 | 62.5 | 28.5 |
| 07:40:16 | TWA 727 | 104 | 2 | 102 | 74 | 28 | 94 | 62.5 | 28.5 |
| 07:43:45 | United 727 | 108 | 1 | 107 | 78 | 29 | 98 | 69 | 29 |
| 08:03:09 | Republic DC-9 | 107 | 7 | 100 | 71.5 | 28.5 | 91 | 62.5 | 28.5 |
| 08:24:47 | Air Cal. 737 | 104 | 6 | 98 | 71 | 27 | 88 | 59 | 29 |
| 08:34:36 | Republic DC-9 | 103 | 8 | 95 | 67 | 28 | 86.5 | 57 | 29.5 |
| 08:38:10 | PSA 727 | 108 | 7.5 | 100.5 | 72 | 28.5 | 90.5 | 61.5 | 29 |
| 08:45:22 | PSA 727 | 108 | 6 | 102 | 73.5 | 28.5 | 92.5 | 63.5 | 29 |
| 08:47:04 | Air Cal. 737 | 103 | 3 | 100 | 73 | 27 | 90 | 62 | 28 |
| 08:59:33 | Air Cal. 737 | 105 | 3.5 | 101.5 | 74 | 27.5 | 92 | 63 | 29 |
| 09:15:00 | A.A. 727 | 112 | 9 | 103 | 75 | 28 | 95 | 66 | 29 |
| 10:00:37 | Air Cal. 737 | 103 | 3.5 | 99.5 | 72.5 | 27 | 89 | 62 | 27 |
| 10:07:54 | PSA 727 | 109 | 6 | 103 | 74.5 | 28.5 | 95 | 66 | 29 |
| 10:15:30 | Air Cal. 737 | 102 | 3 | 99 | 71.5 | 27.5 | 89 | 60.5 | 28.5 |
| 10:37:02 | Western 727 | 110 | 7 | 103 | 75 | 28 | 94 | 65 | 29 |
| 10:50:14 | Air Cal. 737 | 101 | 6 | 95 | 68 | 27 | 86 | 57 | 29 |
| 10:57:06 | Republic DC-9 | 104 | 3 | 101 | 73 | 28 | 90 | 60.5 | 29.5 |
| 11:08:49 | PSA 727 | 109 | 5 | 104 | 75 | 29 | 95 | 65 | 30 |
| 11:39:19 | Cont. 727 | 110 | 4.5 | 105.5 | 76 | 29.5 | 98 | 68 | 30 |
| 12:12:49 | PSA DC-9-80 | 96 | 1 | 95 | 66.5 | 28.5 | 85.5 | 57 | 28.5 |
| | Logarithmic Mean | 107 | 5 | 102 | 74 | 28 | 93 | 64 | 29 |
| | CALCULATED CNEL | 77.5 | | 72.5 | 44.5 | | | | |

63 events 0700-1900
[illegible] ev[illegible] 19[illegible] 2200

Reference 14

Figure III - 12

**SPECIAL MONITORING LOCATION FOR NOISE MEASUREMENTS AT SAN JOSE AIRPORT**
**March 1981**

Table III-8

Suggested Noise Level Reduction
(dBA)

| Generalized Land Use | CNEL Range | | | | |
|---|---|---|---|---|---|
| | 60 - 65 | 65 - 70 | 70 - 75 | 75 - 80 | 80 + |
| Residential | AS | 25 minimum[1] | * | * | * |
| Transient Lodging | -- | 25 | 30 | * | * |
| Schools, Hospitals & Nursing Homes | AS | 25 minimum[1] | * | * | * |
| Commercial | -- | -- | 25 | 30 | * |
| Manufacturing[2] | -- | -- | 25 | 30 | 35 |

Legend

* Uses would not be permitted under suggested land use compatibility guidelines in Table III-3.

1. Acoustical studies may indicate a need for additional insulation in noise sensitive living areas, such as sleeping quarters and areas of the house used at night for relaxing and conversing

2. Noise level reductions are for those portions of the buildings where the public is received, office areas, and noise sensitive areas where normal noise levels are low.

AS Acoustical studies should be performed to determine if insulation should be added to sensitive living areas.

# IV. SAFETY OF PERSONS ON THE GROUND

## Reasons for Airport Safety Zones

Areas near airports are exposed to various levels of accident potential depending on the type of aircraft using the airport, the frequency of aircraft overflights, and local weather conditions. Historically the risk of being killed or injured on the ground near an airport is quite small. A recent study of general aviation accidents (Reference 16) determined that over the period between 1964 and 1979 there was a total of 27 general aviation accidents nationwide in which an aircraft collided with a building or residence on the ground and caused injuries to a third party--a very small number. Between 1964 and 1979 twelve airports in California had 20 off airport accidents in which there was a collision with a building or residence. Between 1974 and 1982 off airport accidents involving US scheduled air carriers resulted in only 36 fatalities on the ground.

Various reasons have been offered for the low incidence of major accidents near airports in relation to the volume of traffic handled. These include the safety features designed into modern general aviation and commercial aircraft, pilot actions in accident situations, preventative land use planning and last, but not least, good fortune. While many airports in the state have not experienced a serious aircraft accident resulting in major property damage or loss of life, this fortunate situation does not alter the basic accident probabilities. Perhaps the most difficult ALUC planning responsibility is the determination of land use measures around airports that are appropriate to the level of risk involved and the potential for injury or property damage should an accident occur. ALUCs have established a variety of safety zones around airports and land use controls within these safety zones to minimize the impact of a crash. These safety zones are described in detail further on.

## Types of Aircraft Accidents

The National Transportation Safety Board (NTSB) maintains extensive data on air carrier and general aviation accidents and their causes. Although the NTSB collects data on all accidents, it is primarily the characteristics of accidents near airports--usually within one mile of the airport--that are of greatest concern to ALUCs. This section briefly discusses the types of accidents associated with air carrier, general aviation, and military flying.

- Air Carrier Accidents. The landing phase of air carrier operations has the higher near airport accident rate as shown in Tables IV-1 and IV-2. The most serious type of landing accident is to undershoot the approach and crash short of the runway. Since many air carrier operations have a high exposure to adverse weather, it is not surprising that weather has been a significant factor in a number of landing accidents. Failure of the pilot and crew to properly monitor aircraft course, airspeed, descent rate, and glide path has been a contributory factor in other landing accidents.

Historically fewer air carrier accidents have occurred on takeoff; however, there have been several major takeoff accidents in recent years. While engine failures are most likely at takeoff thrust levels, all passenger aircraft are

Table IV-1

Air Carrier Accidents by Phase of Operation
(1970 to 1979)

Total Accidents

| Phase of Operation | Frequency | Percent Of Total |
|---|---|---|
| Static | 35 | 9.6 |
| Taxi | 36 | 9.9 |
| Takeoff | 41 | 11.3 |
| In-flight | 152 | 41.9 |
| Landing | 98 | 27.0 |
| Unknown/not reported | 1 | 0.3 |
| Total | 363 | 100.0 |

Fatal Accidents

| Phase of Operation | Frequency | Percent Of Total |
|---|---|---|
| Static | 4 | 7.0 |
| Taxi | 4 | 7.0 |
| Takeoff | 8 | 14.0 |
| In-flight | 16 | 28.1 |
| Landing | 24 | 42.1 |
| Unknown/not reported | 1 | 1.8 |
| Total | 57 | 100.0 |

Note: Fatal accidents are accidents involving a fatality, but not necessarily fatal to all passengers and crew.

Source: Reference 17

Table IV-2

Fatal Air Carrier Accidents On And Near Airports

(US Air Carriers)

| Year | Location | Type of Aircraft | Phase of Operation |
|---|---|---|---|
| 1974 | Pago Pago, Samoa | B-707 | Crashed During Landing |
| | Bali Is., Indonesia | B-707 | Crashed During Landing |
| | Charlotte, NC | DC-9 | Crashed During Landing |
| | Berryville, VA | B-727 | Crashed During Approach to Landing |
| 1975 | JFK Airport, New York | B-727 | Crashed on Landing During Thunderstorm |
| | Gambell Village, St. Lawrence Is, AK | F-27(P) | Crashed During Landing |
| | Fairbanks, AK | DC-6(P) (cargo) | Crashed During Takeoff |
| 1976 | Ketchikan, AK | B-727 | Ran off End of Runway During Landing |
| | St. Thomas, Virgin Is. | B-727 | Crashed During Landing |
| | Van Nuys, CA | DC-6(P) (cargo) | Propeller Failure During Takeoff - Struck Building During Landing |
| 1977 | Canary Islands | 2-B-747s | Ground Collision |
| | St. Louis, MO | L-188(P) (cargo) | Crashed During Takeoff |
| 1978 | Pueblo, CO | DHC-6(P) | Crashed During Initial Climb on Training Flight |
| | Los Angeles, CA | DC-10 | Crashed During Rejected Takeoff |
| | Pensacola, FL | B-727 | Crashed During Final Approach |
| | Portland, OR | DC-8 | Crashed During Landing |
| | San Diego, CA | B-727 | Mid-Air Collision with Light Plane |
| 1979 | Clarksburg, WV | Nord(P) | Crashed During Takeoff |
| | Chicago, IL | DC-10 | Crashed Shortly After Takeoff |
| | Hyannis, MA | DHC-6(P) | Crashed During Approach to Landing |
| | Mexico City, MX | DC-10 | Crashed During Landing |
| 1982 | Washington, D.C. | B-737 | Crashed During Takeoff in Snow Storm |
| | New Orleans, LA | B-727 | Crashed on Takeoff |
| | Boston, MA | DC-10 | Ranoff End of Runway During Landing |

(P) = Propeller-driven aircraft

Note: Fatal accidents are accidents involving a fatality, but not necessarily fatal to all passengers and crew

Source: Reference 18

designed to become airborne with one critical engine out. Mechanical problems, such as landing gear or flap retraction, can reduce climb performance, but are not usually the cause of accidents. Weather--in the form of turbulence, wind shear, and snow storms--has caused several major accidents on takeoff. These weather conditions produce downdrafts, rapid changes in wind velocity with altitude and airframe icing which can degrade climb performance resulting in a crash. A few examples exist where an aircraft has stalled on takeoff due to pilot error. The types and causes of air carrier accidents are shown in Table IV-3.

• General Aviation Accidents. Table VI-4 shows that serious near airport general aviation accidents--accidents in which an aircraft is destroyed or substantially damaged--are evenly divided between the takeoff and landing phases of operation. Engine failure or malfunction is the most frequent type of general aviation accident. Engine failures are most common during climbout when the engine is exerting maximum power. Fortunately, not all engine failures result in crashes, since the pilot may be able to make a controlled emergency landing--either at the airport or in a clear area around the airport. Control problems are more difficult in twin engine aircraft if an engine fails due to the asymmetric thrust created by the remaining engine. The lack of pilot proficiency in this situation has been cited in a number of twin engine accident reports. The second major type of accident on takeoff is the stall, mush, or spin accident. These accidents result from the pilot's failure to maintain the correct airspeed and climb angle to produce the required lift. Because of the lack of altitude in which to recover from a stall on takeoff, there is a greater likelihood the aircraft will crash.

The principal types of accidents occurring during landings are the short landing, stalling the aircraft (due to lack of airspeed), running out of fuel, failure to clear obstructions in the approach path, and engine failure (often occurring with a change in power setting).

Midair collisions result from the failure of pilots to see and avoid each other and occur most frequently in the airport traffic pattern. These collisions are usually caused by carelessness or preoccupation with terrain and structures in the traffic pattern area. (Accident data also show there is a statistically greater chance of a midair collision at an airport without a control tower.)

Table IV-5 summarizes the types of general aviation accidents and the causes or related factors for these accidents. Weather is the most frequent causal factor in fatal accidents; however, over half of the fatal accidents occur more than a mile from the airport. (Detailed causal factors for near airport accidents as a subset of total accidents has not been determined but would be helpful in understanding these accidents.)

• Military Accidents. The military services employ a wide range of aircraft types including helicopters, general aviation type aircraft, high performance jet fighters, cargo transports, and strategic bombers. Each military airport may perform a variety of military missions which determines the kind of flying that is conducted and the types of aircraft in use. While military aircraft are typically of higher performance than civil aircraft, the types of accidents and causes are not that different from those discussed under air carrier and general aviation flying above.

Table IV-3

Type of Fatal Air Carrier Accidents
(1970 to 1979)

| Type of Accident | Frequency | Percent Of Total |
|---|---|---|
| Collision with ground/water | 16 | 28.1 |
| Collided with wires, trees, towers, etc. | 8 | 14.0 |
| Midair collision | 4 | 7.0 |
| Miscellaneous/other | 4 | 7.0 |
| Stall/spin/spiral/mush | 3 | 5.3 |
| Engine failure/malfunction | 3 | 5.3 |
| Propeller/rotor failure | 2 | 3.5 |
| Propeller/rotor accident to person | 2 | 3.5 |
| Undershoot | 2 | 3.5 |
| Overshoot | 2 | 3.5 |
| Collision between aircraft - one airborne | 2 | 3.5 |
| Fire or explosion in-flight | 2 | 3.5 |
| Airframe failure | 1 | 1.8 |
| Turbulence | 1 | 1.8 |
| Engine tearaway | 1 | 1.8 |
| Gear collapse | 1 | 1.8 |
| Hard landing | 1 | 1.8 |
| Collision between aircraft - both on ground | 1 | 1.8 |
| Missing aircraft - not recovered | 1 | 1.8 |
| TOTAL | 57 | |

Causes and Factors Associated with Air Carrier Accidents
(1970 to 1979)

| Causes/Factors | Percentage of Total Accidents | Percentage of Fatal Accidents* |
|---|---|---|
| Personnel (maintenance, weather, traffic control personnel, etc.) | 50.0 | 48.1 |
| Weather | 46.5 | 46.2 |
| Pilot | 38.6 | 61.5 |
| Landing gear | 10.2 | 7.7 |
| Powerplant | 9.1 | 5.8 |
| Airport/airways/facilities | 8.5 | 5.8 |
| Systems | 6.7 | 7.7 |
| Miscellaneous | 6.4 | 7.7 |
| Airframe | 2.9 | 5.8 |
| Instruments/Equipment | 2.9 | 3.9 |
| Terrain | 1.8 | 0.0 |
| Undetermined | 1.0 | 3.9 |
| Rotorcraft | 0.3 | 1.9 |

Note: The percentage totals exceed 100 percent because multiple causes/factors can be cited in any accident.

Source: Reference 17

Table IV-4

Major General Aviation Accidents (1974-1979)

| Landing or Takeoff | Location | Detailed Phase of Operation | Number of Accidents | % |
|---|---|---|---|---|
| Takeoff | On-Airport | Run | 1,251 | |
| | | Aborted Takeoff | 384 | |
| | Near Airport | Initial Climb | 3,182 | 100% |
| | Other | | 236 | |
| | Total | | 5,053 | |
| Landing | On-Airport | Level Off-Touchdown | 3,909 | |
| | | Roll | 3,336 | |
| | Near Airport | Traffic Pattern-Circling | 542 | 16.7% |
| | | Final Approach - VFR | 1,706 | 52.6 |
| | | Initial Approach | 61 | 1.9 |
| | | Final Approach - IFR | 228 | 7.0 |
| | | Go Around - VFR | 653 | 20.2 |
| | | Missed Approach - IFR | 51 | 1.6 |
| | Near Airport Sub-Total | | 3,241 | 100.0% |
| | Other | | 497 | |
| | Total | | 10,983 | |

Note: Major accidents are accidents in which the aircraft was destroyed or substantially damaged.

Source: Reference 19

Table IV-5

Ten Most Prevalent Types of General Aviation Accidents (1974-1978)
(Percentage of Total Accidents)

| Type of Accident | All Accidents | Fatal Accidents |
|---|---|---|
| Engine Failure or Malfunction | 23.8% | 12.4% |
| Ground/Water Loop-Swerve | 12.2 | -- |
| Hard Landing | 6.5 | -- |
| Stall Mush | 4.4 | -- |
| Stall | -- | 6.5 |
| Stall Spin | -- | 9.9 |
| Collision with Ground/Water Controlled | 4.8 | 13.8 |
| Collision with Ground/ Water Uncontrolled | 3.9 | 16.9 |
| Collided with Trees | 4.1 | 8.5 |
| Overshoot | 4.4 | -- |
| Collided with Wires/Poles | 3.8 | 5.6 |
| Nose Over/Down | 3.3 | -- |
| Airframe Failure in Flight | -- | 6.3 |
| Midair Collisions | -- | 5.1 |
| Missing Aircraft, Not Recovered | -- | 1.8 |

Cause or Related Factor of General Aviation Accidents (1974-1978)
(Percentage)

| Cause or Related Factor | All Accidents | Fatal Accidents |
|---|---|---|
| Pilot | 82.7% | 87.9% |
| Personnel | 10.5 | 11.0 |
| Airframe | 1.1 | 3.0 |
| Landing Gear | 4.2 | .1 |
| Powerplant | 14.4 | 8.0 |
| Systems | 1.4 | 1.4 |
| Instruments/Equipment and Accessories | .6 | .8 |
| Rotorcraft | 1.0 | 1.4 |
| Airport/Airways Facilities | 9.6 | 1.2 |
| Weather | 22.4 | 40.5 |
| Terrain | 27.9 | 21.1 |
| Miscellaneous | 4.0 | 2.9 |
| Undetermined | 2.0 | 7.3 |

Note: The percentage totals exceed 100% because multiple causes/factors can be cited in any accident

Source: Reference 20

Most accidents occur on or near the runway surface (short or hard landings, brake malfunctions and aborted takeoffs) and more accidents occur on landing than on takeoff. Flameout (fuel starvation) of an aircraft engine--which contributed to landing accidents by single engine jet fighters in prior years--has largely been eliminated as a problem for modern fighters. Component and material failures occur more frequently in military aircraft as contributing causes to accidents, but these aircraft are subjected to more stress in their flying environment than civil aircraft. Where high volumes of general aviation and military aircraft use adjacent airspace, the potential for midair collisions is higher due to the possibility of uncontrolled civil aircraft straying into the military area, and the major difficulty of seeing and avoiding such aircraft at high rates of speed.

• Helicopter Accidents. In 1981, the NTSB issued a special report reviewing helicopter accidents between 1977 and 1979 (Reference 21). This report was prepared because of the rapid growth in rotorcraft use and the higher rate of accidents involving rotorcraft when compared with fixed wing general aviation aircraft. The NTSB report concluded that the primary cause of the difference in accident rates between fixed wing and rotorcraft was the higher rate of mechanical failures in rotorcraft accidents (specifically, powerplant and rotor systems). The pilot was cited as the main cause or related factor in 64% of the total accidents (failure to maintain adequate rotor speed, improper use of flight controls, failure to avoid obstacles, etc.) but the rate of pilot involvement was no higher than for fixed wing aircraft. Weather and terrain were cited as a cause or related factor in 13% and 24% of all accidents, respectively. (See Table IV-6)

## Probability of Near Airport Accidents

The most often cited reference on the probability of an accident off the airport, but within one mile of the airport, is the McElroy report (Reference 22).

The data in this report was derived from NTSB accident data for a single year, 1970. This report provides a method to predict the probability of a specified number of accidents in the vicinity of an airport given the airport activity level. The report considers both air carrier and general aviation aircraft together; however, most all of the near airport accidents would be associated with general aviation aircraft. There is some evidence that the relationships developed in this report have been useful in forecasting accident probabilities. In order to develop probability values, it is necessary to determine the airport activity levels--either existing or forecasted--and then use these in the formula below. Once "rt" is known, Figure IV-1 can be used to determine the probability of 0, 1, 2, etc. accidents occurring in one year in the vicinity of an airport.

The formula given in the McElroy report is:

rt = (1.38) x (Annual Operations in Millions)

where,

r = near airport accident rate (1.38 accidents within one mile of an airport per million operations - based on 1970 accident data)

t = number of operations (takeoffs and landings) in a year in millions

Table IV-6
Summary of Rotorcraft Accidents
(1977 - 1979)

Type of Accident
(Percentage)

| Type | All Accidents | Fatal Accidents |
|---|---|---|
| Hard Landing | 9.0 | .0 |
| Rollover | 6.0 | 1.6 |
| Collision Between Aircraft | .4 | 1.6 |
| Collison with Ground/Water | 16.2 | 28.6 |
| Collision with Obstacles (wires, poles, trees) | 17.8* | 12.8 |
| Airframe Failure | 4.5 | 14.4 |
| Engine Failure/Malfunctions | 28.8 | 14.4 |
| Rotor Failure | 11.0 | 14.4 |
| Other | 6.3 | 12.0 |
| TOTAL | 100.0% | 100.0% |

Cause of Accidents
(Percentage)

| Cause/Factor | All Accidents | Fatal Accidents |
|---|---|---|
| Pilot | 64.5% | 59.7% |
| Personnel | 13.5 | 16.1 |
| Airframe | .3 | 1.6 |
| Landing Gear | .5 | .0 |
| Powerplant | 21.2 | 8.1 |
| Systems | .3 | .0 |
| Instruments/Equipment | .7 | .0 |
| Rotorcraft | 14.7 | 24.2 |
| Airport/Airway Facilities | .3 | .0 |
| Weather | 13.1 | 17.7 |
| Terrain | 24.3 | 13.7 |
| Miscellaneous | 5.9 | 7.3 |
| Undetermined | 3.9 | 12.9 |

Note: The percentage totals exceed 100% because multiple causes/factors can be cited in any accident.

*A high percentage of these collisions were associated with aerial applications

Source: Reference 21

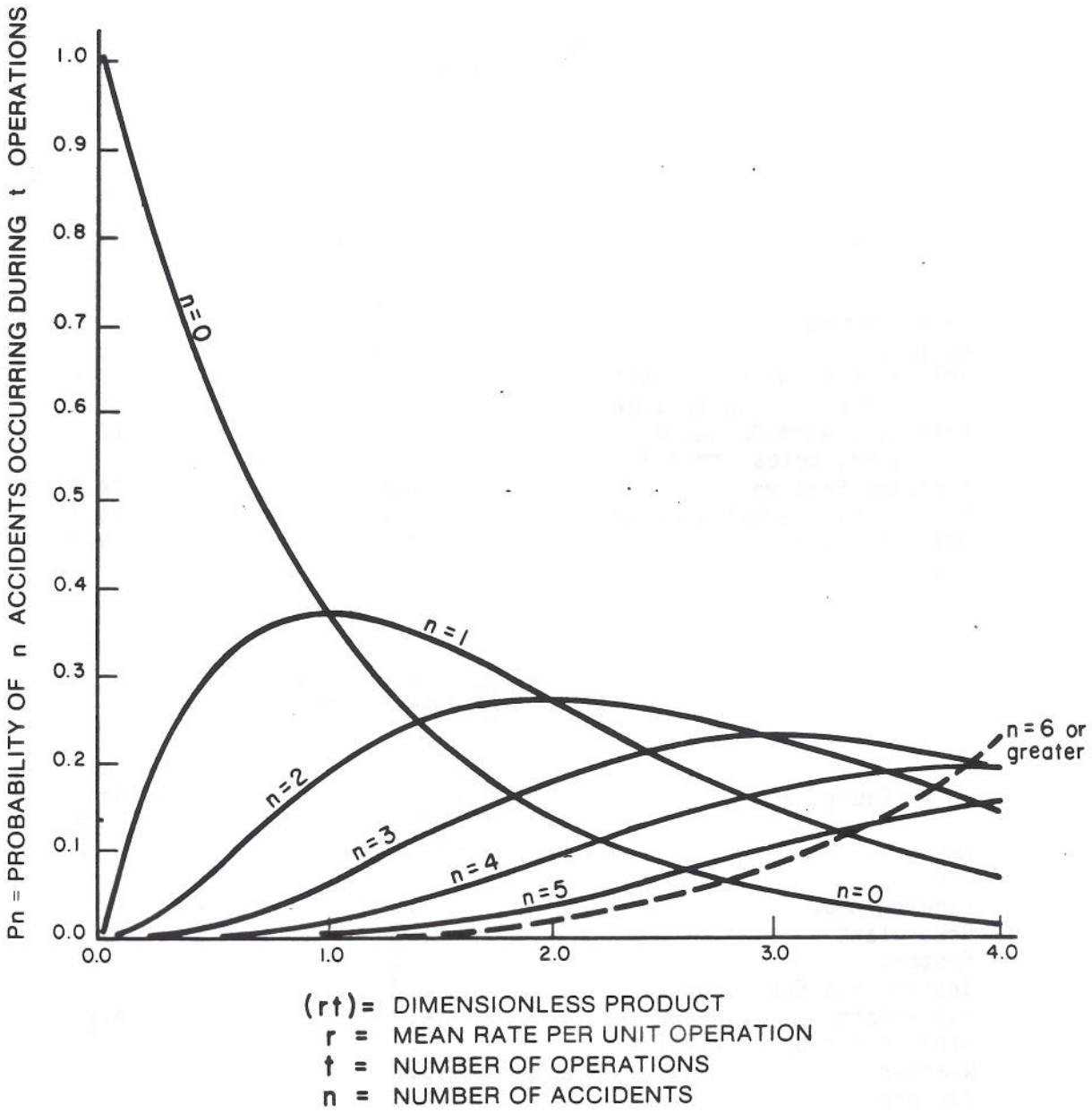



**Figure IV - 1**

**NEAR AIRPORT ACCIDENT PROBABILITY CURVES**

**Reference 22**

Example
A general aviation airport has 250,000 annual operations. What is the probability of 0, 1, 2, and 6 accidents occurring in a year?

$$rt = 1.38 \times \frac{250{,}000}{1{,}000{,}000} = .345$$

From Figure IV-1, the probability of

| | | |
|---|---|---|
| no accidents | = | 70% |
| 1 accident | = | 24% |
| 2 accidents | = | 4% |
| 6 accidents | = | negligible |

Over a five year period the probability of having no accidents would drop to less than 20% (assuming the same annual level of activity as above) and over a ten year period this same probability would be less than 5%.

## Location of Accidents

The most important concern for ALUCs is knowing where accidents occur around airports and the relative likelihood of occurrence at given distances from an airport.

• Air Carrier Airports. Data on the location of accidents associated with air carrier airports is presented in Table IV-7. This data shows that for the period 1974 to 1982 the largest number of fatal air carrier accidents (accidents in which there was a fatality, but not necessarily fatal to all occupants) occurred on the airport property (10) while an equal number of accidents occurred 0-1 mile (7) and 1-5 miles (7) from the airport boundary. Fatal accidents on the airport were usually the result of overrunning the end of the runway on landing or an aborted takeoff.

• General Aviation Airports. Table IV-8 shows that 45% of the recorded general aviation accidents occurred on the airport property, 15% were in the traffic pattern or within one mile from the airport boundary, and 35% were beyond one mile from the airport boundary. (Accidents off the airport are more serious than accidents on the airport as can be seen by the relative percentage of "fatal" and "serious" accidents on and off the airport.) Considering the near airport accidents only (accidents within one mile of the airport), 33% of these accidents occurred within 1/4 mile of the airport and 29% occurred in the traffic pattern. This data suggests that land use under the airport traffic pattern is a significant safety concern and should also be reviewed in ALUC plans along with land uses off the immediate ends of the runways. Table IV-8 also shows that near the airport the greatest likelihood of a midair collision is in the airport traffic pattern.

• Heliports. Helicopter accident locations are shown in Table IV-9 and these data indicate that a smaller percentage of helicopter accidents occur near the airport compared to fixed wing general aviation aircraft (6.5% versus 14.6%).

While these data show the general location of accidents, it is not possible to predict the probability of a crash in a specific area around an airport. The distribution of accident locations varies widely from airport to airport, as illustrated in Appendix F.

Table IV-7

Location Of Fatal U.S. Air Carrier Accidents (1974-1982)

(Includes Takeoff, Landing and Inflight Phases of Operation)

| Location | Number |
|---|---|
| On Airport | 10 |
| Near Airport | |
| - Within 1/4 mile | 1 |
| - Within 1/2 mile | -- |
| - Within 3/4 mile | 1 |
| - Within 1 mile | 5 |
| Near Airport Subtotal | 7 |
| Within 2 miles | 1 |
| Within 3 miles | 2 |
| Within 4 miles | 2 |
| Within 5 miles | 2 |
| Greater than 5 miles | 5 |
| Unknown | 3 |
| Total | 39 |

Note: "On Airport" means on airport property. Distance from the airport is the distance from the airport boundary. Table excludes helicopter accidents and accidents due to sabotage.

Source: Reference 18

Table IV-8

Location Of General Aviation Accidents (1974 - 1979)

(Percentage of Accidents)

| Location | Accidents | | Serious & Fatal Accidents | | Collisions Between Aircraft | |
|---|---|---|---|---|---|---|
| | All Accidents | Near Airport Accidents | All Accidents | Near Airport Accidents | All Accidents | Near Airport Accidents |
| On Airport | 44.8% | -- | 16.6% | -- | 54.5% | -- |
| Near Airport | | | | | | |
| -In Traffic Pattern | 4.2 | 28.6% | 5.8 | 26.4 | 7.8 | 56.9% |
| -Within 1/4 mile | 4.9 | 33.8 | 7.2 | 32.7 | 1.9 | 13.6 |
| -Within 1/2 mile | 2.7 | 18.3 | 4.4 | 19.9 | 2.2 | 15.9 |
| -Within 3/4 mile | .7 | 4.5 | 1.3 | 6.1 | .9 | 6.8 |
| -Within 1 mile | 2.1 | 14.8 | 3.3 | 14.9 | .9 | 6.8 |
| Near Airport Subtotal | 14.6% | 100.0% | 22.0% | 100.0% | 13.7 | 100.0% |
| Within 2 miles | 2.8 | -- | 4.9 | -- | 3.1 | -- |
| Greater than 2 miles | 32.2 | -- | 50.4 | -- | 26.2 | -- |
| Unknown | 5.6 | -- | 6.1 | -- | 2.5 | -- |
| Total | 100.0% | | 100.0% | | 100.0% | |

Note: The NTSB defines an accident as occurrences incident to flight in which, "as a result of the operation of an aircraft, any person (occupant or nonoccupant) receives fatal or serious injury or any aircraft receives substantial damage." Substantial damage means damage or structural failure which adversely affects the structural strength, performance, or flight characteristics of the aircraft, and which would normally require major repair or replacement of the affected component. Accident reports are filed for all accidents, both on and off airports. Also see note on Table IV-7.

Source: Reference 19

Table IV-9

Location of Helicopter Accidents (1977 - 1979)

(Percentage)

| Location | Serious and Fatal Accidents | Total Accidents |
|---|---|---|
| On Airport/Heliport | 15.5% | 19.8% |
| Near Airport | | |
| -In Traffic Pattern | 2.2 | 1.2 |
| -Within 1/4 mile | 1.3 | 1.8 |
| -Within 1/2 mile | 2.6 | 1.7 |
| -Within 1 mile | 4.0 | 1.8 |
| Near Airport Subtotal | 10.1% | 6.5% |
| Within 2 miles | 2.7 | 2.8 |
| Within 5 miles | 7.1 | 4.5 |
| Beyond 5 miles | 54.0 | 52.4 |
| Other | 10.6 | 14.0 |
| Total | 100.0% | 100.0% |

Note: "On Airport" means on airport/heliport property. Distance from the airport is the distance from the airport/heliport boundary.

Source: Reference 21

• Military Airports. In 1973 and 1974 the Air Force Strategic Air Command and the Naval Facilities Engineering Command conducted an analysis of aircraft crash records at military airbases (Department of Defense - unpublished study "Tri-Service Accident Potential Guidelines," 1974). This study included 370 Air Force accidents within 10 nautical miles of airbase runways and 320 Navy accidents within 5 nautical miles of these runways. A recent update of the earlier Department of Defense study (Reference 23) shows that crashes around military airports are distributed as follows:

| Location | Percentage of Accidents |
|---|---|
| - On the runway | 36 |
| - To the side of the runway (± 750') | 20 |
| - Clear Zone (0-3,000') | 12 |
| - APZ I* (3,000' to 8,000') | 7 |
| - APZ II* (8,000' to 15,000') | 3 |

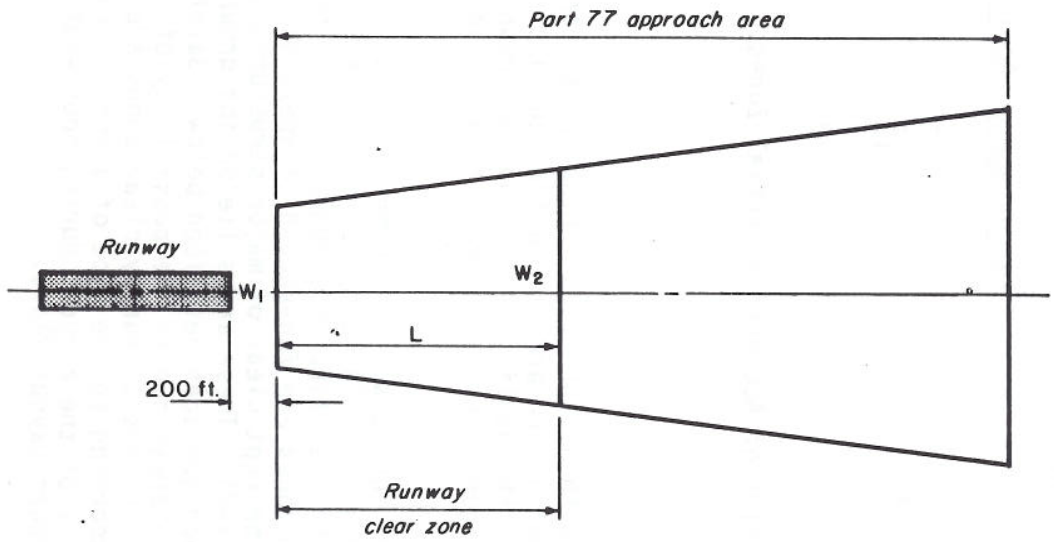
*See discussion further on for description of Accident Potential Zones.

## Size and Configuration of Airport Safety Zones

ALUCs have employed several different methods for establishing safety zones around airport runways. These zones define the areas in which land use restrictions are established to protect the public's safety on the ground. A brief description of the size and configuration of different types of safety zones is given below:

• FAA Clear Zones and Part 77 Imaginary Surfaces. One common approach to delineating airport safety zones is to use the FAA clear zone and imaginary approach surfaces that extend outward from an airport's runways along the extended runway centerline. FAA clear zones are fan-shaped (trapezoidal) areas nearest to the runway that must be kept clear of major structures or concentrations of people (See Figure IV-2). These areas lie on the ground underneath the imaginary runway approach surfaces described below. Safety concerns are greatest in the clear zone areas due to the possibility of crashes on takeoff or landing. The dimensions of runway clear zones are shown on the Airport Layout Plan and vary according to the type of aircraft that use the airport and the operating capability of the airport during poor weather (See Chapter VII for discussion of Airport Layout Plan).

Federal Aviation Regulations Part 77-Objects Affecting Navigable Airspace-establishes various imaginary surfaces, including approach surfaces, for determining when the height of natural growth, objects, or structures may present a safety problem for aircraft using an airport (Reference 24). These surfaces slope upward from the runway at various angles--depending on the type of aircraft using the airport and airport weather capability. The projection of these fan-shaped upward sloping surfaces on the ground has been used to define airport safety zones around airports. Since the dimensions of these approach surfaces depend on the type of approach to a runway, the size of the safety zones can vary from runway end to runway end. Table IV-10 defines the dimensions of the FAA clear zones and imaginary approach surfaces and Figure IV-3 illustrates their use at a general aviation airport.




| CATEGORY * | W1 | W2 | L |
|---|---|---|---|
| 1. Precision instrument | 1,000 | 1,750 | 2,500 |
| 2. Nonprecision instrument for larger than utility with visibility minimums as low as ¾ mi | 1,000 | 1,510 | 1,700 |
| 3. Nonprecision instrument for larger than utility with visibility minimums greater than ¾ mi | 1,000 | 1,425 | 1,700 |
| 4. Visual approach for larger than utility | 1,000 | 1,100 | 1,000 |
| 5. Nonprecision approach for utility | 500 | 800 | 1,000 |
| 6. Visual approach utility | 250 | 450 | 1,000 |

SOURCE: Federal Aviation Administration

**Figure IV - 2**

**RUNW' CLEAR ZONES**

Table IV-10*
Clear Zone and Part 77 Approach Surface Dimensions
(Dimensions in feet)

| Type of Approach | Clear Zone Inner Width | Clear Zone Outer Width | Clear Zone Length | Slope of Part 77 Approach Surface | Part 77 Approach Surface Inner Width | Part 77 Approach Surface Outer Width | Part 77 Approach Surface Length |
|---|---|---|---|---|---|---|---|
| Visual - A | 250 | 450 | 1,000 | 20:1 | 250 | 1,250 | 5,000 |
| Visual - B | 1,000 | 1,100 | 1,000 | 20:1 | 500 | 1,500 | 5,000 |
| Nonprecision A | 500 | 800 | 1,000 | 20:1 | 500 | 2,000 | 5,000 |
| Nonprecision B1 | 1,000 | 1,425 | 1,700 | 34:1 | 500 | 3,500 | 10,000 |
| Nonprecision B2 | 1,000 | 1,510 | 1,700 | 34:1 | 1,000 | 4,000 | 10,000 |
| Precision | 1,000 | 1,750 | 2,500 | 50:1/40:1 | 1,000 | 16,000 | 10,000 @ 50:1<br>40,000 @ 40:1 |

Legend: A - utility runways; B larger than utility
1 - visibility minimum greater than 3/4 mile; 2-visibility minimum less then 3/4 mile

Definitions

Visual Runway - runway intended solely for operation of aircraft using visual approach procedures
Utility Runway - runway constructed for and intended to be used by propeller-driven aircraft weighing 12,500 lbs or less
Nonprecision Instrument Runway - a runway having instrument approach equipment that provides horizontal course guidance or area type navigation to touchdown
Precision Instrument Runway - a runway having an existing approach procedure utilizing an Instrument Landing System (ILS) that provides horizontal and vertical course guidance to touchdown
Slope - horizontal run in feet: vertical rise in feet (e.g., 20:1)

*From Appendix 6 - Runway Clear Zone Dimensions
FAA Advisory Circular - A.C. 150/5300-4B

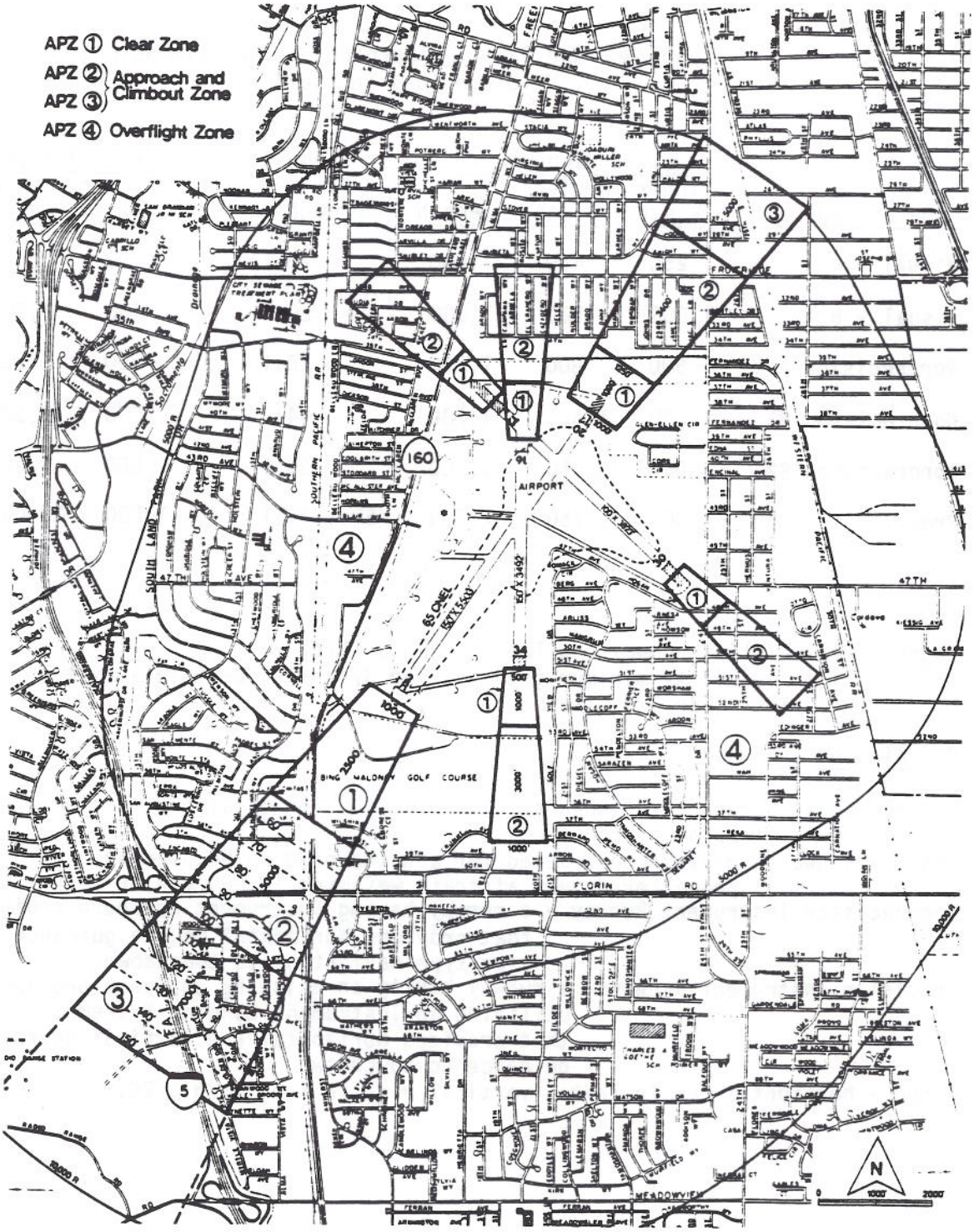



Figure IV - 3

**AIRPORT SAFETY ZONES USING FAA CLEAR ZONES AND IMAGINARY APPROACH SURFACES**
**Sacramento Executive Airport**

Reference 25

• Rectangular Safety Zones. Several ALUCs have adopted rectangular shaped safety zones, often involving inner and outer zones. When inner and outer zones are specified, the length of the inner zone is usually equal to 1/4 mile (based on the accident data discussed earlier) or the length of the clear zone, whichever is longer. The total length of the safety zone typically varies between 2,000 and 5,000 feet, depending on the type of aircraft using the airport. The rationale for the length of these safety zones is provided in a report commissioned by the Santa Clara County ALUC (Reference 26) where it is assumed that engine failure occurs at the point an aircraft crosses the runway end. The distance to glide, touchdown, and roll to a stop determines the length of the safety zone. Calculations indicate that this distance is roughly equal to the accelerate-stop distance (i.e., the distance required for an aircraft to accelerate to lift off speed then brake to a full stop) for various types of aircraft. The required lengths of the safety zones derived in this fashion are shown below (also see Figure IV-4):

- single engine propeller-driven general aviation aircraft: 2,000 feet
- Twin engine propeller-driven general aviation aircraft: 3,500 feet
- Business jet aircraft: 5,000 feet

With respect to the width of the safety zones, it can be assumed that aircraft will depart from the normal flight path in an accident situation. This could occur as a result of the pilot's own action or the complete loss of control of the aircraft, such as in a stall or spin. The recommended width for the safety area in the Santa Clara ALUC report is 1,500 feet, or 750 feet on each side of the runway. Where there are parallel runways, this width should be increased by the distance between the runways. Some ALUCs have modified their safety zones to conform to the actual aircraft departure paths where a high percentage of departures are not straight-out (e.g., a noise abatement route or departure heading given by the FAA tower for air traffic control purposes). ALUCs should consider "bending" the safety areas if there are curved departure routes from an airport (See Figure IV-5).

The length of safety areas for airports serving large commercial jets must be evaluated in a different manner. Table IV-7 indicates that for the period from 1974 to 1982 the number of fatal air crashes within one (1) mile of the airport boundary and 1 to 5 miles from the airport boundary is the same; however, it would be impractical for ALUCs to establish safety zones over the entire 5 mile distance for takeoffs and landings. The history of large jet crashes suggests that 5,000 feet is an appropriate distance in which to establish safety zones. Table IV-11 indicates actual distances from the runway associated with selected air carrier accidents on landing and takeoff.

• Military Accident Potential Zones (APZs). Department of Defense studies of historical accident data resulted in the establishment of Accident Potential Zones (APZs) for military airports. These zones designate areas of higher likelihood of accidents and are employed in all AICUZ studies. Dimensions of these zones vary according to the category of aircraft using the airport and can be summarized as follows for Category B type aircraft (heavier aircraft). These zones are shown in Figure IV-6.

- Clear Zone: Clear Zones lie immediately beyond the end of the runway and extend outward along the extended runway centerline for a distance of 3,000 feet. The inside dimension of the fan-shaped Clear Zone is 1,500 feet and the outside dimension is 2,284 feet. A Clear Zone is applied to each active runway.

**Figure IV - 4**

**RECTANGULAR AIRPORT SAFETY ZONES**
**Proposed Fremont Airport**



**Reference 27**

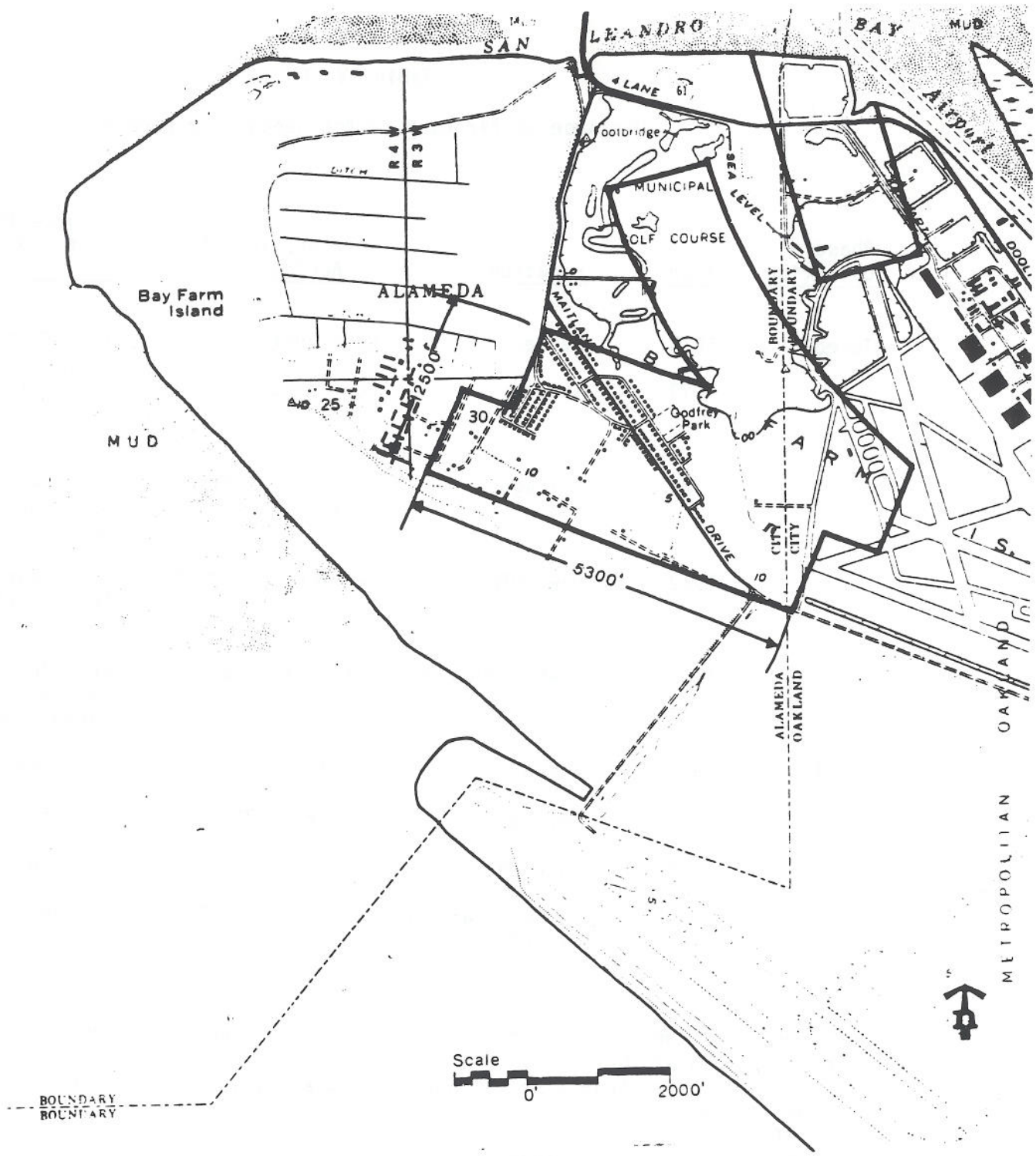



**Figure IV - 5**

**RECTANGULAR SAFETY ZONES FOLLOWING DEPARTURE FLIGHT TRACKS**
**Oakland Airport North Field**

**Reference 28**

Table IV-11

Distance of Air Carrier Accidents from Airport

| Phase of Operation | Year | Location | Carrier/Type of Accident | Distance from Takeoff or Landing End of Runway |
|---|---|---|---|---|
| Takeoff | 1975 | Denver | Continental B-727 | 1600 feet [1] |
| | 1977 | Tucson | Continental B-727 | 710 feet and 130 fee left of runway centerline [2] |
| | 1979 | Chicago | American Airlines DC-10 | 4700 feet and 600 feet from the runway centerline |
| | 1982 | New Orleans | Pan American B-727 | 4610 feet and 400 feet to the left of the runway centerline [3] |
| | 1982 | Washington, DC | Air Florida B-737 | 4625 feet and 625 feet left of the runway centerline |
| Landing | 1974 | Samoa | Pan American B-707 | 3865 feet |
| | 1975 | New York | Eastern B-727 | 1100 feet [4] |
| | 1975 | Raleigh, NC | Eastern B-727 | 282 feet |
| | 1980 | Western Caroline Islands | Continental B-727 | 13 feet |

1. Encountered wind shear - initially hit ground 387 feet to south of departure end of the runway
2. Encountered wind shear - struck power lines and utility poles and returned for safe landing at airport
3. End of impact swath
4. Initially hit approach light 2400 feet from runway

Source: Reference 29

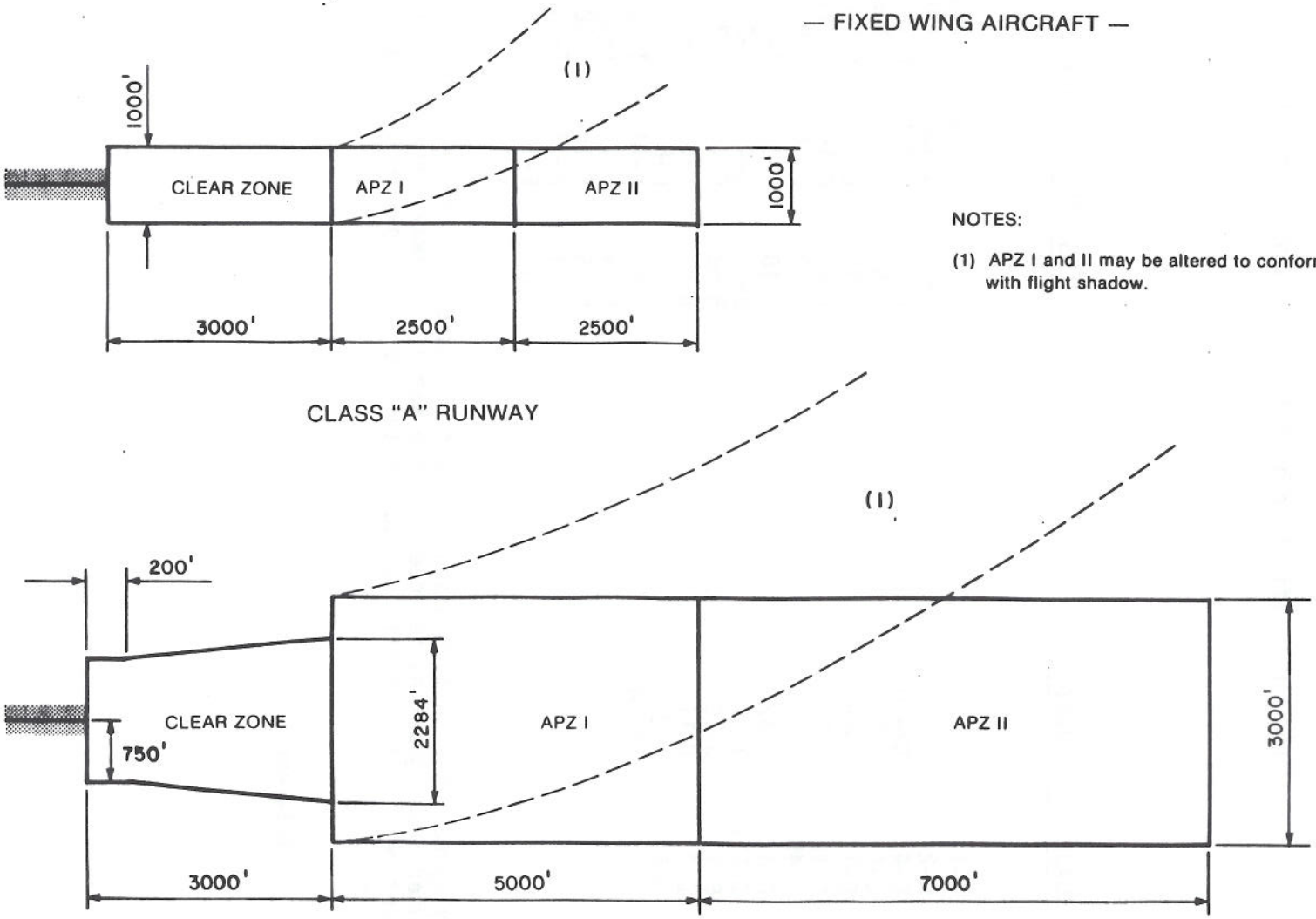



**Figure IV - 6**

**MILITARY ACCIDENT POTENTIAL ZONES**
**Category A & B Aircraft**

Table IV-12

Runway Classification by Military Aircraft Type [1]

| CLASS "A" RUNWAYS | | CLASS "B" RUNWAYS | | |
|---|---|---|---|---|
| C-1 | O-2 | A-3 | C-123 | F-100 |
| C-2 | OV-1 | A-4 | C-130 | F-101 |
| C-4 | OV-10 | A-5 | C-131 | F-104 |
| C-6 | S-2 | A-6 | C-135 | F-105 |
| C-7 | F-28 | A-7 | C-137 | F-106 |
| C-12 | T-34 | A-8 | C-140 | F-111 |
| C-45 | T-41 | A-10 | C-141 | P-2 |
| C-47 | T-42 | A-18 | E-3 | P-3 |
| C-117 | T-44 | B-1 | E-4 | S-3 |
| E-1 | U-10 | B-52 | F-4 | R-71 |
| E-2 | U-11 | B-57 | F-5 | T-2 |
| O-1 | U-21 | C-2 | F-8 | T-29 |
| | UV-18 | C-9 | F-14 | T-33 |
| | | C-14 | F-15 | T-37 |
| | | C-15 | F-16 | T-38 |
| | | C-118 | F-17 | T-39 |
| | | C-121 | F-18 | U-2 |

[1] Only symbols for basic mission aircraft or basic mission aircraft plus type are used. Designations represent entire series. Runway classes in this table are not related to aircraft approach categories or to pavement design classes or types.

Source: Reference 30

- Accident Potential Zone I: APZ I is the rectangular area beyond the Clear Zone which possesses a significant potential for accidents. Typically, the zone is 3,000 feet wide by 5,000 feet long, and is curved to conform to the shape of the flight paths. Military aircraft accidents occur more frequently on approach than on departure. Therefore, APZ I is used for approach flight paths when the operational levels warrant, and application of APZ I on departure paths is used when supporting rationale is provided. For Navy facilities this zone is normally provided under flight paths which experience 5,000 or more annual operations; however, this figure is only a general guideline (Reference 30).

- Accident Potential Zone II: APZ II is the area beyond APZ I having a measurable potential for accidents. APZ II is normally provided under a flight path whenever APZ I is required. Dimensions of these zones are usually 3,000 feet wide by 7,000 feet long. If APZ I is not warranted, then APZ II is not normally used unless an analysis of accidents and operations indicates the need for APZ II. APZ II may be modified to represent the actual curve of a flight path. When APZ II is warranted, it shall be applied to approach paths, and may be applied to departure paths when supporting rationale is provided.

Land Use Restrictions in Safety Zones

The purpose for establishing land use restrictions in safety zones is to minimize the number of people exposed to aircraft crash hazards. The two principal methods for reducing the risk of injury and property damage on the ground are: 1) limit the number of persons in an area and 2) limit the area covered by structures occupied by people so that there is a higher chance of aircraft landing (in a controlled situation) or crashing (in an uncontrolled situation) on vacant land. Unlike airport noise impact areas, where structural sound insulation can be used to reduce excessive exterior noise, there are few practical methods available for permitting increased population in safety zones without increasing safety risks; that is to say each additional person in a safety zone becomes subject to a certain crash hazard risk by virtue of being located in the safety zone.

While the chance of an aircraft injuring someone on the ground is historically quite low, planners must remember that an aircraft crash is a high consequence event. This is why a number of safety studies do not attempt to estimate accident probabilities in specific areas, but rather address the acceptability of different land use densities and lot coverage restrictions assuming a crash did occur. AICUZ studies, for instance, have adopted this approach. The crash impact area on the ground resulting from an accident depends on the size of the aircraft. The impact energy of a B-727 is approximately 570 times greater than that of a Cessna 150 and the fuel load is about 270 times greater (Reference 22). Thus the physics of a crash suggests that land use restrictions should reflect the type of aircraft using an airport, since a crash of a large commercial airliner would have substantially greater damage potential than that of a small single engine general aviation aircraft. Table IV-13 summarizes the most frequent types of ALUC land use restrictions in airport safety zones. The safety zones have been divided into the following categories for ease in tabulation:

Table IV-13

Examples Of Land Use Guidelines For Safety Zones
(Source: Various ALUC Plans)

| SAFETY AREA | DENSITY | COVERAGE | LAND USE |
|---|---|---|---|
| o Clear Zone<br>o Inner Rectangular Safety Area | No people<br>No more than 10 persons per acre<br>- "at any one time"<br>- "on a regular basis"<br>- "over long periods"<br>No more than 25 persons per acre at any time | No structures | No residential<br>No petroleum or explosives<br>No above grade power lines |
| o Part 77 Approach Surface<br>o Outer Rectangular Safety Area<br>o APZ I | No more than 10 people "on an annual average" " per acre"<br>No more than 25 persons "per acre"<br>- "at any time"<br>- "over long periods"<br>- "over 24 hours"<br>No more than 50 persons per acre<br>- "for 2 hours"<br>- "at any time"<br>Residential: no more than<br>- 1 du per 5 acres<br>- 1 du per acre<br>- 1 du per 3 acres<br>- 2 s.f. du per acre<br>- 2 du per 3 acres<br>- 4 du per gross acre<br>- 2 1/2 acre lots, minimum<br>No more than 100-150 people in a single building (AICUZ) | Maximum structural coverage must be less than:<br>- 20%<br>- 25%<br>- 30%<br>- 50% (AICUZ) | Low density residential<br>No multi-family<br>No hotels or motels<br>No restaurants or bars<br>No schools, hospitals or government services<br>No concert halls or auditoriums<br>No industries involved in flammable materials or processes<br>Commercial and industrial generally OK if density and lot coverage restrictions applied |
| o Outer Part 77 Approach Surface<br>o APZ II | No more than 50 persons over long periods<br>No more than 4 du per acre<br>No more than 200-300 people in a single building (AICUZ)* | Maximum structural coverage must be less than:<br>- 30%<br>- 50%<br>- 75% (AICUZ) | Generally same as above. |
| o Overflight Zone<br>o Traffic Pattern | No more than 3 du per acre (under Traffic Pattern) | Maximum structural coverage must be less than<br>- 20% (Traffic Pattern) | No schools, sports arenas, auditoriums, or outdoor amphitheaters<br>No industries involved with flammable materials or processes |

Legend

du-dwelling unit(s)

*most recent guidelines do not specify numbers of persons per building; however, intent is to avoid large concentrations of persons in a single structure

1) Clear Zones (including inner rectangular safety area)

2) Approach Surface (including outer rectangular safety area and APZ I)

3) Outer Approach Surface (outer approach surface refers to ALUC plans that divide FAA imaginary approach surfaces into more than two safety areas; also includes APZ II)

4) Overflight (includes traffic pattern area and area overflown by aircraft arriving and departing an airport; this area applies primarily to general aviation airports and is usually defined by the FAA Part 77 horizontal surface--see discussion of civil airport imaginary surfaces in Chapter V)

The review of use restrictions in safety zones indicates there is a diverse array of standards for land use densities and lot coverage ratios, and some of the original rationale for these restrictions has been lost over time. The information shown in Table IV-13 can be paraphrased as follows. (Parts of this description are excerpted from Reference 31.)

- Clear Zones. Clear zones should be kept essentially clear. Undeveloped land is the best use. Agriculture which does not attract birds is compatible unless it includes structures. Park and recreational uses are satisfactory if they don't attract large groups of people. Transportation facilities are not a serious problem as long as height restrictions are heeded. Power lines are a serious danger. Most other uses should be excluded. Wherever possible, the clear zone should be free of any construction or obstacle and should be minimally used by people.

- Approach Safety Zone. To assure public safety, uses in the approach safety zone should not attract large groups of people. Most residential uses should be prohibited if possible. Where residential development is inevitable or already in place, low density is preferred with retirement homes or other residential institutions being excluded. While manufacturing is generally quite compatible, such uses should be considered "conditional" and watched for potential operations hazards, electrical interference, high intensity lighting, bird attractions, smoke, glare, or other interferences. Transportation is generally compatible as are communications (except radio and television transmission), and utilities (except petroleum storage, electric power plants and lines, and solid waste disposal). Commercial uses are generally compatible though retail establishments such as restaurants or concentrated retail areas which attract people should be avoided. Offices and services are compatible except hospitals and rest homes. Most recreational uses are conditionally acceptable excluding public assembly and other high intensity uses. Resource production, including agriculture and undeveloped land is generally compatible (aggregate extraction if it will result in ponding and other uses posing a bird strike hazard should be excluded). Landfill is not compatible if it would attract birds.

- Overflight Zone. Land use compatibility within the overflight zone for general aviation airports is not as easily defined. These larger areas, encompassing about 4 to 20 square miles, are often heavily urbanized and the hazard to any site within these areas is quite low compared to the areas nearest the runway. However, data in Table IV-8 shows a measurable

accident potential in the airport traffic pattern area. Also midair collisions are more prevalent in this area. Land use compatibility judgments must be based on specific airport operational procedures. Several ALUCs suggest that large assemblages of people not be located beneath the airport traffic pattern because of the potential for injury if there were a crash. Specific types of land uses that have been suggested for relocation outside the airport traffic pattern are:

-schools and hospitals
-spectator sports arenas
-auditoriums
-outdoor amphitheaters

## Suggested Guidelines for Safety Zones

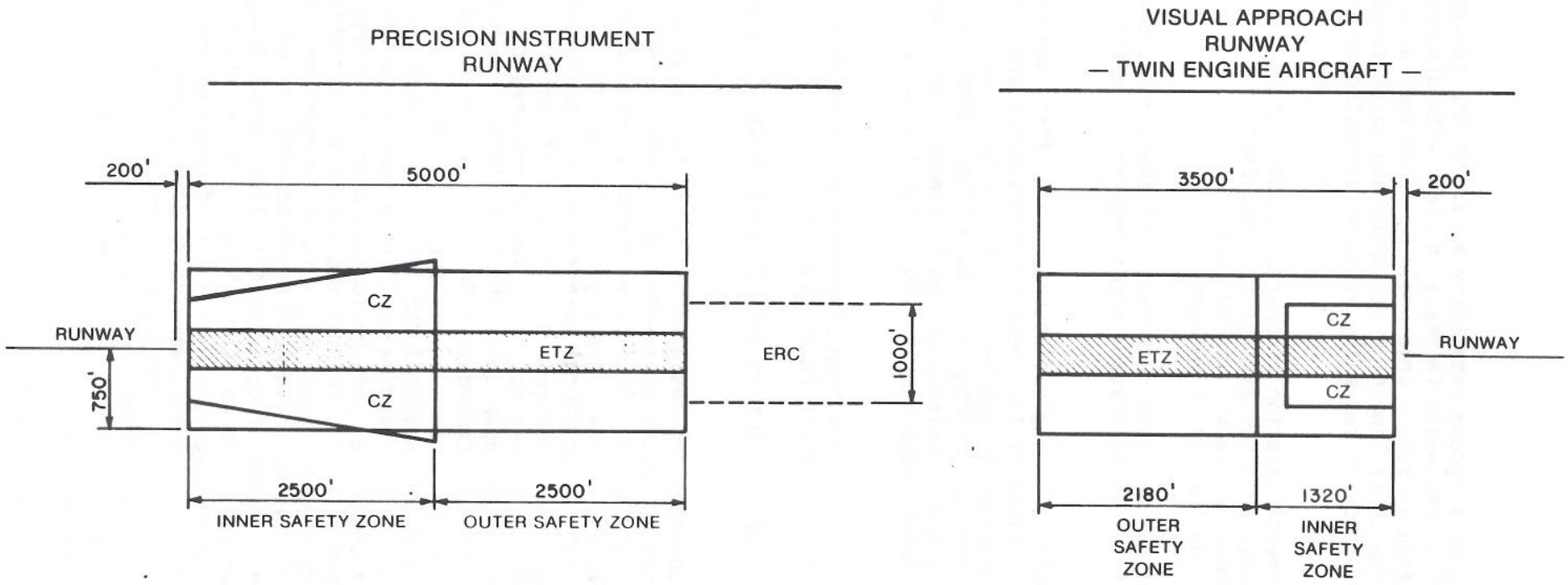
The following guidelines are suggested for safety zones and the rationale for these suggestions is briefly discussed. The probability of an accident will generally increase with increased activity, hence the risk level is not a static value. The density of uses permitted within airport safety zones is an expression of local policy regarding the level of risk each jurisdiction feels is appropriate in response to airport operational conditions.

Suggested safety zones have been divided into five (5) different types for civilian airports as shown below and illustrated in Figure IV-7. For military airports the standard Accident Potential Zones should be used.

- Inner Safety Zone/Clear Zone
- Outer Safety Zone
- Emergency Touchdown Area
- Traffic Pattern/Overflight Zone.
- Extended Runway Centerline (Precision and nonprecision runways only)

• Inner Safety Zone/Clear Zone. The recommendations for clear zones are consistent with most all ALUC plans, i.e., few people (no people is preferred) and no structures in the clear zone. If persons are to be permitted, then the lowest density is preferable--10 persons per acre at any one time. If a rectangular safety zone is used, it would overlap the clear zone and the length would be 1/4 mile or the length of the clear zone, whichever is longer. The width of the inner rectangular safety zone would be 1,500 feet plus any additional distance between parallel runways. For some air carrier airports early turn procedures have been established by the FAA and result in sharp turns before an aircraft reaches the end of the runway. A secondary clear zone is recommended, and this clear zone should be aligned with the normal departure route at the point the departure path crosses the edge of runway (the secondary clear zone should be either 1,700 feet or 2,500 feet in length depending on how frequently the departure is used). Adoption of secondary clear zones will protect the areas overflown by all departures. Likewise if a significant number of general aviation aircraft perform a departure turn that is prescribed for noise abatement or air traffic purposes, the inner rectangular safety zone should be aligned with this departure path.

• Outer Safety Zone. The outer safety zone is the portion of the safety zone beyond the inner safety zone/clear zone. The zone would consist of either the




LEGEND:

CZ = CLEAR ZONE
ETZ = EMERGENCY TOUCHDOWN ZONE
ERC = EXTENDED RUNWAY CENTERLINE

**Figure IV - 7**

**SUGGESTED AIRPORT SAFETY ZONES OFF RUNWAY ENDS**

Part 77 approach surface, or a second retangular area. If the fan-shaped FAA approach area is used, this area would increase in width with distance from the runway, while a rectangular safety area would be 1,500 feet wide throughout its length. The total length of the inner and outer safety zones would reflect the type of aircraft currently using or projected to use the airport as follows:

- single engine general aviation aircraft: 2,000 feet
- twin engine general aviation aircraft: 3,500 feet
- business and commercial jets*: 5,000 feet
  *also all precision instrument runways

For the primary departure runway it is suggested that these zones conform to the major flight tracks in order to protect areas regularly overflown by departing aircraft.

Residential land use should be strongly discouraged and other land uses restricted as indicated in Table IV-13. Density restrictions are needed to ensure that large concentrations of people are not located in the outer airport safety zones. A standard method for determining concentrations of people in safety zones has been developed by the Sacramento County ALUC and is included in Appendix G. Recommended density limits for the outer safety zone are as follows:

- uses in structures: no more than 25 persons per acre at any one time; no more than 150 people in any one building

- uses not in structures: no more than 50 persons per acre at any one time.

Recommendations for lot coverage are designed to insure that a disabled aircraft--either controlled or uncontrolled--has sufficient opportunity to miss inhabited areas and structures. To determine what a reasonable lot coverage restriction would be, a first step might be to lay out the safety areas and estimate the existing structural coverage within the defined safety zones (for instance using aerial photographs). If most of the area is open space, the coverage requirements need not be as severe compared to an area that is heavily developed. Also, open areas should be large enough and properly shaped and oriented to accommodate a forced, but controlled landing. There have been no studies using this specific approach, however, it would not be unreasonable to try and maintain 50% of the total safety zone area in open space. Parking areas and streets could be considered open space for such a calculation. Since large commercial jets would have a greater crash impact than small propeller driven aircraft, density and coverage restrictions would need to be more stringent; however, again there is no apparent precedent for such an approach. Conceptually it would not be unreasonable to consider that 75% of the safety area be retained in open space to limit crash damage and injury for large jet operations. As an alternative to the approach discussed above, fall-back values can be suggested in the way of coverage requirements. Several ALUC plans have recommended that maximum structural coverage be limited to 20-25% for new commercial development in the outer safety zones. The results of field surveys on commercial lot coverage performed by the Sacramento ALUC are contained in Appendix H and indicate that these lot coverage limitations are reasonable.

• Emergency Touchdown Areas. Recommendations in one airport vicinity area plan (Reference 32) call for a clear area in line with the runway that is 500

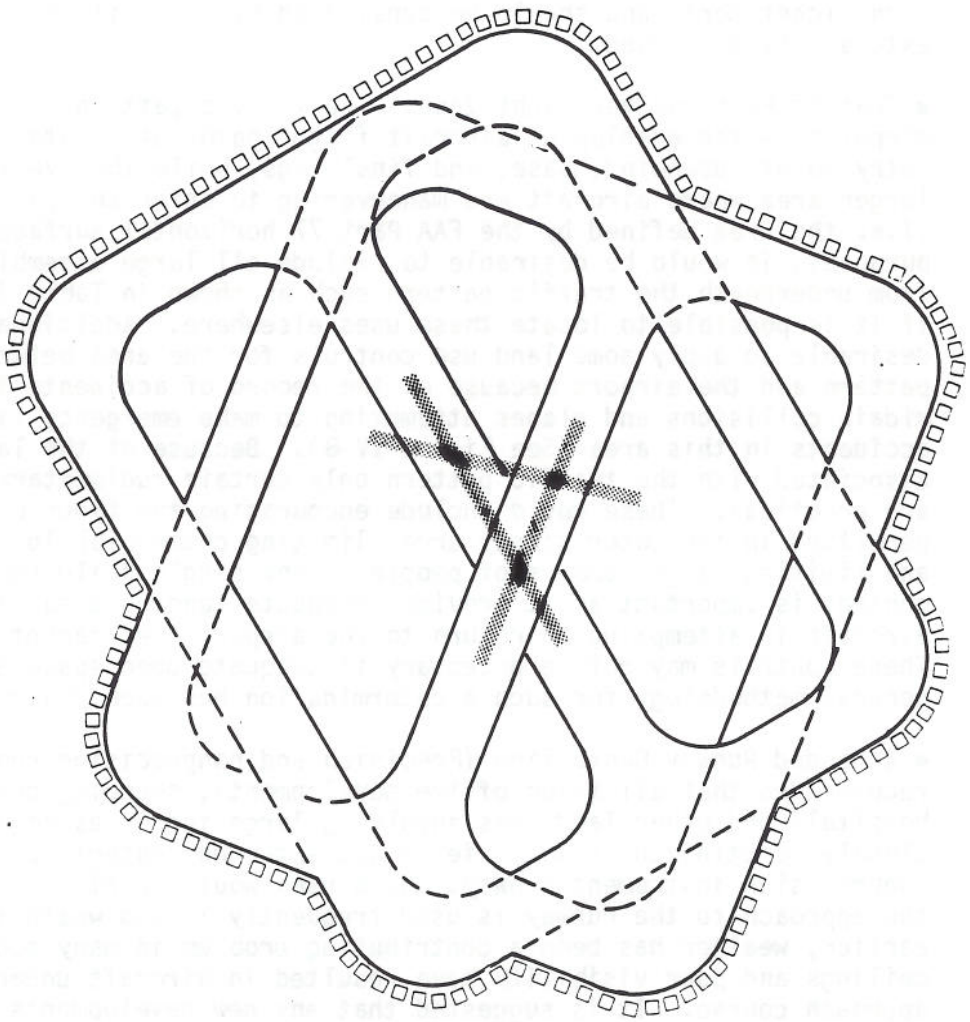
feet wide and extends the length of the safety area. This area would have no obstructions so that aircraft could touch down if they fall short of the runway or need to make an emergency landing on takeoff. This concept has significant merit and should be considered by ALUCs if the land is not already extensively developed.

• Traffic Pattern/Overflight Zone. The traffic pattern for general aviation airports is the envelop of aircraft flight paths associated with the pattern entry point, downwind, base, and final legs, while the overflight area is the larger area where aircraft are maneuvering to enter the pattern for landing (i.e. the area defined by the FAA Part 77 horizontal surface). For safety purposes, it would be desirable to exclude all large assemblages of people from underneath the traffic pattern such as shown in Table IV-13, especially if it is possible to locate these uses elsewhere. Additionally, it would be desirable to apply some land use controls for the area between the traffic pattern and the airport because of the record of accidents in this area--midair collisions and planes attempting to make emergency landings are typical accidents in this area (See Figure IV-8). Because of the large area associated with the traffic pattern only certain rudimentary use restrictions are practical. These would include encouraging the types of land use permitted in the outer safety area, limiting commercial lot coverage to 40-50% and limiting large numbers of people in any single building. The lot coverage control is important as it provides adequate landing area if a disabled aircraft is attempting to return to the airport, yet cannot make the runway. These controls may not be necessary if adequate open space already exists. A general methodology for such a determination has been described above.

• Extended Runway Centerline (Precision and nonprecision runways only). It is recommended that all major office developments, shopping centers, schools, hospitals and other land uses involving large indoor assemblages of people be closely scrutinized if they lie on the extended centerline of a precision or nonprecision instrument runway. Such uses would be of particular concern if the approach to the runway is used frequently in bad weather. As noted earlier, weather has been a contributing problem in many accidents where low ceilings and poor visibility have resulted in aircraft undershooting the approach course. It is suggested that any new developments concentrating large groups of people in structures be reviewed in a corridor 1,000 feet wide and extending 10,000 feet from the landing threshold of a precision or nonprecision runway. Large concentrations of people directly on the runway centerline should be strongly discouraged.

## Special Planning Considerations

• Smoke, glare, lights, and electronic interference. Land use activities which may present visual, electronic, or physical hazards to aircraft in flight should be avoided in the airport vicinity and specifically in the safety zones. Visual hazards include distracting lights (particularly lights which can be confused with airfield lights), glare, and sources of smoke. Electronic hazards include any uses which interfere with aircraft radio communications. The principal physical hazards, other than the height of structures, are bird strikes. The risk of bird strikes is most serious on takeoff for turboprop and jet aircraft (bird ingestion can cause engine failure). Any land uses which can attract birds should be avoided; artificial



LEGEND

□□□□□□ Safety Zone for Airport Traffic Pattern

**Figure IV - 8**

**AIRPORT TRAFFIC PATTERN SAFETY ZONE**

attractors are particularly inappropriate. Sanitary landfills are a prime example of such land uses. (FAA Order 5200.5 "FAA Guidance Concerning Sanitary Landfills on or Near Airports," 10/16/74 provides guidelines on the siting of airports relative to garbage dumps and sanitary landfills.)

As a result of these concerns, most ALUC plans identify the following as incompatible uses in airport safety zones:

- Any use, which would direct a steady light or flashing light of red, white, green, or amber colors associated with airport operations toward an aircraft engaged in an initial straight climb following takeoff or toward an aircraft engaged in a straight final approach toward a landing at an airport, other than an FAA approved navigational signal light or visual approach slope indicator.

- Any use which would cause sunlight to be reflected toward an aircraft engaged in an initial straight climb following takeoff or toward an aircraft engaged in a straight final approach toward a landing at an airport.

- Any use which would generate smoke or which would attract large concentrations of birds, or which may otherwise affect safe air navigation within this area.

- Any use which would generate electrical interference that may be detrimental to the operation of aircraft and/or aircraft instrumentation.

• Shielding of Population within Safety Area. If an incompatible project must be approved in a safety area, there are several methods which could be considered to minimize the crash hazard to people on the ground by "shielding" the people from the aircraft. Such methods include planting trees in front of structures, constructing earth berms, or locating new buildings behind existing buildings so as to be shielded from the line of impact. Additionally buildings could be constructed of brick or concrete in order to prevent light aircraft from penetrating through the structure. One ALUC has proposed building performance criteria to be used for variances from the basic land use policies as follows (Reference 12):

1. Prevent aircraft weighing no more than 12,500 pounds from penetrating more than 18 inches inside an inside wall of a building;

2. Prevent aircraft weighing no more than 12,500 pounds from penetrating beneath the ceiling of the highest story in a building;

3. Prevent any spillage of flammable solids or fluids (liquid or gas) into the interior of the space occupied by the outside walls and the roof of the building, either by direct penetration or through ingestion by ventilation and air-conditioning intakes.

The following assumptions are basic to the above criteria:

a. Gross weight of aircraft: 12,500 pounds

b. Speed with respect to the ground: 120 feet per second, 82 miles per hour, or 71 knots.

c. Direction of impact:

   - 45 degrees with respect to the direction of the runway centerline (in a vertical planview)

   - 15 degrees downward with respect to the horizontal plan.

d. Result in no more than 15 g deceleration at each occupied seat in the aircraft.

e. Natural or artificial barriers may satisfy the criteria to a partial or total extent.

While these standards may help reduce the potential for injury or loss of life on the ground, they do not increase the chances of survivability for pilots and passengers in the aircraft. Consequently any use of such standards would be only a partial solution to the total safety problem and should be considered only as a last resort.

## V. HEIGHT RESTRICTIONS NEAR AIRPORTS

### Reasons for Height Limitations Near Airports

All ALUC plans contain recommendations for limiting the height of structures near airports. These recommendations have a twofold purpose. The first--stemming from the ALUC's statutory duty to protect the public's safety and welfare--is to ensure that pilots operating aircraft near airports have a safe environment in which to fly. Limiting the height of structures near airports will also protect the safety of persons occupying these structures on the ground. The second purpose for ALUC height recommendations is to ensure that neither the operating capability of the airport during VFR and IFR weather nor the usable runway length is adversely affected by obstructions in the surrounding airspace. By carefully controlling the height of buildings near airports, the public's investment in these airports can be protected.

- VFR Flying - Visual Flight Rule (VFR) flying is flying conducted during good weather--generally when the visibility is at least three (3) miles and the ceiling is at least 1,000 feet above ground. Under VFR flight rules, the pilot is responsible for seeing and avoiding objects in his flight path. Surface structures are of concern to a pilot at three distinct times during a flight: 1) when climbing after takeoff, 2) when operating at a low altitude, and 3) when descending preparatory to landing, including flight in an airport traffic pattern.

Departure paths from airports must be kept clear of tall structures that could cause a collision with an aircraft or could distract a pilot's attention during the critical takeoff phase. It is also necessary to consider the effect of tall structures on the safety of aircraft operations in the event an aircraft loses power on takeoff. If an engine fails, an aircraft's ability to climb can be lost or seriously reduced, bringing buildings into closer proximity to aircraft than would occur under normal takeoff conditions. Generally the same statements can be made concerning the landing phase of flight--that is structures need to be kept at a reasonable height below the nominal glide path of aircraft approaching an airport and some consideration should be given to possibility of pilots undershooting the approach.

Within the airport traffic pattern, an object or structure would generally become a concern if it is within 300 feet of the normal pattern altitude. The pattern altitude is established by the airport operator and ranges between 800 feet and 1,500 feet above ground level. While in the traffic pattern, the pilot's attention must be focused on managing the descent of the aircraft and avoiding other nearby aircraft, and not on avoiding tall structures in this area.

Concerns with the height of objects and structures are not just limited to the airspace immediately surrounding airports but extend beyond the usual ALUC planning boundaries. When flying between airports pilots typically navigate using electronic navigational aids and visual reference to natural landmarks such as coastlines, rivers and valleys and transportation facilities such as railroads and highways. These visual reference points together with electronic navigational aids form a network of VFR "flyways". The safety of aircraft operations along these flyways is most affected by tall structures when the weather is marginal. It is during these conditions that pilots must fly at low altitudes to remain in visual contact with the ground. The width

of these VFR flyways is usually considered to be about two statute miles on either side of the normal flight path.

Generally speaking, any object above 500 feet would constitute a safety concern along a VFR flyway. Tall communication antenna towers are common types of structures that pose problems for VFR flight in these corridors; in fact it was construction of these tall antennas that prompted much of the original need for federal airspace obstruction standards.

- IFR Operations and Weather "Minimums." Instrument weather conditions require use of electronic navigational aids on the aircraft and on the ground to provide course and altitude guidance. These operations are usually conducted in poor weather and follow established instrument flight procedures developed by the FAA. There are a number of different procedures that are used during adverse weather:

  - straight in approach
  - circling approach
  - missed approach
  - various types of departures

For each procedure a set of minimum conditions ("minimums") is specified for operation. The elements of minimums are the Minimum Descent Altitude (MDA) or Decision Height (DH) and the weather. The weather minimums include the visibility and may include a ceiling value and vary from airport to airport. Structures located in the landing and takeoff areas used for instrument arrivals and departures may cause the FAA to alter its procedures thereby reducing the utility of the airport. If the weather minimums must be raised, there will be some additional amount of time each year the airport will be effectively shut down because of weather conditions below the prescribed minimums. The number of hours during the year a procedure can no longer be executed represents a loss in utility for the individual airport and a loss in efficiency for the overall air transportation system. Procedures that may be affected include an existing instrument arrival or departure procedure or one that is planned for implementation at some future date. Tall structures that have the potential for affecting instrument flight procedures may be located outside the usual ALUC height referral area.

Tall structures can also cause climb gradients to be imposed. Aircraft using a procedure with a climb gradient must be capable of achieving a higher rate of climb than would otherwise be required to clear obstacles in the departure path. Establishment of a climb gradient could preclude certain aircraft from using an airport or could represent a loss in payload capability and revenue for commercial operators. Climb gradients therefore represent another way airport utility is reduced.

## Part 77 - Objects Affecting Navigable Airspace

Federal Aviation Regulations Part 77 (Reference 24) has been adopted by all ALUC's to define height limits around airports. In addition, several cities and counties in the state have incorporated the obstruction standards in Part 77 directly into their local zoning ordinances. Part 77 of the Federal Aviation Regulations--Objects Affecting Navigable Airspace--contains

three major elements of importance to ALUCs:

- Notice Requirements (Subpart B)
- Obstruction Standards (Subpart C)
- Aeronautical Studies (Subpart D)

The principal purpose behind Part 77 is to provide standards for determining "obstructions" in the navigable airspace. These standards are applied to existing and proposed man-made objects, objects of natural growth, and terrain (The criteria used by the FAA to formulate flight procedures for instrument approaches and departures from airports are contained in another FAA publication called TERPS (Reference 33), an abbreviation for "Terminal Instrument Procedures.") An obstruction is determined to be a "hazard" to air navigation if a subsequent Aeronautical Study performed by the FAA indicates that there would be a substantial adverse effect on aircraft operations.

It is important to note that Part 77 obstruction standards--which are used by all ALUCs as height limits--are used by the FAA in a quite different manner. These standards identify elevations above which air safety may be a problem subject to further review on a case by case basis. If a determination is made indicating a hazard to air navigation, the FAA's authority ceases at this point. It is then up to local zoning agencies to enforce the FAA recommendations and relieve the safety problem. While it is important to understand that the obstruction standards are in fact review standards, it is equally important to recognize that these standards provide a reasonable and defensible balance between the needs of the airspace users and the rights of property owners beneath the flight patterns. In this regard, the use of Part 77 obstruction standards as recommended height limits is appropriate.

Table V-1 summarizes the five (5) major categories of obstructions contained in Part 77, the criteria for determining when the FAA must be notified of plans to construct or alter structures near airports and the major considerations leading to a determination of "hazard" or "no hazard" as described in the FAA handbook Procedures for Handling Airspace Matters (Reference 34).

## Obstruction Standards

Dimensions of the approach, horizontal, transitional, and conical imaginary surfaces are determined by the length of the airport runways and the most precise approach--existing or planned--for each runway end. Different imaginary surfaces are used for civil airports, military airports and heliports.

o Civil Airport Imaginary Surfaces. The imaginary surfaces for civil airports are described below and shown to Figure V-1. Table V-2 summarizes the dimensions and slopes for each of these surfaces.

1. Primary Surface. A surface longitudinally centered on a runway is called a "primary surface." When the runway is paved the primary surface extends 200 feet beyond each end of the runway. The width of the primary surface varies between 250 feet and 1,000 feet depending on the type of approach.

Table V-I
Summary of Federal Aviation Regulations Part 77

| NOTICE REQUIREMENTS | OBSTRUCTION STANDARDS | DEFINITION OF SUBSTANTIAL ADVERSE EFFECT |
|---|---|---|
| Notice of construction or alteration is required if an object:<br><br>(1) is greater than 200 feet in height above ground level at its site.<br><br>(2) penetrates the following imaginary surfaces:<br>o 100:1 plane for a distance of 20,000 ft. from nearest point of nearest runway for airports with at least one runway more than 3200' long<br>o a 50:1 plane for a distance of 10,000 feet from the nearest point of the nearest runway for airports with the longest runway no more than 3200' long<br>o a 25:1 plane for a distance of 5000 feet from the nearest point of the landing and takeoff area for heliports<br><br>(3) penetrates the above surfaces when adjusted upward by 17' (highway), 15' (public roadway), 10' (private roadway), 23' (railroad or waterway or other traverse way).<br><br>(4) is in an instrument approach area and is requested by FAA. | Existing or future object would be an obstruction if it:<br><br>(1) is greater than 500 feet in height above ground level at site.<br><br>(2) for airports one runway at least 3200 feet long: is 200 feet above ground level or airport elevation (whichever is higher) for 3 nautical miles from the airport increasing 100 feet for each mile up to 500 feet.<br><br>(3) for terminal obstacle clearance areas (including initial approach segment, departure area, and a circling approach area), does not provide the required obstacle clearance between the object and the established minimum instrument flight altitude.<br><br>(4) for the enroute obstacle clearance area of a Federal airway or approved off-airway route, would increase the minimum obstacle clearance altitude.<br><br>(5) penetrates the imaginary approach, transitional, horizontal, and conical surfaces established relative to each airport's runways<br><br>(6) penetrates the above surfaces when adjusted upward by 17' (highway), 15' (public roadway), 10' (private roadway), 23' (railroad), or the height of the highest object using waterways and any other traverseway. | Evidence of substantial adverse effect(s) normally requires the issuance of an FAA Determination of Hazard to Air Navigation, i.e.<br><br>(1) IFR - An IFR operation, procedure or minimum flight altitude would require a change if the proposed structure is erected or the existing object is not altered or removed.<br><br>(2) VFR - A VFR operation would be required to change from regular flight course or altitude if the proposed structure is erected or the existing object is not altered or removed.<br><br>(3) There would be an electromagnetic effect upon an air navigation facility.<br><br>(4) There are approved airport improvement plans on file, and future IFR and VFR operations would be affected.<br><br>(5) A significant volume of aeronautical operations would be affected.<br><br>A proposed structure or an existing object would not have a substantial adverse effect if an aeronautical study shows that:<br><br>(1) An affected IFR or VFR operation can and should be changed to accommodate the object, or<br><br>(2) there is no evidence of a significant volume of aeronautical operations.<br><br>Source: Procedures for Handling Airspace Matters, FAA, February 1, 1974. |

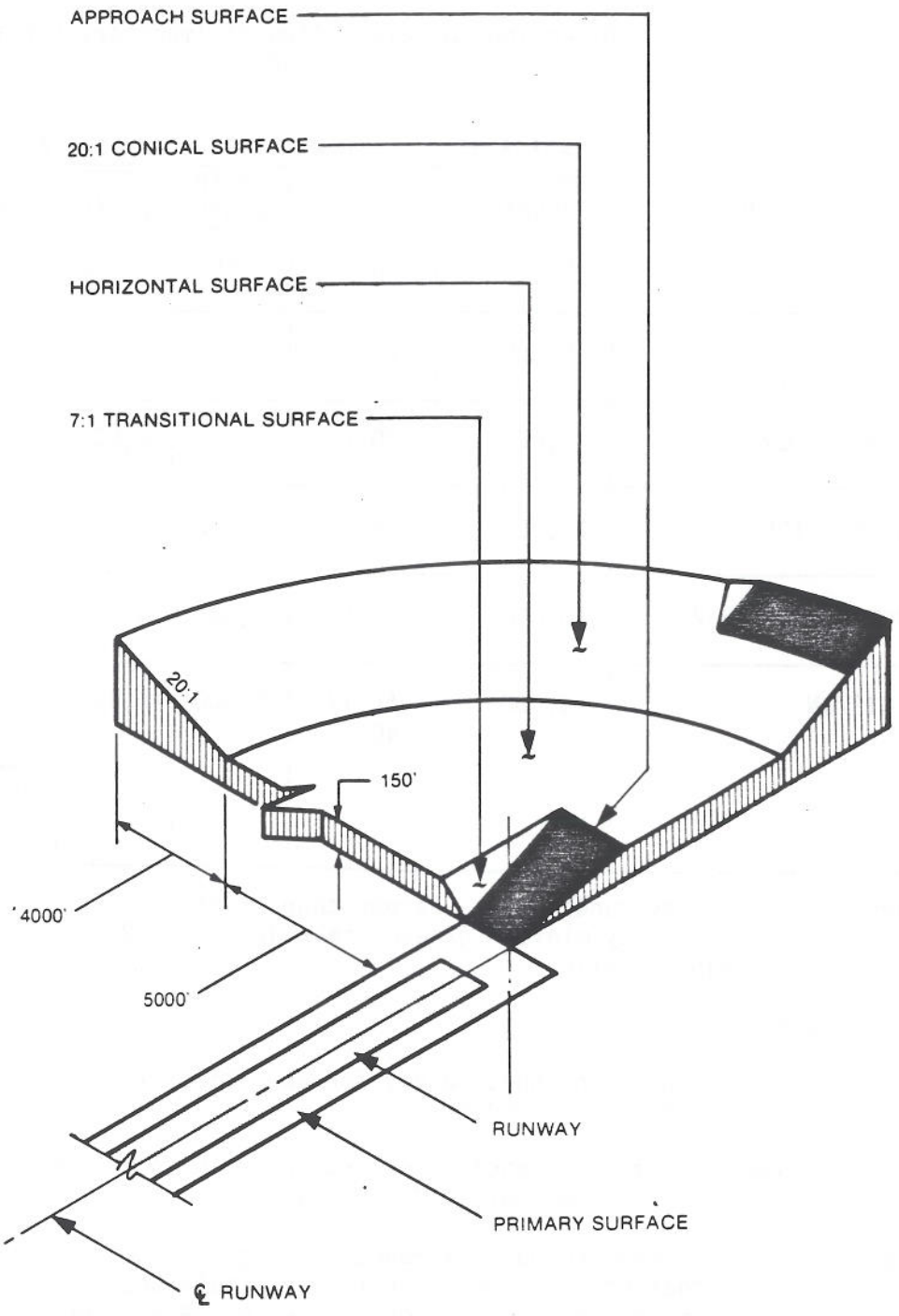



**Figure V - 1**

**PART 77 CIVIL AIRPORT IMAGINARY SURFACES**

**Isometric View**

Table V-2

Dimensions of Civil Airport Imaginary Surfaces
(Feet)

| TYPE OF RUNWAY | RADIUS OF HORIZONTAL SURFACE | PART 77 APPROACH SURFACE | | | | SLOPE OF TRANSITIONAL/ CONICAL SURFACE |
|---|---|---|---|---|---|---|
| | | SLOPE | INNER WIDTH | OUTER WIDTH | LENGTH | |
| VISUAL - A | 5,000 | 20:1 | 250 | 1,250 | 5,000 | 7:1/20:1 |
| VISUAL - B | 5,000 | 20:1 | 500 | 1,500 | 5,000 | 7:1/20:1 |
| NONPRECISION - A | 5,000 | 20:1 | 500 | 2,000 | 5,000 | 7:1/20:1 |
| NONPRECISION - B1 | 10,000 | 34:1 | 500 | 3,500 | 10,000 | 7:1/20:1 |
| NONPRECISION - B2 | 10,000 | 34:1 | 1,000 | 4,000 | 10,000 | 7:1/20:1 |
| PRECISION | 10,000 | 50:1/ 40:1 | 1,000 | 16,000 | 10,000@ 50:1 then 40,000@ 40:1 | 7:1/20:1 |

Legend: A - Utility runways; B - Larger than utility
1 - Visibility minimum greater than 3/4 mile; 2 - Visibility minimum less than 3/4 mile

Definitions

Visual Runway - runway intended solely for operation of aircraft using visual approach procedures

Utility Runway -runway constructed for and intended to be used by propeller-driven aircraft weighing 12,500 lbs. or less

Nonprecision Instrument Runway - a runway having instrument approach equipment that provides horizontal course guidance or area type navigation to touchdown or a plan on file with FAA for such an installation

Precision Instrument Runway - a runway having an existing approach procedure utilizing an Instrument Landing System (ILS) that provides horizontal and vertical course guidance to touchdown or a plan on file with the FAA for such an installation

2. Horizontal Surface. A "horizontal surface" is a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of specified radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs of lines tangent to those arcs.
3. Conical Surface. A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet is known as a "conical surface."
4. Approach Surface. A surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface is called an "approach surface." It is applied to each end of a runway based on the type of available or planned approach.
5. Transitional Surfaces. These surfaces extend outward and upward at right angles to the runway centerline plus runway centerline extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.

o Military Airport Imaginary Surfaces. During the development of Part 77, the Department of Defense requested that separate obstruction criteria be incorporated for application to military airports. The criteria were requested because of the operating characteristics of certain military aircraft, the necessity for low altitude maneuvering and formation takeoffs, the more stringent training needs, and the armament and ordinance-carrying requirements of the military. These standards are incorporated in Subpart C, Paragraph 77.28, and differ from the more familiar standards for civil airports (see Figure V-2).

1. Primary Surface. A surface located on the ground or water longitudinally centered on each runway with the same length as the runway. The width of the primary surface for runways is 2,000 feet.

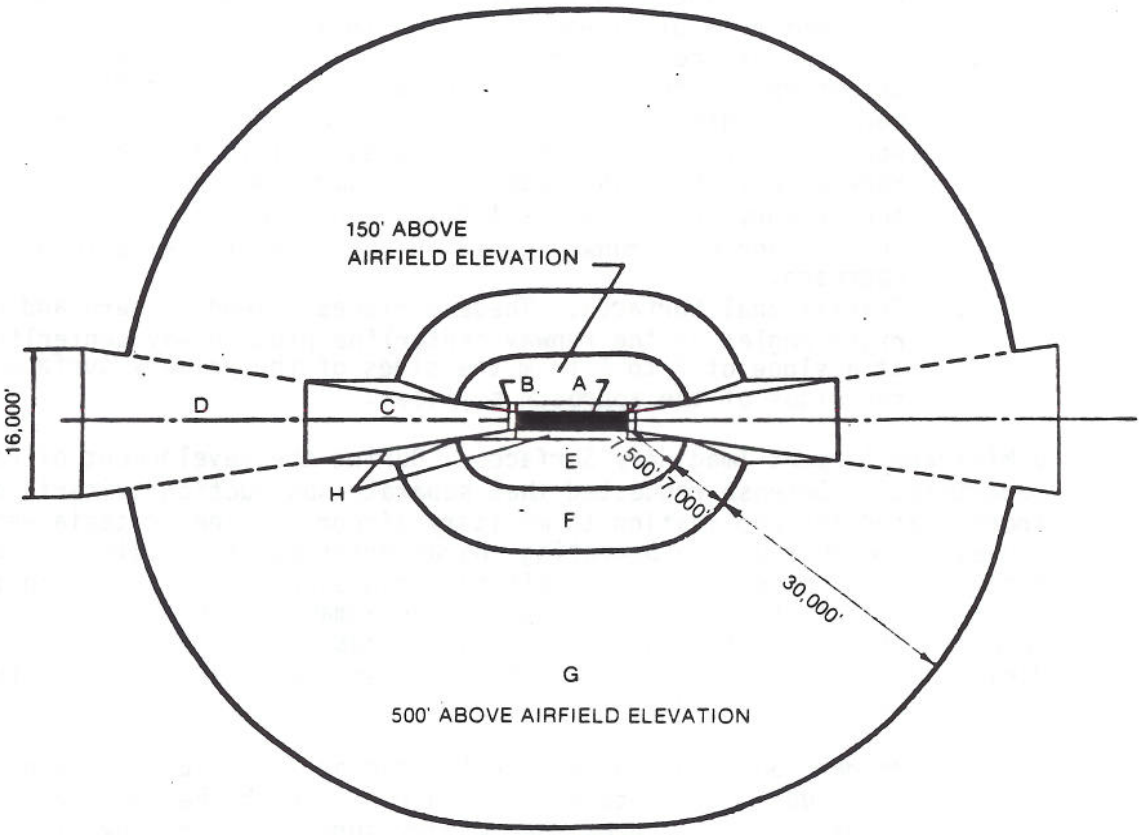
2. Clear Zone Surface. A surface located on the ground or water at each end of the primary surface, with a length of 1,000 feet and the same width as the primary surface.

3. Inner Horizontal Surface. A plane oval in shape at a height of 150 feet above the established airfield elevation. The plane is constructed by scribing an arc with a radius of 7,500 feet about the centerline at the end of each runway and interconnecting these arcs with tangents.

4. Conical Surface. A surface extending from the periphery of the inner horizontal surface outward and upward at a slope of 20 to 1 for a horizontal distance of 7,000 feet to a height of 500 feet above the established airfield elevation.

5. Outer Horizontal Surface. A plane, located 500 feet above the established airfield elevation, extending outward from the outer periphery of the conical surface for a horizontal distance of 30,000 feet.

6. Approach Clearance Surface. An inclined plane, symmetrical about the extended runway centerline, beginning 200 feet beyond each end of the primary surface at the centerline elevation of the runway end and

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A Primary Surface
B Clear Zone Surface
C Approach - Departure Clearance Surface (Glide Angle)
D Approach - Departure Clearance Surface (Horizontal)
E Inner Horizontal Surface
F Conical Surface
G Outer Horizontal Surface
H Transitional Surface

**Figure V - 2**

**PART 77 MILITARY AIRPORT IMAGINARY SURFACES**
**Plan View**



**Reference 24**

extending for 50,000 feet. The slope of the approach clearance surface is 50 to 1 along the runway centerline extended until it reaches an elevation of 500 feet above the established airport elevation. It then continues horizontally at this elevation to a point 50,000 feet from the point of beginning. The width of this surface at the runway end is the same as the primary surface, it flares uniformly, and the width at 50,000 feet is 16,000 feet.

7. Transitional Surfaces. These surfaces connect the primary surfaces, the first 200 feet of the clear zone surfaces, and the approach clearance surfaces to the inner horizontal surface, conical surface, outer horizontal surface or other transitional surfaces. The slope of the transitional surface is 7 to 1 outward and upward at right angles to the runway centerline.

o Heliport Imaginary Surfaces. Because of the proliferation of public and private use heliports, the definition of height standards around heliports is becoming more important in ALUC plans. Obstruction standards found in Subpart C, Paragraph 77.29, have been incorporated in some ALUC plans as the height limits for heliports (see Figure V-3).

1. Heliport Primary Surface. The area of the primary surface coincides in size and shape with the designated takeoff and landing area of a heliport. This surface is a horizontal plane at the elevation of the established heliport elevation.

2. Heliport Approach Surface. The approach surface begins at each end of the heliport primary surface with the same width as the primary surface, and extends outward and upward for a horizontal distance of 4,000 feet where its width is 500 feet. The slope of the approach surface is 8 to 1 for civil heliports and 10 to 1 for military heliports.

3. Heliport Transitional Surfaces. These surfaces extend outward and upward from the lateral boundaries of the heliport primary surface and from the approach surfaces at a slope of 2 to 1 for a distance of 250 feet measured horizontally from the centerline of the primary and approach surfaces.

Depictions of these imaginary surfaces in ALUC plans should show the permissible height of objects and structures at different locations within the approach, horizontal, conical, and transitional surfaces (See Figure V-4). Elevations for these imaginary surfaces should be given in feet Above Mean Sea Level (AMSL) since penetrations of the imaginary surfaces are determined by adding the height of the proposed structure above the ground to the elevation of the project site above mean sea level (see Figure V-8 under "Notice Requirements").

The imaginary airport surfaces in Part 77 lie underneath the actual glide slopes and departure gradients of aircraft landing and taking off at an airport. A common question regarding these imaginary surfaces is the margin of safety provided for normal aircraft takeoffs and landings--in other words, how high are aircraft above these surfaces? Most height problems usually arise with objects or buildings under the imaginary approach surfaces to airport runways as these areas are the areas overflown by all aircraft

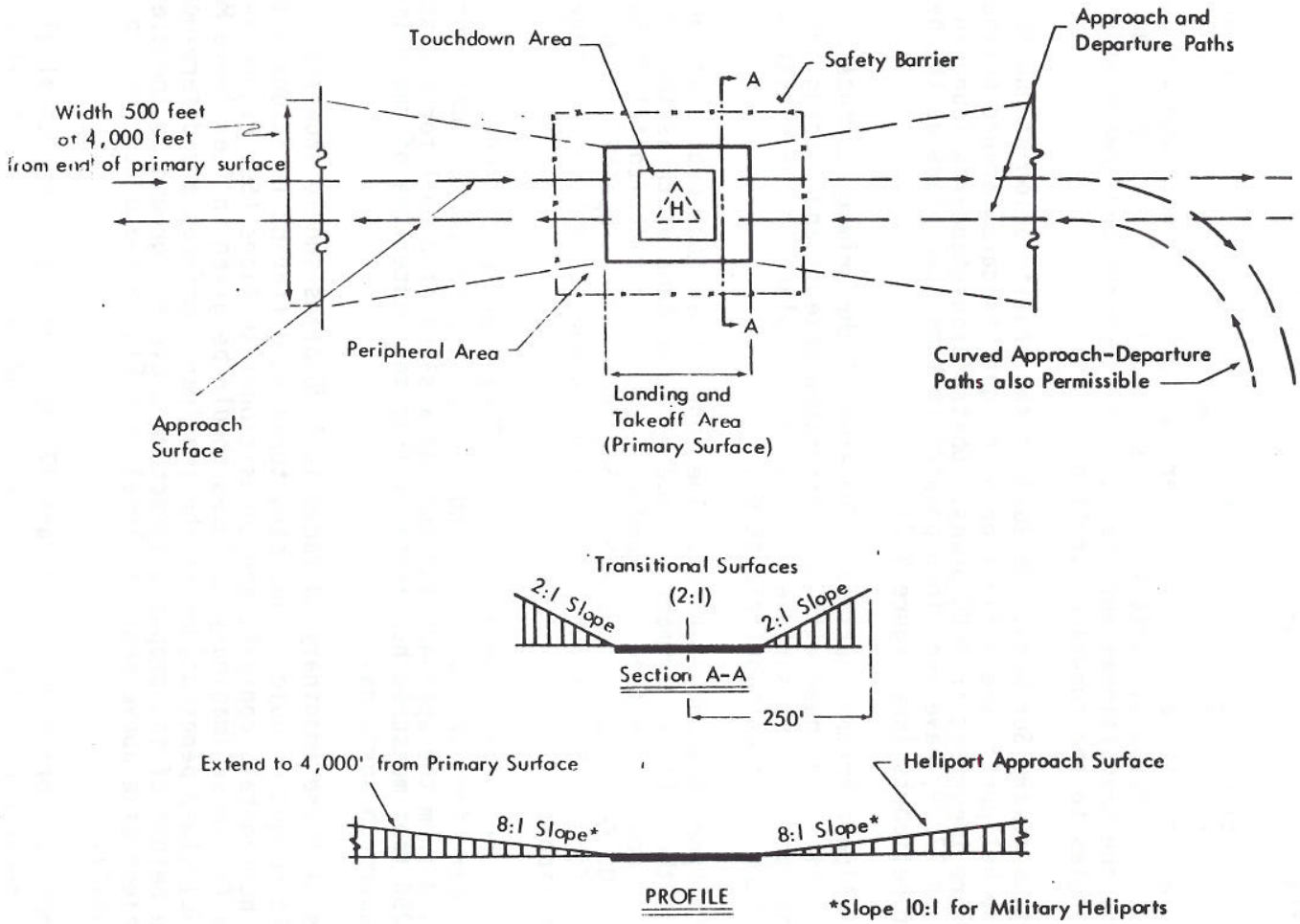



Figure V - 3

**PART 77 IMAGINARY SURFACES FOR HELIPORTS**

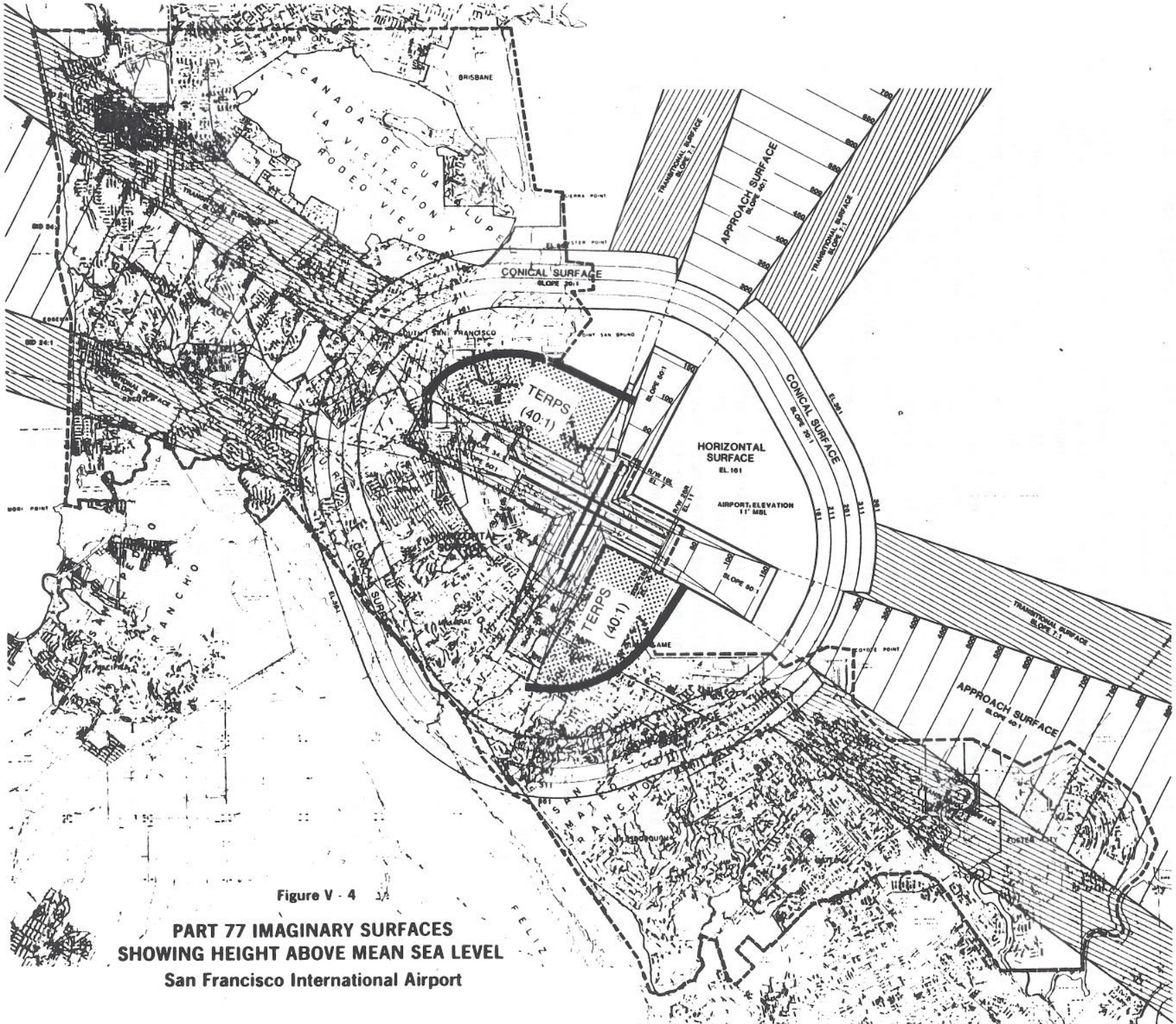



Figure V - 4

**PART 77 IMAGINARY SURFACES**
**SHOWING HEIGHT ABOVE MEAN SEA LEVEL**
**San Francisco International Airport**

arriving and departing the airport; these surfaces extend 5,000 to 10,000 feet from the end of the runway primary surface for most runways and a total of 50,000 feet for precision runways.

The theoretical clearances provided between an aircraft's normal glide slope and the imaginary airport approach surfaces are shown in Table V-3 for a 20:1 imaginary approach surface and a 50:1 imaginary approach surface. These clearances were calculated by assuming that the normal touchdown point for visual landings is 500 feet down the runway (also for a Visual Approach Slope Indicator--VASI--assisted landings) and that the normal touchdown point for an instrument approach using an Instrument Landing System (ILS) is 1,000 feet down the runway. In contrast to the aircraft touchdown point, which is located on the runway, the imaginary approach surface begins at the edge of the primary surface which is 200 feet beyond the physical end of the runway (see Figure V-5). The difference in angles between the glide slope of aircraft and the slope of the imaginary approach surface coupled with the difference in the distance between the touchdown point and origin of the imaginary approach surface on the ground provides the clearance shown in Table V-3.

Under Part 77 there are no departure surfaces per se, but departures are protected by the approach surface that is applied to the departure end of the runway (see discussion on departure surfaces under "Special Planning Considerations"). Calculated clearances above the imaginary approach surfaces cannot be provided for departures due to the large variation in takeoff distance and climb performance among general aviation and air carrier aircraft. Typical climb performance for various types of aircraft with all engines operating is shown in Table V-4.

All approach surfaces extend along the runway centerline. It is interesting to note however, that at some airports a high percentage of aircraft departures do not continue straight-out, but turn shortly after passing over the end of the runway. Where this turn has been formally established by the airport and FAA, the height restrictions should be applied along the actual turn path as well as along the extended runway centerline. No examples can be found in existing plans where this is being done.

Finally, another imaginary surface of importance, the horizontal surface, starts at 150 feet above the airport elevation. This surface protects a fairly large area used by aircraft for maneuvering around an airport. Since the normal traffic pattern altitude is 800 to 1,500 feet, there is a significant altitude buffer beneath the traffic pattern and the horizontal surface.

o Terminal Instrument Procedures (TERPS). Obstacle clearance requirements are established in TERPS (Reference 33) for instrument procedures including arrivals, departures, missed approaches and circling approaches. Obstacle identification surfaces are defined in the TERPS manual to determine when obstacles, either existing or proposed, would affect flight procedures. A penetration of these surfaces would indicate a need to alter a procedure and could adversely affect airport minimums. Departure procedures generally require a 48 foot per nautical mile (1 nautical mile is equal to 6,076 feet) clearance above a 40:1 obstacle clearance plane. Depending on whether the departure is a straight-out or turning departure, and the specific conditions around the airport, the obstacle clearance plane will start anywhere from

Table V-3

Theoretical Clearances For VFR And IFR Approaches
(Feet)

| Imaginary Surface Slope | Type of Aircraft/Approach | Distance from End of Runway 0' | 200' | 1/4 mi. | 1/2 mi. | 3/4 mi. | 1 mi. |
|---|---|---|---|---|---|---|---|
| 20:1 | General Aviation/VFR | | | | | | |
| | - Single engine | 30-50 | 45-70 | 65-125 | 90-190 | 110-260 | 130-325 |
| | - Multi-engine | 35 | 50 | 80 | 110 | 140 | 175 |
| | - VASI approach | 25 | 35 | 40 | 42 | 45 | 50 |
| 50:1 | General Aviation/IFR | 50' | 60 | 100 | 140 | 185 | 225 |
| | Air Carrier/IFR | 50' | 60 | 100 | 140 | 185 | 225 |
| | Military/IFR | 40-50 | 50-60 | 80-100 | 110-140 | 140-185 | 170-225 |
| | Military/VFR | 30 | 40 | 85 | 135 | 190 | 240 |

Assumptions

| Type of Aircraft/Approach | Glide Slopes (Degrees) |
|---|---|
| General Aviation: | |
| - Single engine aircraft | 3.8° to 5.7° |
| - Multi-engine aircraft | 4.2° |
| - VASI approach | 3° |
| - IFR approach | 3° |
| Air Carrier/Military: | |
| - Air carrier IFR approach | 3° |
| - Military IFR approach | 2.5° to 3.0° |
| - Military VFR apporach | 3.4° |
| - STOL (Short Takeoff and Landing) | 8.1° to 9.5° |
| Helicopter | 11.3° to 18.4° |

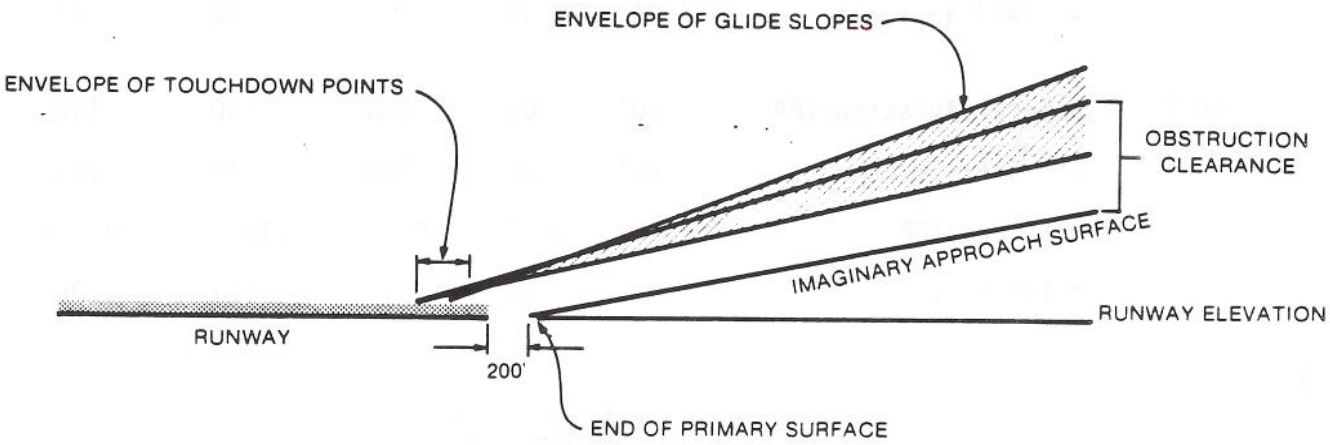



Figure V - 5

**THEORETICAL OBSTRUCTION CLEARANCES PROVIDED BY PART 77 IMAGINARY APPROACH SURFACES**

Table V-4

Aircraft Climb Rates with All Engines Operating

| Type of Aircraft | Representative Climb Rates |
|---|---|
| General Aviation[1] | |
| - Single Engine | 660 feet/ naut. mi. |
| - Twin Engine | 860 feet/ naut. mi. |
| - Twin Engine Turboprop | 1125 feet/ naut. mi. |
| - Business Jet | 4100 feet/min. |
| Air Carrier[2] | |
| - Twin Engine | 960 feet/ naut. mi. |
| - Three Engine | 580 feet/ naut. mi. |
| - Four Engine | 465 feet/ naut. mi. |

1. Average climb gradients for currently manufactured aircraft
   Source: Reference 35
2. Calculated from formula provided by FAA for maximum gross weights

the runway elevation up to 50 feet above the airport elevation for an "early turn" departure. Figure V-4 from the San Mateo County ALUC plan (Reference 6) shows several areas where TERPS criteria need to be considered for turning departures in setting height restrictions around the San Francisco International Airport.

A circling approach is an approach whereby an aircraft approaches an airport using the published approach procedure to one runway then circles to land on another runway at the airport which is not aligned with the final course of the approach procedure. The TERPS manual requires that there be a minimum of 300 feet of obstacle clearance in the circling approach area (see Figure V-6).

A missed approach is established for each instrument approach procedure in the event that an instrument approach to a runway must be terminated. The missed approach procedure is a climb procedure initiated at the specified Decision Height or Minimum Descent Altitude (MDA). The TERPS manual provides a 40:1 missed approach surface, starting a the missed approach point, which must be kept free of obstacles (see Figure V-7).

## Requirements to Notify FAA of Proposed Construction or Alteration

Part 77 sets forth requirements that the FAA Administrator be notified of certain proposed construction or "alterations" in the airport vicinity. The criteria that trigger the need to file Notices are shown in Table V-1. These notices are filed on FAA Form 7460-1 and provide information that allows the FAA to determine the impact of a structure on airspace operations and FAA navigational aids (see Figure V-8). Projects that do not exceed the obstruction standards are simply acknowledged, while those that do are subject to a more detailed aeronautical study.

Several ALUCs receive Notices of Proposed Construction or Alteration at the same time they are submitted to the FAA. This allows ALUCs to have early notification of proposed structures whose height may pose a problem for airport operations.

## Aeronautical Studies

Aeronautical studies are performed by the FAA to determine whether a specific proposal is a "hazard to air navigation." The FAA not only reviews the effect of the height of buildings on the safety of flight, but also the electromagnetic effect of buildings on existing or planned FAA navigational facilities (it would be very expensive to relocate an airport Instrument Landing System, radar, or radio facility because of interference with the signals from these navigational aids). The FAA will also give equal consideration to the possibility of altering airport operational procedures to accommodate a proposed obstruction, provided there is no substantial adverse aeronautical effect.

Once the FAA has received a Notice of Proposed Construction or Alteration, it will first determine whether the project would exceed any of the five Obstruction Standards in Paragraph 77.13 of FAR Part 77. This review is

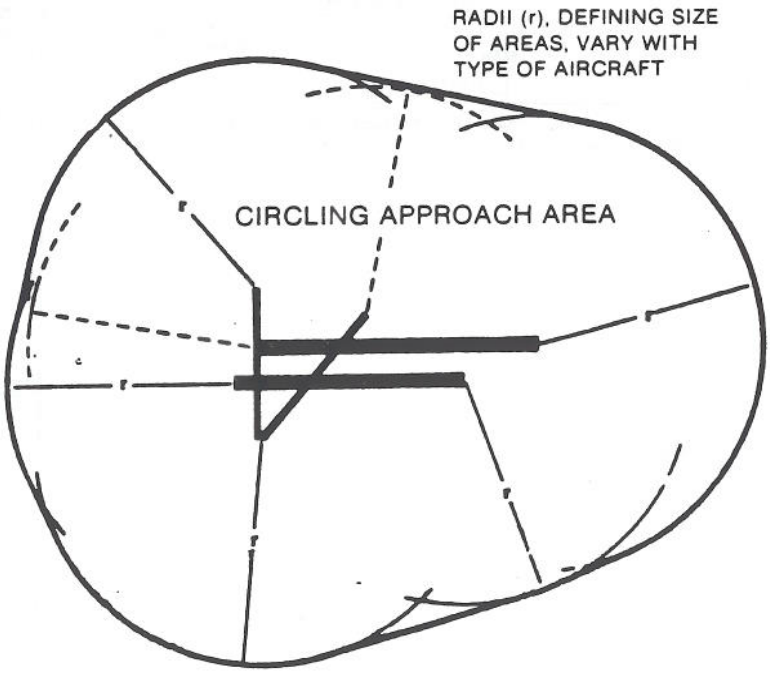



Figure V - 6

**CIRCLING APPROACH AREA**

Reference 33

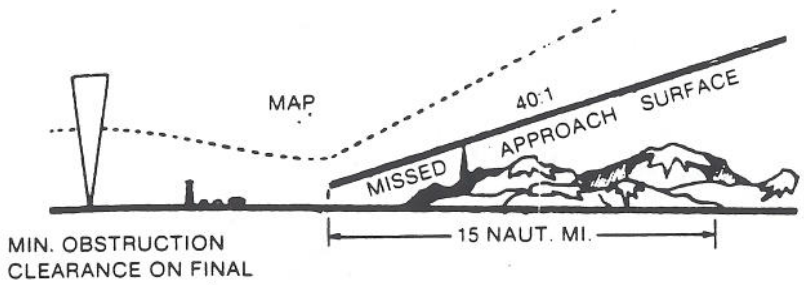



Figure V - 7

**STRAIGHT MISSED APPROACH OBSTACLE CLEARANCE**

Reference 33

**DO NOT REMOVE CARBONS** Form Approved O.M.B. No. 04-R0001

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

## NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

**FOR FAA USE ONLY**

AERONAUTICAL STUDY NO.

1. NATURE OF STRUCTURE

A. TYPE ☐ NEW CONSTRUCTION ☐ ALTERATION

B. CLASS ☐ PERMANENT ☐ TEMPORARY

C. PROPOSED LENGTH OF TIME TO COMPLETE (*Months*)

2. NAME AND ADDRESS OF INDIVIDUAL, COMPANY, CORPORATION, ETC. PROPOSING THE CONSTRUCTION OR ALTERATION (*Number, Street, City, State and Zip Code*)

TO

FAA will either return this form or issue a separate acknowledgement.

A. The proposed structure:

☐ Does not require a notice to FAA.

☐ Would not exceed any obstruction standard of Part 77 and would not be a hazard to air navigation.

☐ Should be obstruction ☐ marked ☐ lighted per FAA Advisory Circular 70/7460-1, Chapter(s) ____

☐ Obstruction marking and lighting are not necessary.

☐ Requires supplemental notice. Use FAA form enclosed.

B. FCC ☐ was ☐ was not advised.

REMARKS:

3. COMPLETE DESCRIPTION OF STRUCTURE (*Include effective radiated power of proposed or modified AM, FM or TV station and assigned frequency; size and configuration of power transmission line in vicinity of FAA facilities as appropriate*).

ISSUING OFFICE:

REVIEWING OFFICER | DATE

4. LOCATION OF STRUCTURE

A. COORDINATES (*To nearest second*)

| LATITUDE | | | LONGITUDE | | |
|---|---|---|---|---|---|
| ° | ' | " | ° | ' | " |
| | | | | | |

B. NEAREST CITY OR TOWN, AND STATE

(1) DISTANCE FROM 48 MILES | (2) DIRECTION FROM 48

C. NAME OF NEAREST AIRPORT, HELIPORT, OR SEAPLANE BASE | (1) DISTANCE FROM NEAREST POINT OF NEAREST RUNWAY | (2) DIRECTION FROM AIRPORT

D. DESCRIPTION OF LOCATION OF SITE WITH RESPECT TO HIGHWAYS, STREETS, AIRPORTS, PROMINENT TERRAIN FEATURES, EXISTING STRUCTURES, ETC. (*Attach a highway, street, or any other appropriate map or scaled drawing showing the relationship of construction site to nearest airport(s). If more space is required, continue on a separate sheet of paper and attach to this notice.*)

5. HEIGHT AND ELEVATION (*Complete A, B and C to the nearest foot*)

A. ELEVATION OF SITE ABOVE MEAN SEA LEVEL

B. HEIGHT OF STRUCTURE INCLUDING APPURTENANCES AND LIGHTING (*if any*) ABOVE GROUND, OR WATER IF SO SITUATED

C. OVERALL HEIGHT ABOVE MEAN SEA LEVEL (*A + B*)

6. WORK SCHEDULE DATES

A. BEGINNING

B. END

7 OBSTRUCTION MARKED AND OR LIGHTED IN ACCORDANCE WITH CURRENT FAA ADVISORY CIRCULAR 70 7460-1, OBSTRUCTION MARKING AND LIGHTING

| | YES | NO |
|---|---|---|
| A. MARKED | | |
| B. AVIATION RED OBSTRUCTION LIGHTS | | |
| C. HIGH INTENSITY WHITE OBSTRUCTION LIGHTS | | |
| D. DUAL LIGHTING SYSTEM | | |

I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge.

| DATE | TEL. NO. (*Give area code*) | TYPED NAME/TITLE OF PERSON FILING NOTICE | SIGNATURE |
|---|---|---|---|
| | | | |

Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1101). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1472(a)).

**FAA Form 7460-1** (4-79) USE PREVIOUS EDITION **DO NOT REMOVE CARBONS**

**Figure V - 8**

**NOTICE OF PROPOSED CONTRUCTION OR ALTERATION**
**FAA Form 7460-1**

conducted by all affected branches of the FAA--Air Traffic, Flight Standards, Airway Facilities, and Airports. If the obstruction standards are not exceeded, the FAA issues an acknowledgement on the same form and returns this to the project sponsor. Marking and lighting of obstructions may be recommended as part of the acknowledgment. Projects that exceed the obstruction standards are normally circularized for public comment; the specific obstruction standards that are exceeded are noted on the FAA circular. The public then has 30 days to submit comments, and the FAA responds to these comments as part of the Aeronautical Study. An informal airspace meeting will be held with the project sponsor, FAA, and interested parties if an FAA airspace specialist determines such a meeting is advisable or if the project is particularly controversial. In these and other discussions with the project sponsor, the FAA will strongly urge the sponsor to reduce the height of a building or other structure so that it will no longer be a hazard or obstruction. The FAA normally issues a determination of hazard or no hazard within 30 to 60 days of an informal airspace meeting, if this meeting is necessary. All determinations for structures that exceed obstruction standards may be appealed by any interested party and the determination may be reaffirmed, revised, or reversed if the FAA grants the petition for review.

The grounds for a determination of hazard or no hazard are shown in Table V-1. For a project to be found a hazard, there must be

- an adverse effect
- a significant volume of aeronautical activity

Eight examples of various types of determinations are included in the Appendix I to illustrate the range of FAA review. These examples include the following:

| | |
|---|---|
| Example 1. | Notice is not required. |
| Example 2. | Proposal does not exceed Part 77; obstruction marking and lighting are not necessary. |
| Example 3. | Proposal does not exceed Part 77; obstruction marking and lighting are recommended. |
| Example 4. | Proposal exceeds Part 77; in-house FAA study reveals project is not a hazard. |
| Example 5. | Proposal exceeds Part 77; in-house FAA study reveals project is not a hazard, but obstruction marking and lighting are recommended. |
| Example 6. | Proposal exceeds Part 77. Proposal has been circularized for comment; study completed and found to be no hazard, conditional on obstruction lights. |
| Example 7. | Proposal being circularized; request for comments prior to determination. |
| Example 8. | Proposal exceeds Part 77. Proposal has been circularized for comment; study completed and found to be a hazard. |

It is clear from the above examples that projects that exceed the ALUC recommended height limits need to be reviewed on a case-by-case basis to determine the specific effects on airport operations and air safety. The FAA is the principal agency having the required expertise to make judgments on these matters after all comments have been considered. If the ALUC height recommendations are penetrated, ALUCs should concentrate on providing valid aeronautical concerns to the FAA. These concerns can then be evaluated in the

context of the Aeronautical Study. In order to become more effective in this area, it is suggested that ALUCs:

1) include the Part 77 criteria under which project sponsors should notify the FAA and ALUC of proposed construction or alterations in the ALUC plan;

2) request the FAA to notify ALUCs of proposed projects that exceed obstruction standards in Part 77 and will require an Aeronautical Study;

3) in response to FAA requests for comments on an Aeronautical Study, provide comments where appropriate. In these studies the FAA is not looking for general comments supporting or objecting to projects, rather it is looking for specific aeronautical objections that it should address in its Aeronautical Study;

4) formally state in the ALUC plan that any structure, either within or outside of the planning boundary, would not be in conformance with the ALUC plan if it:

   - is determined to be a "hazard" by the FAA;
   - would significantly raise the ceiling or visibility minimums at an airport for an existing or planned instrument procedure (i.e., a procedure consistent with the FAA-approved airport layout plan or a proposed procedure formally on file with the FAA);
   - would result in a loss in airport utility, such as causing the usable length of the runway to be reduced;
   - would conflict with the VFR airspace used for the airport traffic pattern or enroute navigation to and from the airport.

It is clearly a complex task for local plans to anticipate the effects of existing and proposed instrument procedures on the heights of buildings in different areas of the community, particularly when these areas are fairly remote from the airport. However, inclusion of the above statements in the ALUC plan as recommendations to local agencies would provide the proper attention to these concerns and would indicate the proper response to any project that was being reviewed by the FAA.

In certain instances a tall structure may also require a permit from the State Division of Aeronautics. A permit is required under existing law if a structure is more than 500 feet above the ground or if it is within one (1) mile of an airport and is determined to be a hazard by the FAA (Sections 21656 and 21659 of the Public Utilities Code). Appendix J contains applicable sections of the law.

## Special Planning Considerations

o Departure Surfaces for Aircraft. Some airspace user groups do not believe that Part 77 provides adequate protection of the airspace in the departure area around airports. In the strictest sense, the imaginary surfaces contained in Part 77 and adopted by ALUCs in their plans are approach surfaces. Obstacle clearance requirements for terminal instrument procedures

are addressed in Paragraph 77.23(a)(3) which requires use of the TERPS document. Chapter 12 of TERPS discusses obstacle clearance requirements for departure routes.

Obstacles are identified in the departure area if they penetrate a 40:1 obstacle identification surface which begins no higher than 35 feet above the runway end for most departures and 50 feet above the elevation of the airport for early turn departures. The principal purpose behind TERPS is to provide flight procedures that avoid existing obstacles by specifying flight paths or climb gradients for aircraft; however, it is also used for obstacle identification in much the same manner as the imaginary surfaces discussed earlier.

A possible deficiency with this document and with Part 77 is the lack of guidance in protecting the airspace off the departure end of a runway if an aircraft loses an engine and cannot climb at the same rate as with all engines operating. If structures are allowed to be built up to the imaginary approach surface height, sufficient clearance may not exist for the problem departure.

TERPS departure criteria provide a 48 foot per nautical mile buffer assuming an aircraft climb gradient of 152 feet per nautical mile. This climb gradient is higher than can be maintained in an emergency situation for many aircraft. A twin engine air carrier jet aircraft (e.g. B-737 or DC-9) certified under Federal Aviation Regulation Part 25 is required to have a continued takeoff capability with the loss of a critical engine and to sustain a 145 foot per nautical mile climb gradient (2.4%) up to 400 feet with the landing gear retracted; this climb rate may be further degraded due to wind conditions or mechanical problems (e.g., rough air or unstable airspeed).

For this reason a safety margin is required above the obstacles in the takeoff path to determine the climb performance at maximum allowable takeoff gross weight. This margin is .8% per nautical mile for a two-engine aircraft. Therefore, a two-engine airplane taking off with its gross weight limited by a minimum allowable climb gradient of 2.4% may not have obstacles above a 1.6% plane starting at the end of the runway (62.5 to 1).

A second concern is the twin engine general aviation aircraft. Light twins certified under Federal Aviation Regulations Part 23 (maximum weight of 6000 lbs. or less and stall speed of 61 knots or less) are not required to have any climb performance on takeoff with an engine out, while heavier twins must show a single engine rate of climb at 5,000 feet but are not required to demonstrate a positive rate of climb in takeoff configuration with an engine out (an exception to this statement is twin engine aircraft certified for commercial air taxi operations, which must be able to takeoff with an engine out). The maximum rate of climb with an engine out for currently manufactured twin engine aircraft--other than twin engine turboprops--is 120 to 240 feet per nautical mile (Reference 35). A single engine aircraft that loses an engine will have no climb performance and must land.

An additional concern that has been raised in connection with TERPS is the adequacy of height protection for early turn procedures--that is, a turn initiated before the end of a runway to avoid obstacles in the departure path. Protection for these turns is provided by a 40:1 obstacle identification surface starting 50 feet above the airport elevation, whereas the obstacle identification surface for straight-out departures starts

anywhere from the runway elevation to 35 feet above the runway. (The rationale for this is that there must be at least 50 feet of clearance for the wing before a pilot would initiate a turn.)

Given these concerns, several suggestions have been proposed to correct perceived deficiencies related to height restrictions in the departure area. One suggestion is to rely on standards other than FAA standards in the departure area. The International Civil Aviation Organization (ICAO) specifies dimensions for approach surfaces for arrivals and "takeoff climb surfaces" for departures (Reference 36). Climb surfaces begin at the end of the primary surface (200 feet from the end of the runway) and start at the runway elevation. These surfaces are aligned with the departure course no matter whether the course is a straight-out or turning departure. Table V-5 summarizes the ICAO standards.

ICAO standards provide a 50:1 departure surface for "main takeoff" runways longer than 3,000 feet in length and a 40:1 takeoff climb surface for "other" runways longer than 3,000 feet. For runways between 2,500 feet and 3,000 feet, a 25:1 takeoff climb surface is recommended.

The standards further recommend that if no object reaches the 50:1 takeoff climb surface of the main takeoff runway, new obstacles should be limited down to a slope of 62.5 to 1. Where the departure end of a runway is protected by virtue of an imaginary approach surface established for a precision or nonprecision approach (50:1 or 34:1), an airport may already have adequate departure height protection for straight-out departures. If not, the adoption of departure height standards should be seriously considered. As an alternative to the use of the FAA approach surfaces, the following standards are suggested for consideration in departure areas:

| Slope | Application |
|---|---|
| - 50:1 | for all main takeoff runways for air carrier airports served by large jets (62.5 to 1 should be considered if obstacles do not exist in the 50:1 surface and local conditions permit) |
| - 40:1 | for all main takeoff runways at airports with significant use by twin engine general aviation aircraft. (Recommendation of a 40:1 departure surface gradient is based on best case climb performance for newer twin engine aircraft. Older models may not be able to maintain a 40:1 climb gradient; hence, selection of a 40:1 slope, while preferable to an existing 20:1 or 34:1 approach surface, is still a compromise.) |
| - 34:1 | for all general aviation airports with runways over 2,500 feet |
| - 20:1 | for all other airports |

Table V-5

ICAO Takeoff Climb Surfaces

| Runway | Category | Slope | Length of Climb Surface |
|---|---|---|---|
| A, B, C | Main takeoff runway | 50:1 | 50,000 feet |
| A, B, C | Other runway | 40:1 | 40,000 feet |
| D | | 25:1 | 8,300 feet |
| E | | 20:1 | 5,200 feet |

Runway Category:

A: 7,000 feet and over
B: 5,000 feet to 7,000 feet
C: 3,000 feet to 5,000 feet
D: 2,500 feet to 3,000 feet
E: 2,000 feet to 2,500 feet

Source: Reference 36

For straight-out departures, the inner width, outer width, and length of the proposed departure surface would be similar to the FAA approach surface dimensions for the same gradients (i.e, 50:1, 34:1, etc.) shown in Table V-2. For turning departures, the surfaces should include the envelope of actual aircraft flight paths and begin at the runway elevation. (A determination of actual flights paths should be made in consultation with the FAA, airport operator, airlines, and general aviation users.)

Departure surfaces are particularly important to consider at airports where the length of the runway and/or the presence of rough terrain off the end of the runway create a greater inclination on the part of pilots to become airborne if there is an engine problem. Consideration of departure surfaces becomes particularly appropriate when: 1) temperature and/or altitude conditions reduce power and lift, and 2) where runway length is such that, for different categories of aircraft, pilots must be able to quickly recognize an emergency to stop within the remaining runway pavement. Both of these situations increase the likelihood of pilots attempting to become airborne in an emergency, rather than attempting to brake to a stop. Appendix K includes examples of takeoff lengths and accelerate-stop distances for various classes of general aviation aircraft.

Examples currently exist of the application of departure surfaces for both air carrier and general aviation airports. The City of South San Francisco protects a 62.5:1 departure surface for the Shoreline Departure route from Runway 28 at San Francisco International Airport. Two departure corridors 400 feet wide have been protected at San Carlos Airport, which is heavily used by twin engine general aviation aircraft--one corridor for straight-out departures and the other for turning departures. The departure gradient for San Carlos Airport is close to 80:1.

o Marking and Lighting of Obstructions. The purpose for marking and lighting obstructions is to identify tall structures in the path of aircraft so that pilots may see and avoid these structures. The FAA usually recommends marking and lighting if a structure is over 200 feet tall; however, the FAA cannot require the sponsor to actually install the necessary equipment. ALUC plans should indicate the need for marking and lighting of any structure over 200 feet tall or where otherwise recommended by the FAA. Marking and lighting should also be recommended for any development within the airport traffic pattern that is significantly higher than existing structures. Marking and lighting would normally be conducted in accordance with FAA Advisory Circular AC 70/7460-1F, "Obstruction Marking and Lighting" (Reference 37).

o Tall Antennas. Tall communication towers can have an adverse effect on air safety, if located along a VFR flyway used for VFR traffic to and from local airports. An aircraft traveling at 165 knots (190 mph) requires one mile to see, recognize, alter course, and avoid an obstruction by 2,000 feet laterally (AC 70/7460-1F, Foreword). When flying in reduced visibility, a pilot's attention cannot be focussed straight ahead, as he must constantly look to the sides to pick out landmarks and other navigational aids. This is why it is sometimes difficult to see and avoid slender towers and their supporting wires. While tall antenna structures are not a significant concern for most ALUCs, problems have arisen in the past due to the location of these towers near airports or along the approaches to airports. The appropriate method for commenting is the Aeronautical Study. The Federal Communications Commission will not grant an operating permit for a tower determined to be a hazard to air navigation by the FAA.

o Tall Buildings in the Airport Traffic Pattern. There may be instances where a tall building or structure does not exceed FAA obstruction standards but is nevertheless believed to present a problem for airport operations. There are no specific guidelines that can be presented in these instances. General areas of concern would be:

- a structure located at a critical point in the traffic pattern that would cause pilots to divert their attention from the landing path, or from other aircraft in the immediate area;

- a building that might cause pilots to fly higher over the structure and land longer, and possibly harder, on the runway;

- a building in an area of known turbulence or wind shear that could cause sharp changes in aircraft altitude.

A reduction in structural height could be considered as a mitigation for these types of concerns, but it would be difficult to identify such issues in advance. If a formal Aeronautical Study is not required, the ALUC could serve as a forum for the discussion of such issues and report its findings to the local approving jurisdiction.

o Controlling Obstructions in Imaginary Approach Surfaces. The National Ocean Survey publishes Obstruction Charts (OCs) for many airports which identify the location and height of obstructions in the imaginary airport surfaces. A review of this chart would be useful when analyzing proposed projects that would represent obstructions in the airspace or when considering adoption or revision of height standards in the ALUC plan (see Figure V-9 for example of an Obstruction Chart). An additional item to consider in reviewing existing obstructions is whether they are permanent or temporary, since an obstruction that will be removed in the future may present an opportunity to recapture some operational capability for the airport. If another permanent obstruction is subsequently approved to an equal or greater height, the chance to regain some airport utility may be inadvertently forfeited.

o Shielding of Structures. Some proposed structures do not require Notice of Proposed Construction or Alteration because they are effectively shielded by an existing obstruction and would have "no greater aeronautical effect." Since the criteria for an exemption due to shielding are somewhat complex, the FAA is usually in the best position to determine whether or not a proposed structure would qualify under this type of exemption.

o Height Easements. In some cases airports have acquired height easements in the approach and departure areas for the airport. These easements have been purchased to protect the airspace used by aircraft and may be more restrictive than the height of the Part 77 imaginary surfaces. ALUC height restrictions should not be any less restrictive than the height restrictions provided by any existing airport easements. Additionally it is suggested that ALUC plans require that height easements be granted to the airport for any new structure developed in the ALUC height restriction area. Such easements will serve to limit further encroachment in the airspace if the site is redeveloped in the future or if it is subsequently desired to increase the height of the structure for some other reason.

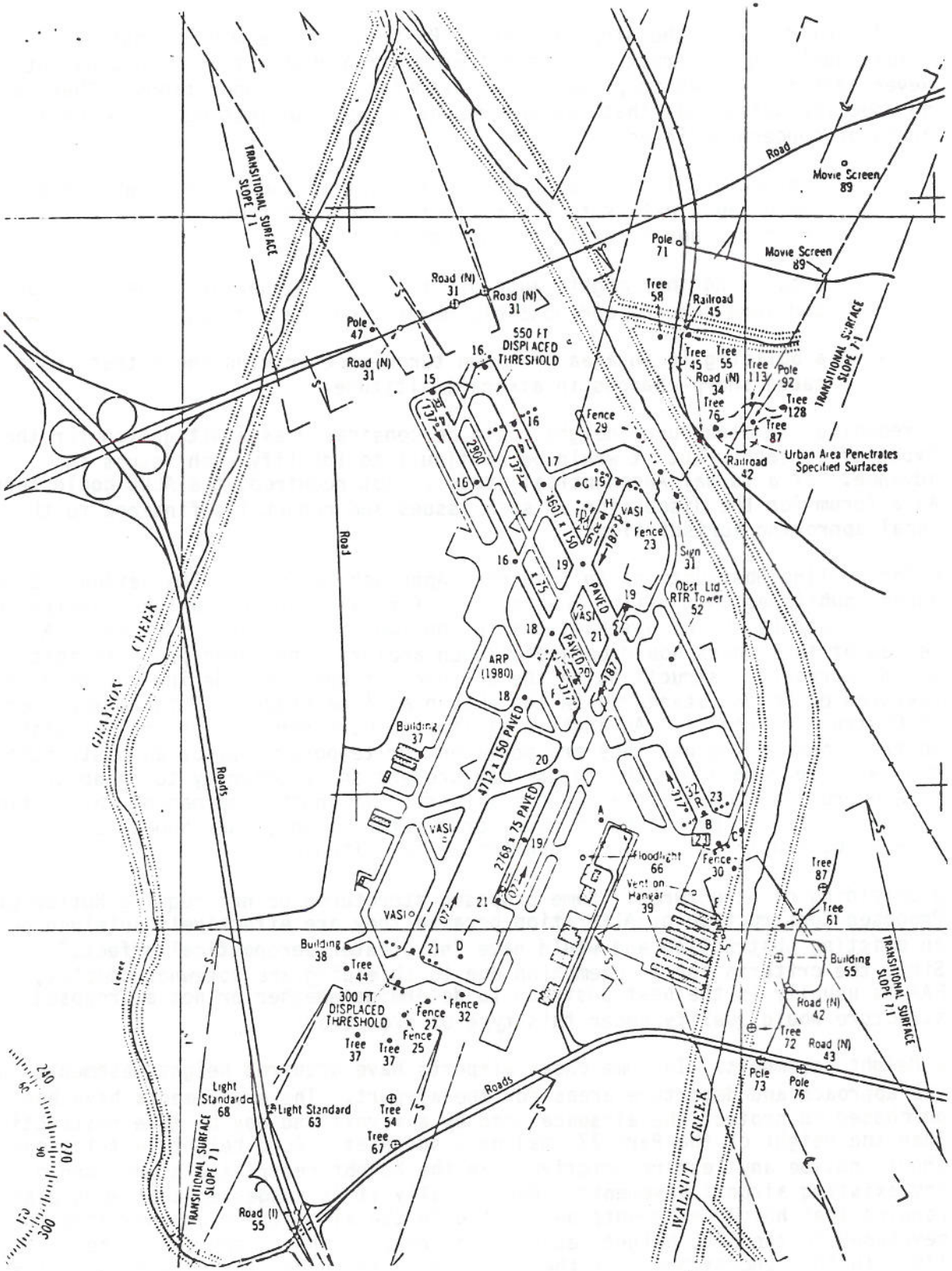
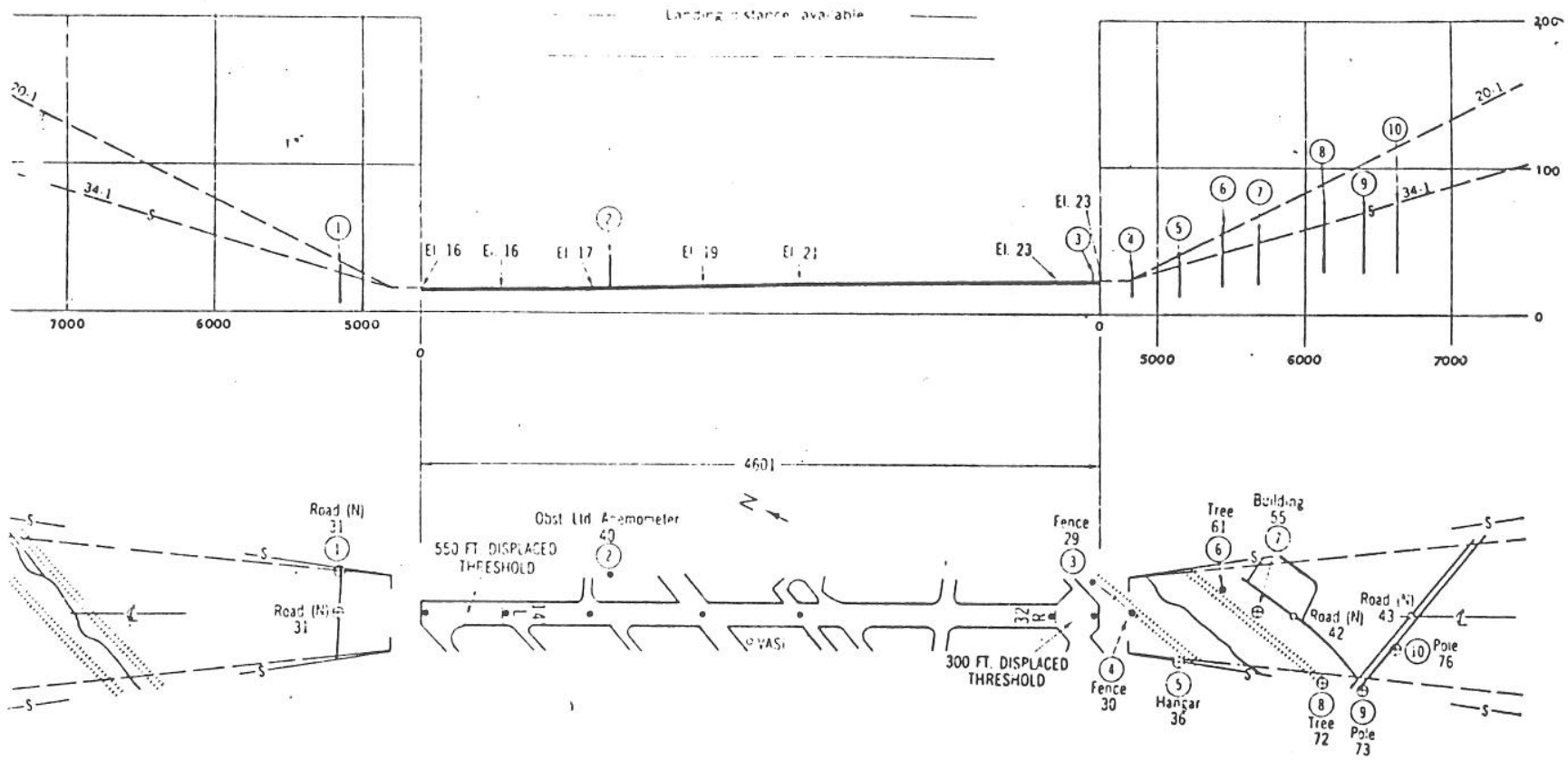



**Figure V - 9a**

## FAA OBSTRUCTION CHART
## Plan View of Obstructions in Approach Area




OPERATIONAL DATA

| RNWY ____ | | RNWY ____ |
|---|---|---|
| ——— | TAKE-OFF RUN AVAILABLE | ____ |
| - - - | TAKE-OFF DISTANCE AVAILABLE | ____ |
| — · — | ACCELERATE STOP DISTANCE AVAILABLE | ____ |
| — — — | LANDING DISTANCE AVAILABLE | ____ |

**Figure V - 9b**

## FAA OBSTRUCTION CHART
### Profile View of Obstructions in Approach Area

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## VI. PLANNING BOUNDARIES

Section 21675(c) of the Public Utilities Code provides for the adoption of ALUC planning boundaries and requires that these boundaries be established after hearing and consultation with the involved agencies. Several ALUC plans have adopted both a "planning boundary" and a "referral area." The planning boundary consists of the total area influenced by airport activity, while the referral area is a smaller area, having the most significant noise and safety concerns, where projects should be referred to the ALUC for its review. A variety of methods have been used to define planning boundaries and referral areas. The most common techniques for delineating these areas are:

- major transportation facilities and geographic features that include, as a minimum, the noise and safety impact areas
- existing or projected noise contours
- the Part 77 horizontal and conical surfaces
- separate maps showing noise, safety, and height restriction zones

Under the previous ALUC law, individual projects were submitted to ALUCs for their review. This project review function led to the selection of streets and roads and identifiable geographic features for defining referral areas, so that property owners could conveniently determine which areas were subject to ALUC review. Specific area plans around airports also define the planning boundary by using such features. Other ALUCs have adopted noise contours for the planning boundary. For most air carrier airports, the noise impact boundary will encompass the airport safety zones; however, for some general aviation airports the noise impact boundary may not include all of the appropriate safety zones. Noise contours will not include all the areas where ALUC height restrictions apply.

A third type of planning boundary uses the Part 77 horizontal and conical surfaces. As discussed in Chapter V, the horizontal surface is established by connecting arcs of either, 5,000 feet or 10,000 feet drawn from the primary surface at the ends of the runways. For general aviation airports, the horizontal surface has the advantage of encompassing the airport traffic pattern and the area regularly overflown by aircraft entering and leaving the airport traffic pattern. (The conical surface extends another 4,000 feet beyond the horizontal surface.) At large air carrier airports, the noise impact boundary can extend well beyond the horizontal surface, so these surfaces alone would not be sufficient to define the total area of ALUC concern. Finally, several ALUCs have simply prepared separate maps for noise impact areas, safety zones, and height restriction areas. Any project falling within one or more of these areas would be referred to the ALUC for review in relation to the appropriate policies for those areas.

### Planning Boundaries

The current ALUC law places more emphasis on planning boundaries as opposed to referral areas. For instance, Section 21676(c) of the Public Utilities Code states that each local agency whose general plan includes areas covered by an airport land use commission plan shall submit a copy of its general plan or specific plan(s) to the ALUC for a determination as to the consistency with the ALUC plan. Section 21676(b) of the Public Utilities Code states that

prior to the amendment of a general plan or specific plan or the adoption or approval of a zoning ordinance or building regulation within the planning boundary established by the ALUC, the local agency shall first refer the proposed action to the commission. The basic requirement for the planning boundary, therefore, is that it include all areas surrounding an airport in which there is some issue concerning airport land use compatibility that needs to be reconciled through the ALUC/general plan consistency review process.

To provide explicit information on the ALUC policies that apply within the area surrounding an airport, it is suggested that a composite planning boundary map be drawn identifying the following and referencing the appropriate ALUC policies:

- Noise Contours and Noise Annoyance Areas. Land use and sound insulation policies apply; also noise easements may be required
- Safety Zones. Use restrictions apply relative to types of land use, density of use and lot coverage.
- Part 77 Imaginary Approach Surfaces. Height restrictions apply; variances will be granted only if an FAA Aeronautical Study indicates there will be no adverse effects on air safety or significant loss of airport utility; obstruction marking and lighting may be required; height easements may also be required (Note: some ALUCs may also choose to adopt "departure" surfaces as discussed in Chapter V).
- Part 77 Horizontal Surface/Airport Traffic Pattern. Height restriction to 150 feet applies throughout the horizontal surface; variances will be granted only if an FAA Aeronautical Study indicates these will be no adverse effects on air safety or significant loss of airport utility; no large assemblages of people should be permitted; height easements may be required.
- Part 77 Conical Surface (optional).
- Extended Runway Centerline (Precision and nonprecision instrument runways only). Large concentrations of people in structures along the extended runway centerline should be discouraged.

The planning boundary would then be configured to include all of these areas. Figure VI-1 provides an example of how such a composite planning boundary map might look.

## Referral Area

Referral areas can still provide a useful function under the new ALUC law. Local agencies are encouraged to seek ALUC advice on projects that could significantly affect the airport, and the referral area would serve to identify the areas with the most critical noise and safety concerns. ALUCs will have a continuing interest in reviewing certain projects to ensure their consistency with the current general and specific plans, zoning ordinances, and building standards that are, in turn, consistent with the ALUC plan. Therefore ALUC plans may specify certain land use actions which should be referred to ALUCs for review, and ALUCs could develop working agreements with local agencies to this end. Such agreements could include cooperation between counties where the planning boundary and/or referral area for an airport covers portions of two or more counties. Selection of the referral area boundaries would be a matter of local discretion, depending on the significance of the noise and safety issues.

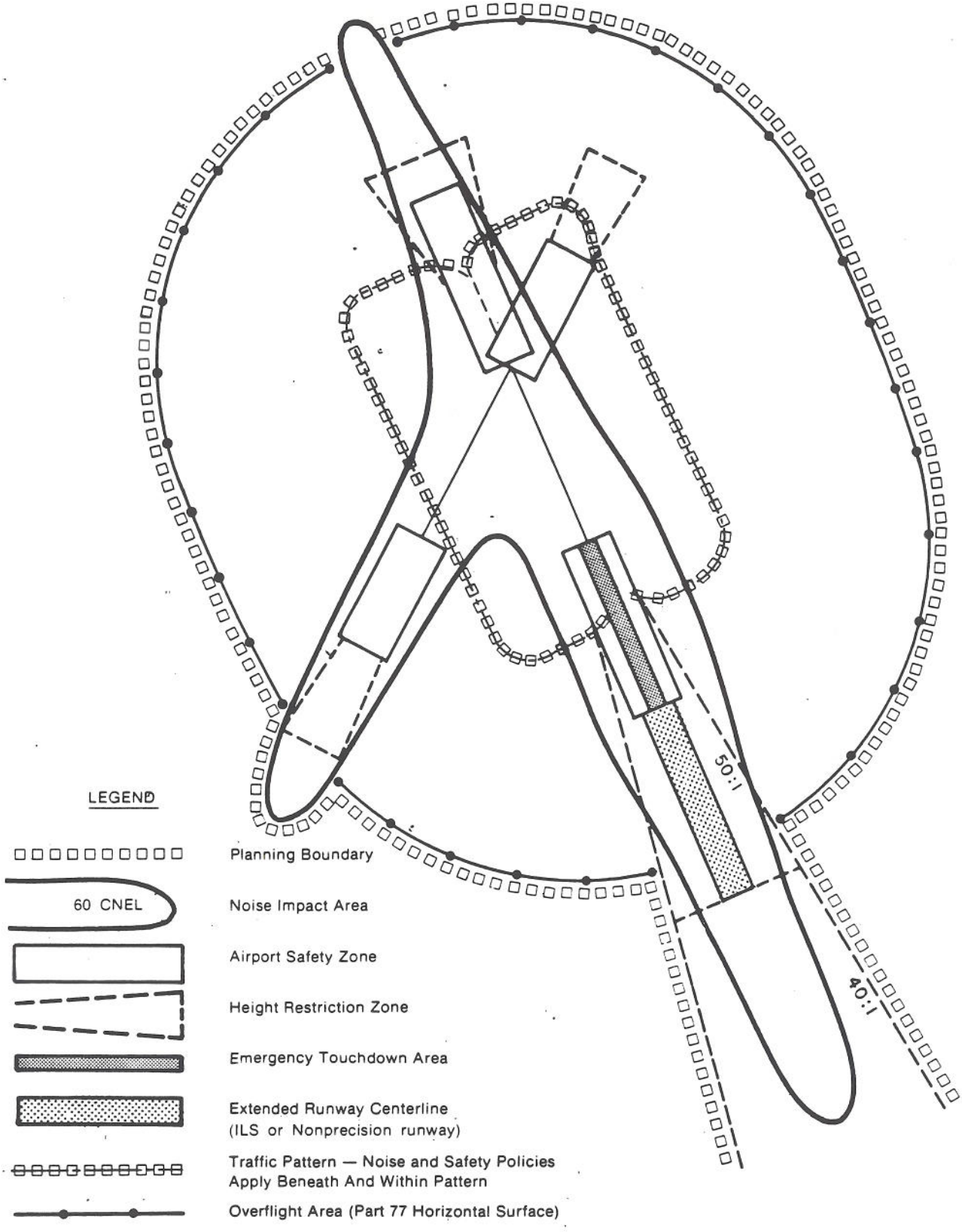


**Figure VI - 1**

**HYPOTHETICAL ALUC PLANNING BOUNDARY**

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# VII. AIRPORT MASTER PLANS

## Basis for Review of Airport Master Plans

Section 21675 of the Public Utilities Code states that the "commission plan shall include a long range master plan that reflects the anticipated growth of the airport during at least the next 20 years." Thus the master plan is the starting point for the preparation of the ALUC plan. Both the old and new ALUC law provide that each public agency owning an airport within the boundaries of the ALUC plan shall refer proposed changes to the ALUC prior to modification of its airport master plan. However, the law does not give the commission jurisdiction over the operation of an airport; the responsibility--and liability--for operational decisions resides with the airport proprietor.

## Contents of Airport Master Plans

An airport master plan provides a long range plan for airport development, typically addressing airport needs over a 20 year period. Airport master plans typically include the following major elements:

- Inventory of existing airport facilities
- Forecasts of anticipated growth in activity
- Demand/capacity analysis of airfield, ground access, terminal, and aircraft parking facilities
- Facility requirements--including the availability of land to meet future airport needs--relative to new and improved runways, taxiways, airport navigational aids, aircraft parking, terminal areas, airport access roads, and support facilities
- Staging of proposed development
- Capital costs
- Economic feasibility and financing
- Airport Plans--airport layout, land use, terminal area, airport access, etc.

Implementation of the airport master plan requires preparation of Environmental Impact Reports and Environmental Impact Statements under California and federal law. These documents discuss the range of alternatives considered for the proposed project and the associated impacts. The Master Plan is the usual source for the noise contours adopted by ALUCs in their plans and for the approach and clear zone plans depicting the Part 77 imaginary surfaces near the airport.

If an airport does not have a formal airport master plan, other sources can be tapped to provide the necessary information about the airport. For example, Section 65302(g) of the Government Code requires an airport to provide the local agency producing the noise element of the general plan "data relating to current and projected levels of activity and a detailed methodology for the development of noise contours given this supplied data, or they shall provide noise contours [as specified in the foregoing statements]."

Airport operators must have an approved Airport Layout Plan to receive federal aid (Reference 38). This plan provides detailed information on existing and

planned runways, runway length and strength, navigational aids, imaginary approach surfaces and clear zones and existing easements from which it is possible to develop airport safety zones and height restrictions for the airport (See Figure VII-1). If the airport is smaller and has not received federal aid, FAA Form 5010, "Airport Master Plan," provides a basic inventory of airport information including data on facilities, activity levels, and obstructions (See Figure VII-2). These forms are prepared for private as well as publicly owned airports.

Finally, Section 21661.6 of the Public Utilities Code requires that prior to land acquisition to expand an existing airport, the acquiring entity must submit a plan for such expansion to the board of supervisors or the city council in which the proposed property to be acquired is located. Prior to acquisition, the applicable board or council shall approve or disapprove the plan, and use of the land for airport-related purposes must be based on the approved plan. Variances from the plan may not take effect without approval by the applicable board or council.

## Areas for ALUC Review

Since the master plan directly affects ALUC recommendations regarding noise compatibility of surrounding land uses, safety zones, and height limits, airports should work closely with the airport land use commission in formulating changes to the master plan. For example, requirements for new safety zones and height restrictions in areas not presently included in the ALUC plan would have major planning and political implications.

Table VII-1 describes how different types of airport master plan recommendations could affect the ALUC plan. The following types of airport master plan recommendations represent the most critical planning concerns for ALUCS:

- 20 year forecasts of aviation use
- runway improvements
  - lengthening
  - strengthening
  - new parallel or crosswind runway
  - displaced runway landing threshold
- new navigational or lighting aids
  - increased approach precision (i.e., upgrading of visual approach to nonprecision approach or nonprecision to precision approach)
  - runway lighting
  - Visual Approach Slope Indicator (VASI)
- new ancillary facilities
  - cargo facilities
  - maintenance or engine testing facilities
  - helicopter landing areas
  - blast fences

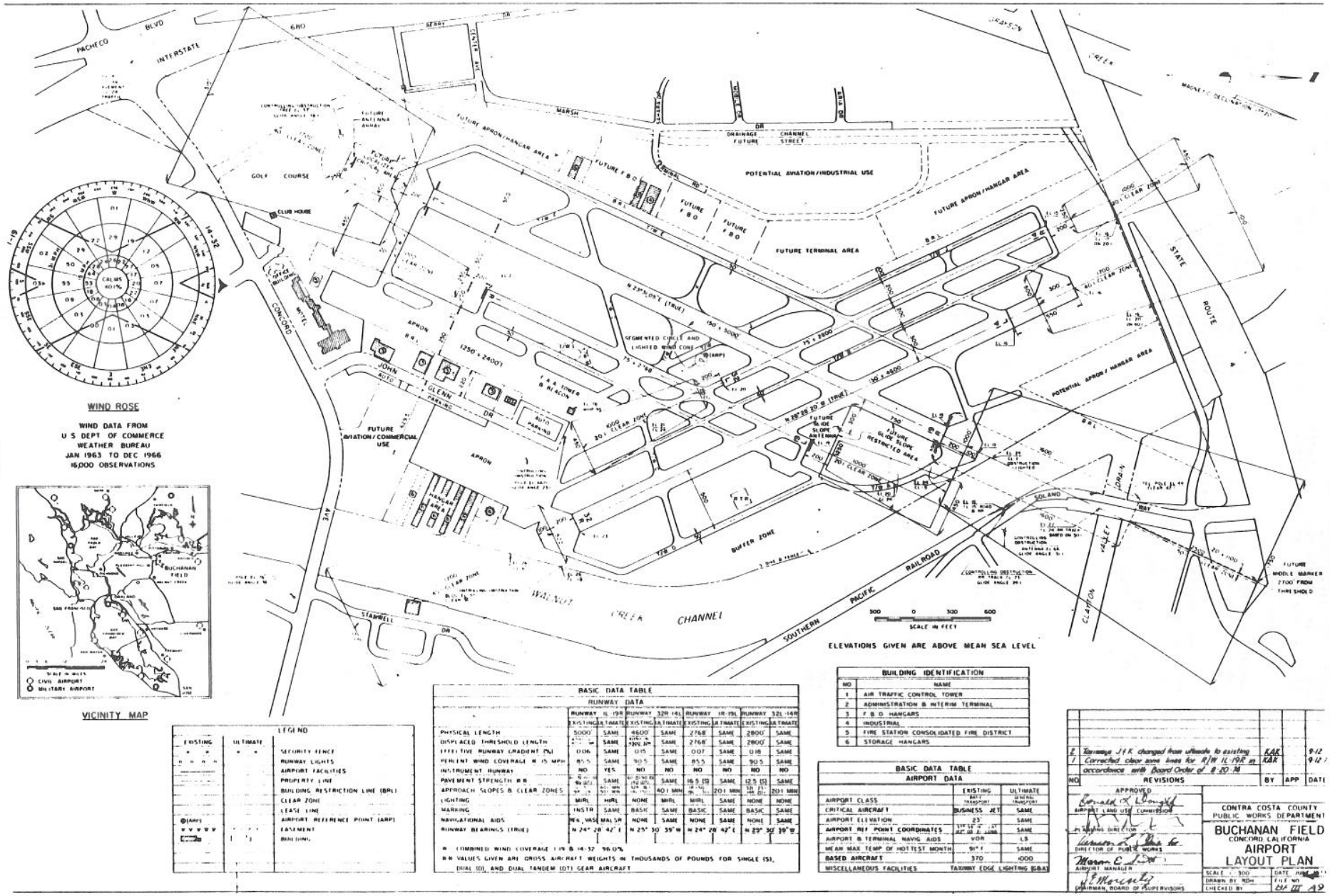


**Figure VII - 1**

**EXAMPLE OF AN AIRPORT LAYOUT PLAN**

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>1 ASSOC CITY: SANTA ROSA                    4 STATE: CA          FAA SITE NR: 02258.A
>2 AIRPORT NAME: SANTA ROSA AIR CENTER                  5 COUNTY: SONOMA CA
 3 CBD TO AIRPORT(NM): 03 SW  6 REG/ADO: AWE/SFO  7 SECT AERO CHT: SAN FRANCISCO

        GENERAL                                  SERVICES                BASED AIRCRAFT

 10 OWNERSHIP: PRIVATE                      >70 FUEL: 80 100              90 SINGLE ENG:   86
>11 OWNER: SANTA ROSA ARPT ASSOCTS          >71 AIRFRAME RPRS: MINOR      91 MULTI ENG:     1
>12 ADDRESS: BOX 874                        >72 PWR PLANT RPRS: MINOR     92 JET:
             SAN CARLOS, CA 94070           >73 BOTTLE OXYGEN: NONE            TOTAL       87
>13 PHONE NR: 415-591-5748                  >74 BULK OXYGEN: NONE
>14 MANAGER: MRS CHARLOTTE TOLLEFSON         75 TSNT STORAGE: TIE         93 HELICOPTERS:
>15 ADDRESS: BOX 7157                        76 OTHER SERVICES: INSTR     94 GLIDERS:
             SANTA ROSA, CA 95401               RNTL                    95 MILITARY:
>16 PHONE NR: 707-545-9664.
>17 ATTENDANCE SCHEDULE:
      MONTHS      DAYS      HOURS
       ALL         ALL      0800-DUSK          FACILITIES              OPERATIONS
                                               - - - - - - - -         - - - - - - - - - -
                                           >80 ARPT BCN: N             100 AIR CARRIER:
 18 AIRPORT USE: PUBLIC                    >81 APT LGT SKED:           101 COMMUTER:
 19 ARPT LAT: 38-24-52N      ESTIMATED     >82 UNICOM: 122.800         102 AIR TAXI:
 20 ARPT LONG: 122-45-25W                  >83 WIND INDICATOR: YES     103 G A LOCAL:      50000
 21 ARPT-ELEV: 00100  ESTIMATED             84 SEGMENTED CIRCLE: YES   104 G A ITNRNT:     30000
 22 ACREAGE: 00500                          85 CONTROL TWR: NO         105 MILITARY:
>23 RIGHT TRAFFIC: 34                       86 FSS: UKIAH                    TOTAL:      80000
>24 NON-COMM LANDING FEE: NO                87 FSS ON ARPT: NO
 25 NASP/FEDERAL AGREEMENT: N               88 FSS PHONE NR: 707-462-8878   OPERATIONS FOR 12
 26 FAR 139 INDEX: N                        89 TOLL FREE NR: 545-3724       MOS ENDING 03SEP81

      RUNWAY DATA
- - - - - - - - - - -
>30 RUNWAY IDENT              16/34
>31 LENGTH:                   6889
>32 WIDTH:                    200
>33 SURF TYPE-COND            CONC-G
>34 SURF TREATMENT
 35 GROSS WT: SW              *
 36 (IN THSDS) DW
 37            DTW
 38            DDTW

    LIGHTING/APCH AIDS
- - - - - - - - - - - -       16/34
>40 EDGE INTENSITY
 41 NOW ELEMENT 81
>42 RWY MARK TYPE-COND       *NSTD-F/NSTD-F      /        /        /        /
>43 VASI                      N      /N          /        /        /        /
 44 THR CROSSING HGT                 /          /        /        /        /
 45 VISUAL GLIDE ANGLE               /          /        /        /        /
>46 CNTRLN-TDZ                N-N    /N-N        /        /        /        /
>47 RVR-RVV                   N-N    /N-N        /        /        /        /
>48 REIL                      N      /N          /        /        /        /
>49 APCH LIGHTS                     /          /        /        /        /

    OBSTRUCTION DATA
- - - - - - - - - - - -       16/34
 50 FAR 77 CATEGORY           B(V)   /B(V)       /        /        /        /
>51 DISPLACED THR             1032   /1580       /        /        /        /
>52 CTLG OBSTN                TREES  /POLES      /        /        /        /
>53 OBSTN MARKED/LGTD               /          /        /        /        /
>54 HGT ABOVE RWY END         65     /25         /        /        /        /
>55 DIST FROM RWY END         850    /276        /        /        /        /
>56 CNTRLN OFFSET             0R     /0R         /        /        /        /
 57 OBSTN CLNC SLOPE          *10:1  /3:1        /        /        /        /
 58 CLOSE-IN OBSTN            N      /N          /        /        /        /

 20:1 LANDING LENGTH
- - - - - - - - - - - -       16/34
 60 LANDING RWY-LENGTH               /          /        /        /        /
 61 CTLG OBSTACLE                    /          /        /        /        /
 62 HGT-ABOVE THR                    /          /        /        /        /
 63 DIST FROM THR                    /          /        /        /        /
 64 CNTRLN OFFSET                    /          /        /        /        /

(>) ARPT MGR PLEASE ADVISE FSS IN ITEM 86 WHEN CHANGES OCCUR TO ITEMS PRECEDED BY >
>110 REMARKS:
A035      RWY 16 /34  GROSS WEIGHT STRENGTH PRVDD BY OWNER 30000 LBS.
A042      RWY 16  NO NUMBERS AT RWY 16 DSPLCD THR.
A057      RWY 16  APCH RATIO 30:1 FROM DSPLCD THR.
A057      RWY 34  APCH RATIO 49:1 FROM DSPLCD THR.
A110 -01  FLD CONDS-RWY, TWY, APRON-WEEDS AT JOINTS IN CONCRETE.
A110 -02  ARPT CLSD TO NIGHT OPNS.
A110 -03  ACFT OPERS USE BEST NOISE ABATEMENT PROCEDURES. RECOMMEND ACFT LNDG RWY 16 MAKE
          BASE LEG SOUTH OF HIGHWAY AT NORTH AND NOT LAND STRAIGHT-IN.

111 INSPECTOR: (S)                    112 LAST INSP: 03SEP81  113 LAST INFO REQ:
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FAA Form 5010-2 (8-80) SUPERSEDES PREVIOUS EDITION

Figure VII - 2a

**AIRPORT MASTER RECORD**
**FAA Form 5010**

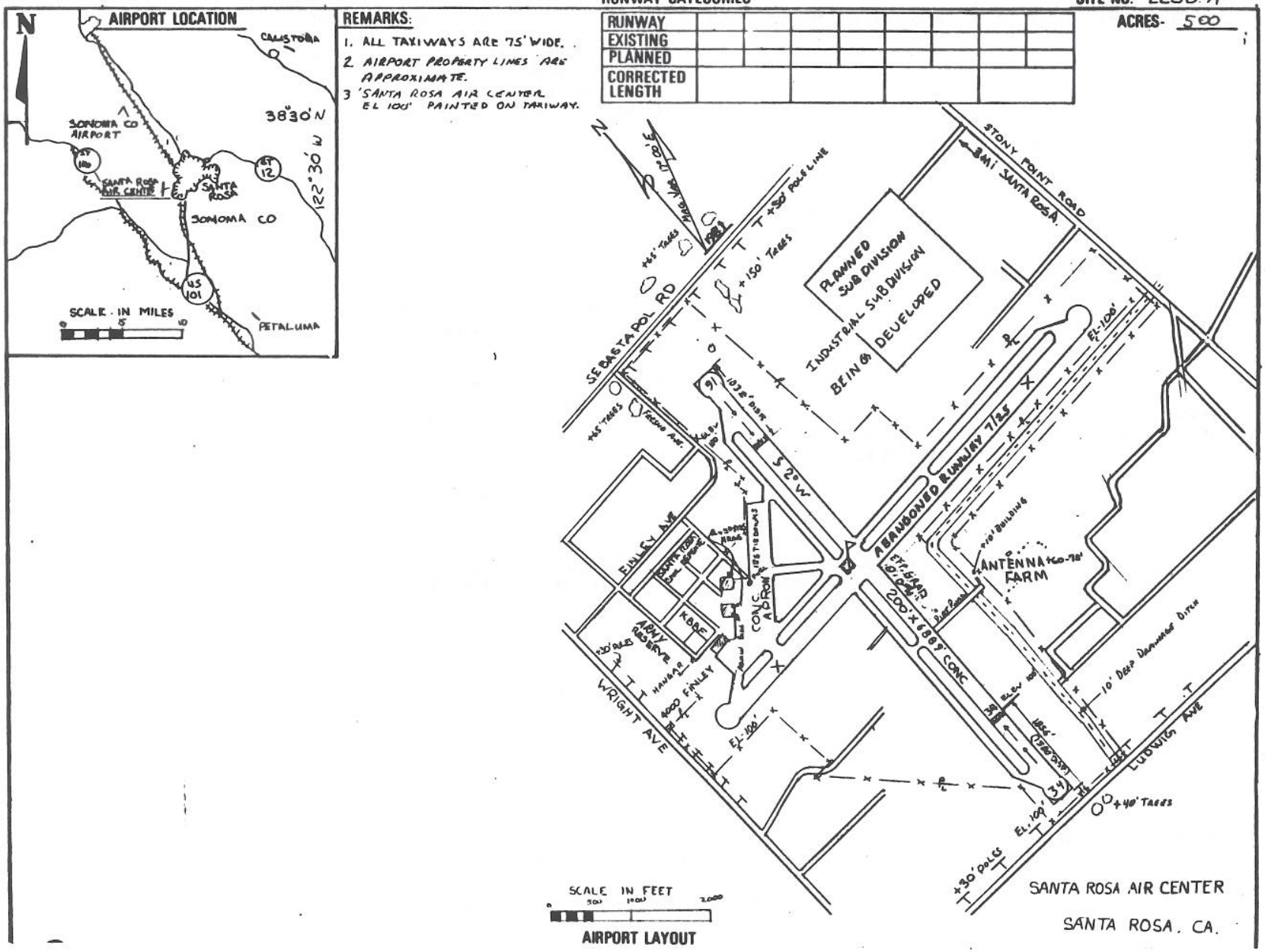


Figure VII - 2b

**AIRPORT MASTER RECORD**
**FAA Form 5010**

Table VII-1

Airport Master Plan Review Areas

| | NOISE COMPATIBILITY | SAFETY ZONE | HEIGHT LIMITS |
|---|---|---|---|
| 20 year Forecasts<br>o Number of takeoffs and landings<br>o Types of aircraft using airport | o Forecasts provide the basis for the noise contours:<br>- is new or expanded airline service anticipated? What types of aircraft? How many operations?<br>- will air cargo activity increase?<br>- what percentage of general aviation airport activity will be single, twin engine and business jets? What types of business jets? | o Introduction of new aircraft types may require adjustment of safety areas | o New air service may be predicated on improved navigational aids which may affect height limits |
| Runway Improvements | | | |
| o Strengthen runway | o Stronger runways can accommodate heavier aircraft which may result in:<br>- fewer operations (larger planes carrying more passengers)<br>- more operations by heavier, potentially noisier, aircraft compared to current types using airport | o Introduction of new aircraft types may require adjustment of safety areas | |
| o Lengthen runway | o Longer runways could:<br>- result in new, larger aircraft using the airport<br>- permit takeoff weight (and noise) to be increased for longer stage length flights<br>- permit landing threshold to be shifted, which could result in higher approaches (lower noise) over populated areas<br>- bring takeoff noise closer to existing population areas | o Safety zones would be shifted and may need to be expanded for new aircraft types | o Part 77 imaginary surfaces would be shifted with runway |
| o Add new runway<br>-Parallel | o Could substantially increase operations and could increase noise<br>o Could possibly permit landings on one runway, takeoffs on another, thereby reducing noise over sensitive areas<br>o Could result in a new traffic pattern pattern (s) impacting areas where no traffic existed before (e.g. addition of a new traffic pattern on opposite side of airport) | o Would add new safety zones | o Would increase area where height restrictions apply<br>o New instrument approach and departure procedures may affect new areas |
| -Crosswind | o Could introduce noise into entirely new area, or<br>o Could relieve noise in an area experiencing excessive noise<br>o Could shift noise from one community to another, but result in a net reduction in total noise exposure | o Would add new safety zones | o Would establish height restrictions in landing and takeoff areas for new runway<br>o New instrument approach and departure procedures may affect new areas |

Table VII-1 (con't.)

Airport Master Plan Review Areas

| | NOISE COMPATIBILITY | SAFETY ZONE | HEIGHT LIMITS |
|---|---|---|---|
| - Displaced threshold | o Could provide minor improvements in noise due to increased altitude over community or shift takeoff noise further away from community (for displaced takeoff threshold)<br>o May cause a shift in landings to another runway, due to aircraft landing distance requirements | o Should not affect safety zones which are established from physical end of runway | o Part 77 imaginary surfaces may or may not be affected |
| New Navigational Aids/Lighting | | | |
| o Increase precision of approaches | o Installation of navigational aids for precision or nonprecision approach could increase airport use | o Precision approach could affect size of safety zones | o In general, a more precise approach would result in more stringent height restrictions due to imaginary surfaces and TERPS criteria |
| o Runway lighting | o Runway lighting is a safety feature but could result in increased nighttime use of airport | | |
| o Visual Approach Slope Indicator | o Could bring general aviation aircraft lower to ground due to shallower (3°) approach for VFR traffic | | |
| Airport Facilities | | | |
| o Air cargo facilities | o New or expanded cargo facilities can result in increased nighttime operations which could have a significant effect on noise contours | | |
| o Maintenance and engine test facilities | o Relocation of engine runup areas can reduce noise in surrounding communities | | |
| o Blast fences at runway ends | o Blast fences, to control jet exhaust, would only have minor effect on noise<br>o Blast fences may increase effective length of runway (if aircraft gain takeoff distance) and possibly shift noise from one runway to another | | |
| o Helicopter landing areas | o Helicopter approach and departure paths are usually a concern due to unique characteristics of helicopter noise | | o Imaginary surfaces may need to be incorporated for helicopter landing and takeoff areas |

## Airport Noise Control Programs

There are currently ten (10) airports in California that have been officially declared to have a "noise problem" -- nine air carrier and one general aviation airport. These airports as well as many other airports throughout the state have formalized noise control programs. It is suggested that ALUCs incorporate these noise control programs in their own plans to show the basis for the adopted noise impact boundaries. By making such programs explicit within the ALUC plan, ALUCs have a basis for commenting on proposed airport operational changes.

There are, of course, a variety of actions that may be considered for inclusion in an airport noise control program. The California airport noise standards (See Appendix B) lists methods whereby the impact of airport noise can be controlled and reduced. They include but are not limited to the following:

1. Encouraging use of the airport by aircraft classes with lower noise level characteristics and discouraging use by higher noise level aircraft classes;
2. Encouraging approach and departure flight paths and procedures that minimize the noise in residential areas;
3. Planning runway utilization schedules to take into a account adjacent residential areas, noise characteristics of aircraft and noise sensitive time periods;
4. Reduction of the flight frequency, particularly in most noise sensitive time periods and by the noisier aircraft;
5. Employing shielding to advantage, using natural terrain, buildings, etc.; and
6. Development of a compatible land use within the noise impact boundary. Preference shall be given to actions which reduce the impact of airport noise on existing communities. Land use conversion involving existing residential communities shall normally be considered the least desirable action for achieving compliance with these regulations.

One approach that is being used in the San Francisco Bay Area to manage airport noise is the establishment of noise "budgets" for the major commercial airports. This budget is defined by the number of dwelling units or acres within the projected 65 CNEL contour, with interim yearly targets being set to achieve quantifiable noise control objectives within a specific time frame. If the yearly targets are not being achieved through the introduction of quieter aircraft into the airline fleet and the adopted noise control program, airport proprietors would need to develop additional measures to bring noise impacts into line with the targeted budget. This type of noise management program has distinct advantages for ALUCs since it provides greater certainty that the noise impact boundary will not be significantly expanded beyond the limits adopted in the ALUC plan. Airports that become involved in this type of program should use their noise monitoring systems to annually update the noise contours. Figure VII-3 shows how noise impacts have changed at San Francisco International Airport in relation to the adopted noise budget for this airport.

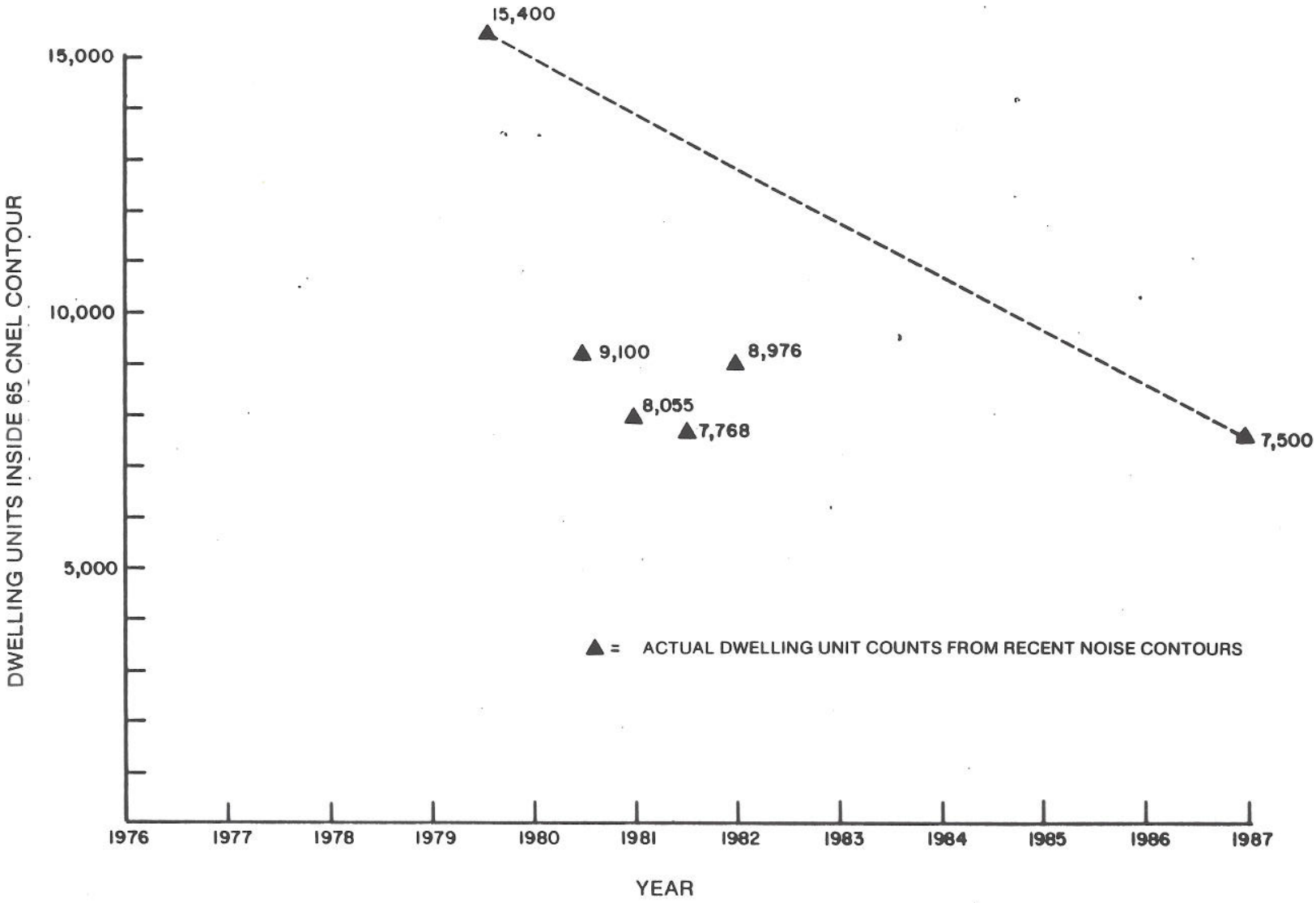


**Figure VII - 3**

**SAN FRANCISCO INTERNATIONAL AIRPORT NOISE "BUDGET"**

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# VIII. ACHIEVING CONSISTENCY THROUGH PLAN REVISIONS

Previous chapters have covered the preparation and modification of local airport land use plans adopted by ALUCs. State law now requires consistency between an applicable general plan adopted by a city or county and the airport land use commission plan. Appendix A contains the text of the airport land use commisson law. This chapter covers the first method by which cities and counties can achieve the required consistency through amendment of county and city general plans.

This chapter is intended to answer questions posed with respect to implementation of AB 2920's provisions. It does not substitute for the guidance provided in the Office of Planning and Research's "General Plan Guidelines" (Reference 41), which local agencies should consult in adopting plan revisions. It is intended to complement the state guidelines in certain technical areas.

## Airport Land Use Commission Determinations

By August 31, 1983, each ALUC is to review the plans submitted by cities and counties on or before July 1, and determine whether they are consistent or inconsistent with the existing ALUC plans, as such plans provide on July 1. If a determination of inconsistency is made by an ALUC, the local agency is to be notified, and is required to have a hearing to reconsider its plans. The local agency may overrule the ALUC determination by adopting specific findings that the actions in the general plan are consistent with the purposes of the ALUC statute.

In a similar way, city or county proposals to amend the general or specific plan, or to adopt or approve a zoning ordinance or building regulation, must first be referred to the commission. The same requirements are applied to public agencies owning airports; prior to modification of airport master plans, the proposed modification must be referred to the applicable ALUC for review and a determination of consistency or inconsistency. The law provides that a commission is required to make a determination of consistency or inconsistency within 60 days from the date of referral. If not specifically made within that period, Section 21676 provides that the proposed action "shall be deemed consistent with the commission's plan."

## Two Methods to Achieve Plan Consistency

The Legislature, in enacting Chapter 1041 of the Statutes of 1982 (AB 2920), provided cities and counties with two ways to make the ALUC and general plans consistent. The first is to incorporate or otherwise reflect the content of the airport land use commission plan in the general plan and applicable implementation regulations, such as zoning ordinances and building codes. Specific issues related to use of this method of achieving consistency are discussed in this chapter.

Alternatively, if a city or county does not agree with specific provisions of the ALUC plan, and wishes to adopt a different provision within the general plan (or, again, implementing regulations), it may do so and still achieve consistency with the ALUC plan by adopting specific findings that the change enacted is consistent with the stated purposes of the ALUC law. Use of specific findings to achieve consistency is discussed in Chapter IX.

## Consistency Begins with the ALUC Plan

Section 65302.3(a) of the Government Code requires local government general plans, and any applicable specific plan, to be consistent with an applicable ALUC plan adopted under Public Utilities Code Section 21675. This provision of the Government Code was added by enactment in 1982 of AB 2920.

Specifically, the Government Code section requires that the general or specific plan "shall be amended...to be consistent with provisions of the plan" developed by the ALUC under PUC Section 21675.

Until December 31, 1983, the baseline ALUC plan for determining consistency is the ALUC plan as of July 1, 1983.

After December 31, 1983, the general plan and any applicable specific plans must be amended within 180 days of an amendment to an ALUC plan, in accordance with the provisions of the new Section 65302.3, which will be added to the Government Code on January 1, 1984.

The phased implementation of the new process will mean cities and counties can amend their plans to achieve initial consistency with the existing ALUC plans during the period until December 31, 1983. During this same period, ALUCs may develop new provisions for their plans, and can adopt those amendments after January 1, 1984. These amendments would subsequently have to be considered by local agencies for incorporation within the general plan.

## Is There a Six-Month Escape Window from Consistency Requirements?

During discussions with ALUC staffs and commissioners, and local government staffs in the preparation of this report, concern has been expressed that AB 2920's changes to the Government Code may have inadvertently granted an "escape window" for six months between January 1, 1983 and July 1, 1983, during which time local governments could approve projects without any ALUC review. Similar concerns were voiced about the six-month period between July 1, 1983 and December 31, 1983, in which time local governments could amend their general plans in a manner to enable development without any ALUC review as it existed on July 1, 1983.

These two periods are addressed separately below.

1. Could local governments approve projects between January 1, 1983 and July 1, 1983 without review by an ALUC? Although this question is addressed in this handbook after the end of the time period in question, it is worth setting forth an interpretative answer.

Under provisions of the revised Sections 21674 and Section 21676 of the Public Utilities Code, ALUC commissions retained their authority to review plans, zoning ordinances and building regulations of cities and counties. This authority was in effect on January 1, 1983. Therefore, if an ALUC wished to review a local government's action after January 1, 1983, it had the authority under those sections to advise the local agency of its concerns. Obviously, if an ALUC plan did not provide policies for the project area in question, the ALUC's ability to make determinations of consistency was reduced considerably. However, this concern is not a deficiency of the law itself.

2. What happens with respect to ALUC and local plan amendments proposed after July 1, 1983 and before December 31, 1983?

Although ALUCs may adopt amendments to their plans at any time, any amendment adopted between July 1, 1983 and December 31, 1983 would not necessarily have to be reflected in the local general plans. If there is a concern that a city or county may not be willing to amend the general plan (because Government Code Section 65302.3 as it reads until January 1, 1984 does not require this) to reflect an ALUC plan amendment provision adopted after July 1, 1983, but before December 31, 1983, the ALUC should, as a practical matter, postpone the plan amendment until January 1, 1984 or thereafter.

However, during the same period, any local government's proposed amendment of its general plan would have to be referred to the ALUC for consideration and a determination of consistency prior to adoption by the local agency. **This authority is contained in Section 21676 of the Public Utilities Code, which requires ALUCs to be consulted with respect to proposed general plan changes, and requires ALUCs to make a determination of consistency.**

What ALUCs Review Under AB 2920

As stated above, the first step in developing the required consistency among plans is for the ALUC to review the existing general and specific plans and determine whether those plans are consistent with the ALUC plan as it exists on July 1, 1983.

**If a consistency determination is made by the ALUC with respect to an existing general plan provision, no further action by the city or county is necessary under the provisions of the law prior to December 31, 1983.** "Existing" in this context means a plan as adopted by a local agency prior to July 1, 1983. If a notification that a local plan is inconsistent with an ALUC plan is not made by or shortly after August 31 (the deadline by which ALUCs are to act to determine consistency or inconsistency), and absent any information a city or county may have that its plan is inconsistent, the local agency may reasonably presume its plan is consistent with the ALUC plan. However, such a presumption probably could not reasonably be defended if the local agency failed to submit its plan to the ALUC for review.

If an ALUC determines the general plan provisions or a specific plan is inconsistent with the ALUC plan, it is required to notify the city or county of that determination. Neither the old ALUC law nor provisions of AB 2920 state specifically the grounds under which the ALUC is to determine consistency. However, the ALUC considerations must be based on an adopted ALUC plan. The purposes of ALUC planning are stated in Sections 21670, 21674 and 21675 of the Public Utilities Code. Therefore, the consideration of general plan consistency should--at a minimum--address the specific statutory language.

Under provisions of Section 21676(a) of the Public Utilities Code, if a determination of inconsistency is made by an ALUC, the local agency would then hold a hearing to reconsider the applicable plan provision(s) the ALUC has determined to be inconsistent with the ALUC plan. At that point, the local agency can adopt a modification in its plan to overcome the stated reasons for the ALUC determination of inconsistency, or it can adopt findings that the general plan provision is consistent with the ALUC plan. The use of findings to establish consistency is covered in Chapter IX. The local agency, if it enacts a modification to its plan, should also amend other portions of the general plan, applicable implementing ordinances and other regulations, to ensure internal plan consistency as required by law.

Another common question asked in the discussions with ALUC and local government staff during preparation of this handbook was whether it is necessary for ALUCs to review zoning ordinances and other building regulations, in addition to general and specific plans. There is no simple answer.

Neither consistency or inconsistency between the ALUC plan and plans of local agencies should be presumed at the outset of the review process. The ALUC, in taking its actions to review local plans prior to August 31, 1983, should review whatever documentation is available from a city or county to support a finding of either consistency or inconsistency. If the general plan is not very specific, the ALUC staff should review the zoning ordinances to determine whether a finding of consistency could be defended. Sections 21661.5, 21674, 21675 and 21676 establish the legal basis for the commission review of a city or county general plan, implementing regulations and other local government actions (powers and duties for the most part unchanged by AB 2920). Under these sections, an ALUC may:

- Review plans, regulations and other actions of local agencies (Section 21674).
- Develop height restrictions on buildings (Section 21675).
- Specify use of land (Section 21675).
- Determine building standards, including soundproofing adjacent to airports (Section 21675).
- Review proposed amendments to general or specific plans (Section 21676).
- Review the proposed adoption of a zoning ordinance or building regulation (Section 21676).
- Review proposed changes to an airport master plan (Section 21676).
- Act upon plans for the construction of a new airport (Section 21661.5).

The levels of activity under these sections would vary in the state, depending on the complexity of planning issues, adequacy of existing plans, and staff and other resources.

To summarize, AB 2920 imposes an obligation on ALUCs to make a determination that local general plans are "consistent" or "inconsistent" with the provisions of the ALUC plan. The ALUC should review those local government documents it believes necessary to make such a determination. It need not review the entire general plan, every specific plan, the entire zoning ordinance and every regulation adopted by the local agency. It should review relevant documents but not those unrelated to airport land use compatibility.

Individual Projects and Internal Plan Consistency

Related to the question of what ALUCs are to review under AB 2920 is the question of whether state law provides ALUCs with authority to review individual projects.

The previous ALUC law on this question was not very precise. It is unclear whether ALUCs had the authority to review development proposals except as they could be categorized as an "action or regulation" under the previous Section 21674. Legal counsels for ALUCs in the state are of diverging opinions on this point. AB 2920 was only somewhat more definitive--referring to ALUCs powers to review "plans, regulations and other actions of local agencies and airport operators...." Notwithstanding that uncertainty, other parts of state law with respect to local planning may provide adequate guidance on the point.

Section 65300.5 of the Government Code declares legislative intent that the "general plan and elements and parts thereof comprise an integrated, internally consistent and compatible statement of policies...." The California Supreme Court in a recent case (Bownds v. City of Glendale [1980] 113 Cal. App. 3d, 875) noted that the purpose of this requirement has been to "ensure that decisions made by local governmental entities, which affect future growth of their communities, will be the result of considered judgment in which due consideration is given to the various interrelated elements of community life...."

Required Consistency of General and Specific Plans. Specific plans adopted under Article 8 of Chapter 3 (commencing with Section 65450) of the local planning law are required by Section 65451 of the Government Code to contain "all detailed regulations, conditions, programs and proposed legislation" necessary to carry out the provisions of the general plan's mandatory elements, including the noise, land use and circulation elements.

Required Consistency of Zoning Regulations with General Plan. Chapter 4 of the local planning law (commencing with Section 65800) specifies the legal requirements for zoning regulations. Section 65860 provides that a county or general law city **zoning ordinance** "shall be consistent" with the applicable general plan. Section 65803 of the Government Code states that charter cities except Los Angeles are exempt from the plan-zoning ordinance consistency requirement except to the extent required by a city charter or ordinance (many do so). Section 65800 provides that the zoning limitations imposed by state law are intended as a "minimum of limitation in order that counties and cities may exercise the maximum degree of control over local zoning matters." A **development agreement** authorized under Section 65867.5 of the Government Code cannot be approved "unless the legislative body finds that the provisions of the agreement are consistent with the general plan and any applicable specific plans."

**Variances** from the requirements of a zoning ordinance are granted under Section 65906 of the Government Code. This section provides for variances only when application of the ordinance would deprive the property of privileges enjoyed by other property in the vicinity under

identical zoning conditions. Variances are not a change in zoning but a legitimately sanctioned deviation from zoning provisions. The granting of a variance is an administrative function and is discretionary. Consequently, a variance would probably not constitute an "other action" subject to review by an ALUC unless the requested condition is directly related to a matter of ALUC concern (e.g., variance from a height limitation contained in an ordinance). Under Section 65901 of the Government Code, **conditional use permits** may be issued under criteria listed in a zoning ordinance. Conditional use permits are probably not an "other action" subject to ALUC review unless the proposed use is clearly incompatible with the orderly function of an airport.

Required Consistency of Subdivision Maps with the General Plan. Under provisions of Section 66473.5 of the Government Code, a city or county cannot approve a subdivision map unless the city council or board of supervisors finds the proposed subdivision to be consistent with the general plan or any specific plan.

**In general, therefore, unless an ALUC believes a case can be made that a local agency is not following the above-referenced sections of law in approving projects, a review of the general plan and specific plan provisions and applicable ordinances or building regulations should suffice to determine consistency of local government actions.**

This general conclusion, however, does not preclude an ALUC from including within its plan the types of city or county actions it desires to review to achieve the purposes of the ALUC law. Nor does it preclude a city or county from seeking an ALUC recommendation on an individual project. It should be apparent from this and foregoing chapters that airport land use planning and achieving compatibility are not simple matters. Airport land use issues vary throughout the state. ALUC plans deal with differing conditions.

A building on one part of a development site might be airport compatible and on another part of the same site it might not be. Under a zoning ordinance, either location might be acceptable. It is important, therefore, that cities, counties and airport operators work cooperatively with the ALUCs to fulfill the coordinated planning purpose established by Section 21674 of the Public Utilities Code. Case-by-case analyses--while not always desirable and in some cases inappropriate--might be called for when a potentially incompatible development is proposed and where the potential solution to avoid incompatibility does not necessarily involve project denial.

## Dealing with Incompatible Uses

As noted earlier in this report, AB 2920 is primarily directed at preventing **new** noise and safety problems, and not at addressing existing existing problems of incompatibility of land uses with airport activity. Despite enactment of AB 2920, the problem of existing incompatible uses remains one of the most difficult problems facing ALUCs, cities, counties, and airport operators.

It is fairly well understood that AB 2920's planning consistency process will not address the removal of **existing** incompatible uses from the airport environs. "Incompatible uses" are defined in Section 5014 of the California Administrative Code for airport noise purposes. No comparable definition exists for safety purposes.

Within the context of local government planning and zoning law, the term most comparable to an "incompatible use" is the "nonconforming use." Zoning ordinances ordinarily provide for exemption of existing nonconforming uses from the requirements of the ordinance. Numerous court cases have upheld the power of local agencies to include such exemptions within their zoning ordinances. Local agencies may also include provisions in the ordinance requiring the termination of a nonconforming uses within a "reasonable" time period, to allow for amortization of investments made in property improvements. A local agency may also enact zoning ordinance provisions to prohibit enlargement or extension of a nonconforming use of land. Court decisions have also upheld the ability of a local agency to deny a change in use from a lawful nonconforming use to a substantially different nonconforming use (although it remains unclear what constitutes a "substantially different" nonconforming use).

Several ALUC and airport vicinity plans reviewed in the preparation of this report include provisions recognizing incompatible or nonconforming uses, but they do not declare existing incompatible uses "inconsistent." It is probably not wise to do so. The ALUC law declares as one of its purposes the minimization of exposure of land around airports to excessive noise and safety hazards "to the extent that such areas are already devoted to incompatible uses."

While it appears most appropriate to recognize the existence of existing incompatible uses but not to declare them inconsistent, the ALUC plans and local general plans should address changes in existing uses within the airport environs. The ALUC plans that include such provisions approach changes in uses in a fashion similar to how a city would treat a nonconforming use under the zoning ordinance--namely that, over time, these would be eliminated. Examples are discussed below.

The San Mateo County ALUC plan provides guidelines dealing with infill development in an area already devoted to incompatible uses (discussed in Chapter III). The plan also provides for the reconstruction of "nonconforming uses" destroyed by fire or natural disaster if the portion destroyed is valued at less than 50% of the market value of the improvements. Neither the infill policy nor the replacement policy apply to property within the airport approach zones.

The Sacramento County ALUC has adopted policies with respect to incompatible uses around Executive Airport. These policies provide that existing incompatible uses may be continued, but that no inconsistent use of land or any building or structure may be expanded except as set forth in the plan.

The exceptions include reconstruction and expansion of single-family

residences, expansion of public schools though changes such as moving portable buildings or construction of new rooms (so long as they do not expand the school capacity by one-third), and reconstruction of shopping center anchor tenants' property after complete or partial destruction. The plan also provides that a public agency may permit an "expansion or continuation of an inconsistent use" if the public agency determines "that the benefit to the public health, safety and welfare outweighs any detriment inherent in...[a] change or that the literal application of the provisions of...[the ALUC] plan will result in practical difficulties or unusual hardships for the property owner...."

The Shasta County Area Specific Plan for Redding Municipal Airport includes a provision that uses that continue to be or that become nonconforming uses shall be subject to the provisions of the zoning plan regarding such uses. Ordinary maintenance and routine repairs can be made to a nonconforming building. Nonconforming commercial and industrial uses are to be reviewed by the city or county prior to issuance of a permit for expansion of the use or structure or conversion to a different use. The plan declares that the purposes of the review is to:

> establish a schedule of improvements intended progressively to bring the site development standards toward conformity with...[the plan's] regulations. A development agreement should be executed that specifies the schedule of improvements, the extent of permissible expansion, and the uses to which the property may be converted. The schedule for progress toward compliance with design standards should call for all required improvements to be completed within eight years. Failure to execute a development agreement should require denial of a permit to expand or convert a nonconforming use, and should require that the nonconforming use be eliminated within 20 years from the date of review.

## General Plan Elements and Airport Land Use Policies

Because the general plan of a city or county is required to be internally consistent, local governments have a wide variety of options for incorporating the land use and regulatory content of the ALUC plan within the general plan. Choices will depend on the level of specificity of the ALUC plan and the applicable general plan. It will also depend on the complexity of the land use compatibility problems that exist around the airports, the degree of flexibility to control future land uses that remains available to the local agencies, and the operational or future needs of the airports. The availability of local resources for plan updating activities may influence the option chosen; if a comprehensive general plan update is planned in the near future, ALUC plan policies and programs may easily be incorporated as part of the overall plan update process. If resources are more limited, the development of a more limited planning document may be called for. Three possible options are described below.

The first approach is a plan element specific to the airport environs.

The second approach would address airport land use compatibility issues in the appropriate portions of the general plan elements mandated by law. The third approach is to use optional general plan elements.

Location Specific Plan Element. Within the context of local planning law, a city or county might adopt a geographically specific plan governing land uses within an airport environs. If called a "specific plan," this type of plan would contain all regulatory language and other conditions governing development activity within the geographic area designated by the plan. This geographic area could coincide with the planning area boundary established by the ALUC.

Such a plan could establish:

- Procedures for review and approval of development projects (such as through an airport environs review ordinance).
- Noise insulation requirements and/or standards for structures that are equivalent to or exceed those imposed by the noise element of the general plan.
- Avigation easement requirements, when necessary to assure compatibility with noise standards and to allow for continued operation of an airport under the variance procedures of the Division of Aeronautics.
- Notification programs for prospective property owners.
- Height and density limitations on new development.
- Permitted and excluded development classifications, both public and private.
- Procedures to eliminate incompatible uses upon a change in an existing, incompatible use.
- Designation of clear zones and safety zones.
- Other provisions deemed appropriate to protect operation of the airport and prevent new noise and safety hazard problems.

Use of Mandatory Elements. Another option available to local governments is to place the provisions of the ALUC plans in appropriate sections of the general plan of the city or county. Government Code Section 65302 requires nine elements in the general plan:

- Land use
- Circulation
- Housing
- Conservation
- Open space
- Seismic safety
- Noise

- Scenic highway
- Safety.

The following discussion illustrates how the mandatory elements might be used to incorporate ALUC plan policies or otherwise satisfy the consistency requirements established by AB 2920.

**Land Use Element** - All provisions governing types of structures permitted, maximum densities allowed, prohibited uses, and the timing and magnitude of development activity in the airport environs can be described.

**Circulation Element** - The airport configuration can be described. This element can also designate major access routes and provide for ground transportation coordination, including transit accessibility.

**Housing Element** - The designation of vacant land not available for residential purposes in airport environs, to protect public health and safety, can be described.

**Conservation Element** - Airport environs land use and related development policies can protect land and water resources. They can also contribute to flood control, water pollution control, protection of watersheds and stream channels, and prevent, control or correct erosion. These effects should be noted in this element.

**Open-Space** - Designation of airport environs land uses and related development policies may preserve areas required for protection of plant and animal life; areas required for ecologic and other scientific study purposes; rivers, streams, bays and estuaries; and coastal beaches, lakeshores, banks of rivers and streams, and watershed lands. This element can also describe how regulation of land uses within the airport environs will contribute to managed production of resources, including rangelands, agricultural lands and areas of economic importance for production of food and fiber; and management of lands for recreational purposes. Most importantly, it can describe how the land use regulations in the airport environs will preserve open space for public health and safety.

**Seismic Safety Element** - Geologic considerations that must be considered in development in and around airports should be documented in this element.

**Noise Element** - All specific noise-compatibility strategies of the ALUC plan that the city or county intends to carry out within the airport environs should be identified in this element. As stated previously, the noise element requirements are more technically prescribed than in other elements, so careful attention should be given to incorporation of ALUC plan provisions.

**Scenic Highway Element** - This is probably the least relevant mandatory element with respect to ALUC activities. It is

potentially an appropriate element to describe access routes serving smaller airports outside the major urban areas of the state.

**Safety Element** - This element is required to cover fire prevention and geologic hazards. More general community safety issues are sometimes described. To the extent these are considered in an ALUC plan, this element may be an appropriate part of the general plan to document city and county policies related to airport environs safety policies, objectives and programs.

Optional Plan Elements. Local agencies are also authorized to adopt various other elements and to combine elements within the general plan to satisfy the purposes of the general plan law. They may also include elements of their own design in the general plan. Several optional plan elements mentioned by statute (Section 65303 of the Government Code) and their likely relationship to the ALUC plan are described below:

- Recreation element - This is probably not applicable to ALUC plan issues.
- Transportation element - Port, harbor, aviation and related facilities are specifically mentioned as topics for coverage by such an element.
- Transit element - Transit access to airports should be described if applicable and this element is prepared.
- Public services and facilities element - Airport-related plans for sewage disposal, refuse disposal, drainage, and utilities should be included in this element, if prepared.
- Public building element - Locations and arrangements of airport terminals, and ancillary public buildings should be listed in this element, if included in a general plan.
- Community design element - Such an element should describe standards and principles governing subdivisions, and showing recommended designs for community and neighborhood development and redevelopment. It should also include design standards for noise mitigation purposes consistent with ALUC plan provisions.
- Redevelopment element - Land acquisition and other public programs to protect airport environs should be listed, if applicable, in this element.
- Historical preservation element - Such an element is of limited applicability to airport land use programs.

## Coordination with Other Regulatory Plans

The consideration of general plan amendments may also require coordination with agencies charged with implementing other regulatory programs, such as the air quality management agencies, solid waste management authorities (especially with respect to siting of airports and sanitary landfills and other solid waste management facilities), and agencies with regulatory authority in the California coastal zone (the California Coastal Commission and the Bay Conservation and Development Commission). Amendments to the land use element resulting from an ALUC determination are required to be approved by the Coastal Commission, if the land use plan covers territory within the coastal zone.

## Other Local Programs and Ordinances

Local governments can adopt land use and development controls that can be used to protect noise impacted areas and airport safety zones. They range from specific provisions of a zoning ordinance to land acquisition to building code modifications. Examples include special review requirements for airport area developments, noise insulation requirements, acquisition of easements and notification of appropriate agencies and prospective property purchasers of the presence of a noise source.

Zoning ordinances may employ an overlay to or may be combined with existing zoning to identify areas subject to effects of airport operations. Land uses in the safety zones should follow the guidelines suggested earlier. Outside the safety zone, noise attenuation measures and height restrictions will still be necessary.

Among the ordinances and other implementation techniques used in California by local agencies are:

- airport environs review ordinances
- height zoning ordinances
- noise insulation standards
- avigation easements
- noise easements
- restrictive use or land conservation easements
- departure path agreements.

Clear procedures for achieving compatible land uses near an airport are often not in place, so a specific review ordinance would indicate how project reviews are to be conducted. An **airport environs review ordinance**--such as that developed for the Nut Tree Master Plan in Solano County (Reference 42)--subjects all development projects in the vicinity of an airport to review for compatibility with the airport.

The ordinance:

- sets noise insulation standards
- requires avigation easements
- requires notice to future purchasers of such properties and
- requires review of development plans for compliance with the ordinance.

If building height is a critical issue, height limitations could be included in the ordinance. In the example cited, the City of Vacaville combined the concepts of both the review ordinance and height zoning into its building regulations and permit process, rather than establish a separate permit process. The model ordinance is included in Appendix L.

The Federal Aviation Administration has developed a **height limitation zoning ordinance** that can be used as a guide to control the height of objects around airports. The Nut Tree Master Plan study cited above provides an example use of the FAA model. Both the model and the example are included in Appendix M. Since the ordinance is based on FAR Part 77 (discussed in Chapters IV and V), two disadvantages associated with it are its reliance on the imaginary surfaces extending straight-out from the end of a runway and only indirect consideration of instrument departure procedures. The model ordinance can be modified to take into account normal operating procedures of the airports for which zoning is being proposed. Suggestions for handling special situations are discussed in Chapter V.

**Noise insulation standards** can be incorporated into local building regulations. Use of such standards is discussed in Chapter III. Model standards are shown in Appendix E.

**Avigation easements** are used to grant to the airport certain rights over the subject land. The most commonly granted rights include:

- Right-of-flight at any altitude above the acquired easement surfaces.
- Right to cause noise, vibrations, fumes, dust, and fuel particle emissions.
- Right to prevent construction or growth of all structures, objects or natural growth above the acquired easement surfaces.
- Right-of-entry to remove, mark, or light any structures or growth above the acquired easement surfaces, or right to require the owner to remove, mark or light.
- Right to prohibit creation of electrical interference, unusual light sources, and other hazards to aircraft flight.

The easement surfaces acquired are usually based on FAR Part 77. Appendix N contains a model avigation easement with all these conditions.

Avigation easements also contain provisions releasing the aircraft operator from liability under specified conditions, waiving the property owner's right to sue, and continuing the easement on transfer of ownership.

**Noise easements** can also be developed and obtained separately. The City of South San Francisco is planning a pilot program to install sound insulation in homes in return for granting noise easements. Appendix O contains a model noise-only easement. Noise easements are very important in areas where land may still be developed for residential purposes or where permitting of such development would contribute to the existing or future noncompliance of the airport with the California airport noise standards.

New residential units are a compatible land use within a noise-impacted area around airports only if an easement is granted to the airport operator. This distinction is made in Section 5014 of California Administrative Code Title 21 (the California noise standards). This section provides that "property subject to an avigation easement for noise" is a compatible land use. Existing buildings--i.e., buildings existing on December 1, 1972--are a compatible land use only if they are acoustically treated. Noise easements should specifically include the existing noise level at the site above which liability for noise would not be relieved. This would provide the greatest assurance that the easement would be enforcable.

**Restrictive use easements** may be obtained to limit the occupancy or type of use of property. An example of this type of easement is the proposed use of **conservation easements** in Sonoma County, discussed in Appendix P. The county would acquire the building development rights--which it would never exercise--for certain lands around the Sonoma County Airport at Santa Rosa (lands in agricultural uses). The Redding Municipal Airport Area Specific Plan adopted in Shasta County includes a provision permitting a local agency to acquire all or part of the development rights to a parcel within 90 days of the date of an application for development of property within a specified safety corridor, designate by an **acquisition overlay.**

When the planning boundaries of an airport overlap one or more counties, **cooperative agreements** among the jurisdictions can provide the means to resolve airport land use compatibility issues. Solano and Napa Counties' height-limiting ordinances provide an example of such cooperative planning agreements. Napa County Ordinance No. 416 (enacted in August 1972) established height limits and land use restrictions in the Napa County Airport approach zones. Solano County Ordinance No. 855 (enacted in November 1973) incorporates the approach zones and height limits for the Napa County airport in the Solano County zoning code.

An excellent example of cooperation between a developer and an airport to protect airport operations is the **departure paths agreement** developed between San Mateo County--which operates San Carlos Airport--and the developer of a large industrial/commercial project. Based on discussions held early in the project planning, the developer agreed to move several buildings and limit the height of structures to protect two departure paths for the general aviation airport. This is described in more detail in Appendix Q.

These brief references illustrate the ingenuity of affected parties in developing constructive solutions to airport-related problems. Some of the solutions were not achieved easily. They do suggest that solutions can be arrived at if ALUCs, airport operators, local governments and development interests work together.

# IX. USE OF SPECIFIC FINDINGS

Previous chapters of this report have covered the preparation and modification of local airport land use plans adopted by ALUCs and the modification of city and county plans and implementing regulations to bring about plan consistency as required by state law. This chapter covers the second method by which cities, counties and airport operators can achieve consistency with adopted plans or recommendations of ALUCs.

## Airport Land Use Commission Determinations

By August 31, 1983, each ALUC is to review the plans submitted by cities and counties on or before July 1, and determine whether they are consistent or inconsistent with the existing ALUC plans, as such plans provide on July 1. If a determination of inconsistency is made by an ALUC, the local agency is to be notified, and is required to have a hearing to reconsider its plans. The local agency may overrule the ALUC determination by adopting specific findings that the actions in the general plan are consistent with the purposes of the ALUC statute.

In a similar way, city or county proposals to amend the general or specific plan, or to adopt or approve a zoning ordinance or building regulation, must first be referred to the commission. The same requirements are applied to public agencies owning airports; prior to modification of airport master plans, the proposed modification must be referred to the applicable ALUC for review and a determination of consistency or inconsistency.

The law provides that a commission is required to make a determination of consistency or inconsistency within 60 days from the date of referral. If not specifically made within that period, Section 21676 provides that the proposed action "shall be deemed consistent with the commission's plan."

## Two Methods to Achieve Plan Consistency

The Legislature, in enacting Chapter 1041 of the Statutes of 1982 (AB 2920), provided cities and counties with two ways to make the ALUC and general plans consistent. The first is to incorporate or otherwise reflect the content of the airport land use commission plan in the general plan and applicable implementation regulations, such as zoning ordinances and building codes. Specific issues related to use of this method of achieving consistency were discussed in Chapter VIII.

Alternatively, if a city or county does not agree with specific provisions of the ALUC plan, and wishes to adopt a different provision within the general plan (or, again, implementing regulations), it may do so and still achieve consistency with the ALUC plan by adopting specific determinations that the change enacted is consistent with the stated purposes of the ALUC law. Use of specific determinations to achieve consistency is discussed in this chapter.

## When Findings Are Used in Airport Land Use Planning

Findings are used in implementing the airport land use planning law under three circumstances:

1. When a city or county wishes to override an ALUC **determination of inconsistency** between an ALUC plan as it exists on July 1, 1983 and the local general plan submitted to the ALUC for review under provisions of AB 2920.

2. When a city or county wishes to override a recommendation of an ALUC with respect to a **proposed action** to alter the general or specific plans or implementing regulations.

3. When a city or county owning an airport wishes to override a recommendation of an ALUC plan with respect to a **proposed modification to the overall master development plan** for the airport.

Any city and county actions in the first of the three circumstances will take place under the law only between August 31 and December 31 of 1983.

## The Purpose of Findings

The old ALUC law permitted local agencies to override ALUC determinations or actions by a four-fifths vote. Under the new provisions of AB 2920, however, local agencies are no longer permitted merely to vote to override an ALUC plan provision or action for whatever reason.

In the event of a conflict between an ALUC plan and the city or county plan (or its accompanying zoning ordinance or building regulations), **specific findings are required by law to bring about consistency of plans**, which the law also requires. The purpose of findings, therefore, is to assure compliance with state law.

## Required Content of Findings

The specific findings to be adopted under any of the three circumstances stated above are a precondition to an action to override a decision (whether in the form of plan content or a recommendation) of an airport land use commission. The adoption of the findings is to form the legal basis for a statement that the decision to override is consistent with the stated purposes of the airport land use planning law. These purposes are set forth in Section 21670 of the Public Utilities Code:

- It is in the public interest to provide for the orderly development of each public use airport in this state and the area surrounding such airports in such a manner, among other things, to promote the overall goals and objectives of the California airport

noise standards adopted pursuant to [Public Utilities Code] Section 21669, and prevent the creation of new noise and safety problems.

- It is the purpose of this article to protect public health, safety, and welfare by ensuring orderly expansion of airports and the adoption of land use measures that minimize the public's exposure to excessive noise and safety hazards within areas around public airports to the extent that such areas are not already devoted to incompatible uses.

Thus specific findings must demonstrate that the action taken in overriding an ALUC action nevertheless fulfills one or more of the stated purposes of the law:

- To provide orderly development of the airport.
- To provide orderly development of the area around the airport to promote the overall goals and objectives of the California airport noise standards.
- To prevent the creation of new noise and safety problems.
- To protect public health, safety and welfare by ensuring the orderly expansion of airports.
- To ensure the adoption of land use measures that minimize the public's exposure to excessive noise and safety hazards within areas around the airport to the extent such areas are not already devoted to incompatible uses.

Background on Finding Procedures

A discussion in this handbook regarding the steps to be taken to adopt specific findings related to airport land use planning decisions will necessarily be brief. It draws upon a lengthy memorandum (Reference 43) prepared by the Governor's Office of Planning and Research--"Bridging the Gap: Using Findings in Local Land Use Decisions." The OPR memorandum refers to numerous court decisions regarding findings and their adoption; the discussion here is based on the general conclusions of those cases, and any new case law should be reviewed prior to the adoption of findings by local agencies.

The most important case regarding the use of findings in local land use decisions was Topanga Association for a Scenic Community v. County of Los Angeles ([1974] 11 Cal. 3d 506). The court defined findings, explained their purposes, and outlined when findings are needed in making local land use decisions.

Findings were defined in the decision as legally relevant conclusions that explain the decision-making agency's method of analyzing facts,

regulations, policies, and the rationale for making the decision based on the facts involved. Findings are used to show how local decision-makers arrived at their decision based on facts and established policies.

The court also outlined four purposes for making findings, and noted that they should:

1. Provide a framework for making principled decisions, enhancing the integrity of the administrative process.

2. Help make analysis orderly and reduce the likelihood that the agency will randomly leap from evidence to conclusions.

3. Enable the parties to determine whether and on what basis they may seek judicial review and remedy.

4. Apprise a reviewing court of the basis for the agency's action.

In general, California law does not clearly distinguish between the situations that require findings and those that do not. OPR's review of the case law concluded that:

- Findings are required for adjudicative (administrative) decisions.

- Findings are not required for legislative acts unless specifically required by statute.

In the case of airport land use planning matters, findings would be required for adjudicative activities such as consideration of variances, conditional use permits, and tentative subdivision and parcel maps that would apply a fixed rule, standard or law to a specific parcel of land. Findings would also be required of legislative acts of a city council or board of supervisors with respect to overriding an ALUC determination because such findings are required by state law.

## Judicial Standards of Review

Before a court would review findings for inadequacy, it would first determine in what category the agency's decision falls: adjudicative or legislative. Then the court would decide what judicial standard of review would be applied. In the case of administrative or adjudicative acts, the "administrative mandamus" standard of Section 1094.5 of the Code of Civil Procedure would be applied, while for legislative acts, the "traditional mandamus" standard of Section 1085 of the Code of Civil Procedure would be applied. Section 65301.5 of the Government Code provides that the adoption of a general plan, element or amendment is a legislative act reviewable pursuant to CCP Section 1085.

The remaining discussion in this chapter of the handbook will presume that a court review of findings adopted by local agencies would be undertaken using the "traditional mandamus" standard, and not the stricter "administrative mandamus" standard. AB 2920 did not specifically require that findings meet the administrative mandamus standard; even if such requirement had been imposed, the courts would not be obliged to observe it. Instead, the court would consider all the relevant circumstances in making the decision about which standard of review is appropriate (City of Chula Vista v. Superior Court of San Diego County [1982] 133 Cal. App. 3d 472).

## Traditional Mandamus Standards

When a party wishes to challenge a legislative act of a city council or board of supervisors in court, the court will use a deferential standard to review the acts of the legislative body. The standard applied would determine:

1. Whether the action was arbitrary, capricious, or entirely lacking in evidentiary support.

2. Whether the legislative body has failed to follow the procedures and given the notices required by law.

In general, California courts have held they will **not invalidate a legislative action unless it is unreasonable, lacks a rational basis or unless the notice of the hearing was defective or nonexistent.**

In addition, if there is one reasonable argument supporting the action, the courts will traditionally defer to the legislative body and uphold the decision. Although the courts will consider a legislative action's reasonableness, they will also generally avoid substituting their judgment because a legislative body's acts are presumed valid, carrying out the constitutional power to promote general health, welfare and safety of the community.

In the case of a finding on an airport land use matter, a legal decision would probably center on the question of whether the the action to override was "reasonable," assuming that the legislative body provided a properly drawn notice of public hearing in a timely fashion.

## Determining Reasonableness

The enactment of AB 2920 requiring findings to override an airport land use commission decision was one of the few instances in which the Legislature imposed a requirement for findings prior to a local legislative decision. Absent court decisions on the use of findings to comply with the provisions of the airport land use planning law (or

court decisions regarding the adoption of findings to satisfy various requirements of the housing element law and related statutes), local agencies will have to take reasonable steps to assure legally adequate findings.

One way of doing this is to recognize that, irrespective of the likelihood that the standard of judicial review will be the traditional one, a reasonable course of action would be to apply certain principles that would be used in reviewing administrative acts. In other words, a local agency can protect itself from a challenge that its legislative acts are unreasonable by showing that it has **proceeded in the manner required by law**, that the **findings made support the decision** itself, and that the **evidence supports the decision.**

Thus the court could review the situation, and could find a "reasonable" argument supporting the local agency's actions. Although substantial evidence (necessary to satisfy the requirement in Topanga that there be a "bridge [of] the analytical gap between the raw evidence and the ultimate decision") is not required to satisfy the judicial standard of traditional mandamus, some evidence supporting the local decisions should be provided to protect the local agency from legal challenge of unreasonable behavior.

Four other guidelines are presented in the case law and actual planning experience regarding the adoption of findings. These should be followed when adopting findings under Section 21676 of the Public Utilities Code. They are:

1. A decision-making body such as a city council or board of supervisors may use a subordinate body's findings, but it is not obligated to do so.

2. Findings must not recite the law, but must be substantive and address the specific statutory requirements.

3. Findings need not be formal, and may instead be included in the agency's order or resolution.

4. Findings should be clearly set forth prior to the decision based on the findings.

Thus, a city council may or may not accept the findings of a planning commission on a disputed matter. It may hold its own hearings before deciding on the matter. However, findings must not merely recite the language of the statute that requires a finding of consistency, but must set forth the analytical basis for the finding. Local agencies have discretion in how the findings are recorded, whether in orders, resolutions or in minutes of the meeting. Finally, local agencies should carefully prepare the findings, assess the evidence supporting the findings and ensure that the findings support the conclusion or decision, all prior to making the decision.

Demonstrating Consistency of Purposes

Any findings adopted by a local agency to override a decision of an airport land use commission should be addressed to one or more specific purposes of the ALUC statute. These were listed previously. The following sections are intended to show how findings may be drafted to demonstrated the required consistency.

1. Providing orderly development of the airport. The findings should document how the local agency has considered the master plan for the development of the airport over the next 20 years, how the local agency intends to plan for airport development, and how zoning actions will be changed to protect undeveloped land from non-airport related uses, if the airport master plan identifies a future need for such land or a need to protect the land from development to preserve public safety.

The local agency in this case will have to rely heavily on specific plans for airport development (or their equivalent) provided by either the airport operator or the local airport land use commission. If such plans (or their equivalent) are not available, the local agency cannot reasonably be expected to accept an ALUC determination of general plan inconsistency (nor should an ALUC expect to be able to justify its conclusion of inconsistency). A local agency could adopt findings that, because it is unable to anticipate the development needs of the airport over the next 20 years, its general plan content with respect to land areas will concentrate on achieving consistency with existing airport development and effects, as well as achieving other publicly recognized purposes. For example, a local agency might state that its action is based on the need to provide for the accommodation of its share of regional housing needs (state law requires sufficient land be zoned to enable the jurisdiction to meet its share of the applicable regional housing need).

2. Provide orderly development of the area to promote the overall goals of the California airport noise standards. The airport noise standards are set forth in Title 21, Subchapter 6 (commencing with Section 5000) of the California Administrative Code.

In addressing this issue in developing findings, the local agency should refer specifically to the content of its own noise element of the general plan. Section 65302(g) of the Government Code requires the general plan to include a noise element. This element is required to describe, in quantitative terms, the community noise environment in terms of noise exposure contours for both near and long-term levels of growth and traffic activity.

Sources of environmental noise required to be considered in the noise element include "commercial, general aviation, heliport, helistop, and military airport operations, aircraft overflights, jet engine test stands, and **all other ground facilities related to airport operation** [emphasis added]."

Of all the general plan elements, the noise element is the most specific in terms of content and method of preparation. Local agencies should rely on it for the basic information upon which to make any land use decision with respect to airport noise. State law requires that the noise element recommend mitigation measures to existing and foreseeable noise problems. Such foreseeable changes might include potential land use changes from incompatible to compatible uses. In addition, local agencies may specify the exact manner in which the noise element will be integrated into the zoning ordinance and the land use and circulation elements of the general plan.

Prior to the adoption of findings to override an ALUC decision, the local agency will have to address the specific content of its own noise element, identify any potential inconsistencies with noise policies and land use compatibility criteria in the ALUC plan, and resolve them as part of the process of adopting an action to override an ALUC recommendation or finding of plan inconsistency.

3. Prevent creation of new noise and safety problems. Noise issues should be addressed in the fashion described in number 2 above.

Existing state law requires there to be a safety element of the general plan [Section 65302(i)]. The safety element is to address protection of the community from fires and geologic hazards. To the extent that general plan safety element addresses other locally relevant safety issues, including the general protection of residents from death and injuries and the protection of property, it should be relied upon for specific evidence showing how the local agency will act to protect public safety and therefore supports a decision to override an ALUC recommendation.

4. Protect public health, safety and welfare by ensuring the orderly expansion of airports. This purpose should be considered similarly to that described in number 1 above.

5. Ensure the adoption of land use measures that minimize the public's exposure to excessive noise and safety hazards within areas around the airport to the extent such areas are not already devoted to incompatible uses. The key words in this purpose are "minimize" community exposure with respect to "excessive" noise and safety hazards, "to the extent such areas are not already devoted to incompatible uses."

The language used in the statute implies a quantitative assessment of hazards that should be conducted by the airport land use commission and the local city or county.

The purpose of the statute is not merely to "reduce" noise and safety hazards, but to "minimize" exposure in areas with "excessive" noise or safety hazards. To adopt a finding demonstrating consistency with this purpose, the local agency would first have to determine whether existing noise or safety hazards are "excessive."

If existing noise and safety hazards are not excessive, then the actions taken by the local agency must "prevent the creation of new noise and

safety problems" to be consistent with the purposes of the statute (see number 3 above).

If the existing hazards are excessive, the local agency would have to show how its action in overriding an ALUC determination of plan inconsistency or recommendation "minimizes" additional exposure to those noise and safety hazards that have been identified. Finally, the local agency would have to show the extent to which land uses in the area in question are already incompatible with airport operations, and how an action to override would not create a new incompatible use, or would not expose additional persons or property to noise and safety hazards associated with existing incompatible uses.

Airport Immunity as a Consequence of Findings

The most important consequence of a local government's decision to override an airport land use commission determination of inconsistency of a plan provision or other action is a grant of immunity to an airport operator for liability for damages to property or personal injury under certain circumstances. Section 21678 of the Public Utilities Code specifies that the airport operator (if it is other than the city or county making the decision to override) is immune from liability for damages to property or for personal injury "caused by or resulting directly or indirectly from the public agency's decision to override the commission's action or recommendation."

This provision directly addresses one of the deficiencies of the old law--namely that the airport operator had no control over the development around airports, and sometimes was subject to legal action from new residents who purchased property in an area that neither an ALUC or the airport believed should be developed for residential purposes.

The new law does not transfer the liability to the public agency making the decision to override an ALUC action; instead it declares the Legislature's grant of immunity to the airport operator for potential consequences of the decision to override. The language of Section 21678 does not relieve the airport operator of any liability for existing conditions, nor would the grant of immunity be extended by this section for damages caused directly or indirectly from significant changes in the operational procedures of the airport.

Airport operators have the ability to act **voluntarily** under Federal law and regulations to protect themselves from noise-damage awards. Section 107 of the Airport Safety and Noise Abatement Act of 1979 (49 U.S.C. 2107) limits noise damage suits by property owners in areas surrounding airports. No person acquiring property or an interest in property after February 18, 1980, in an area surrounding an airport for which an airport noise exposure map has been submitted to the FAA may recover damages for noise except under specified circumstances. If an individual had "actual or constructive knowledge" of the existence of a noise exposure map, he or she can recover damages from the airport only upon a demonstration that there has been:

- a significant change in the type or frequency of aircraft operations, or
- a significant change in the airport layout, or
- a significant change in the flight patterns, or
- a significant increase in nighttime operations.

The person also has to show that the damages have resulted from the change in operations or increased airport activity. "Constructive knowledge" is presumed if notice of the existence of the noise exposure map has been published at least three times in a newspaper of general circulation, and if a copy of the map is furnished at the time of property acquisition.

The noise exposure maps are prepared pursuant to Section 103 of the 1979 Act (49 U.S.C. 2103). Federal guidance for the preparation of these maps is contained in FAR Part 150. Airport operators choosing to participate in the program would submit the maps to FAA for approval. Part 150 also requires that a revised map be submitted whenever any actual or proposed change in operations of the airport "might create any substantial, new, noncompatible use in any area depicted on the map."

As with any public policy, the degree of quantification of information and the exercise of judgment of decision-makers will be an uncertain process, subject to legal challenge and subject to questions about the "wisdom" of the policy intentions involved. It is hoped this handbook will help local governments carry out the provisions of AB 2920. Further, it is hoped that in the course of implementation of AB 2920, improvements in its planning process can be identified--keeping foremost in mind the purposes for which the law was intended--the protection of public health, welfare, and safety and the promotion of airport activities necessary to the overall development of the state.

# APPENDICES

The material presented in the appendices is reference material. Certain appendices contain model ordinances and easements. These are presented to assist local agencies, which are free to alter them to deal with local conditions or desires. Implementation of any of these ordinances and easements is voluntary.

Article 3.5. Airport Land Use Commission

***Creation; Membership; Selection***

21670. (a) The Legislature hereby finds and declares that:

(1) It is in the public interest to provide for the orderly development of each public use airport in this state and the area surrounding these airports so as to promote the overall goals and objectives of the California airport noise standards adopted pursuant to Section 21669 and to prevent the creation of new noise and safety problems.

(2) It is the purpose of this article to protect public health, safety, and welfare by ensuring the orderly expansion of airports and the adoption of land use measures that minimize the public's exposure to excessive noise and safety hazards within areas around public airports to the extent that these areas are not already devoted to incompatible uses.

(b) In order to achieve the purposes of this article, every county in which there is located an airport which is served by a scheduled airline shall establish an airport land use commission. Every county, in which there is located an airport which is not served by a scheduled airline, but is operated for the benefit of the general public, shall establish an airport land use commission, except that the board of supervisors of the county may, after consultation with the appropriate airport operators and affected local entities and after a public hearing, adopt a resolution finding that there are no noise, public safety, or land use issues affecting any airport in the county which require the creation of a commission and declaring the county exempt from that requirement. The board shall, in this event, transmit a copy of the resolution to the Director of Transportation. For purposes of this section, "commission" means an airport land use commission. Each commission shall consist of seven members to be selected as follows:

(1) Two representing the cities in the county, appointed by a city selection committee comprised of the mayors of all the cities within that county, except that if there are any cities contiguous or adjacent to the qualifying airport, at least one representative shall be appointed therefrom. If there are no cities within a county, the number of representatives provided for by paragraphs (2) and (3) shall each be increased by one.

(2) Two representing the county, appointed by the board of supervisors.

(3) Two having expertise in aviation, appointed by a selection committee comprised of the managers of all of the public airports within that county.

(4) One representing the general public, appointed by the other six members of the commission.

(c) Public officers, whether elected or appointed, may be appointed and serve as members of the commission during their terms of public office.

(d) Each member shall promptly appoint a single proxy to represent him or her in commission affairs and to vote on all matters when the member is not in attendance. The proxy shall be designated in a signed written instrument which shall be kept on file at the commission offices, and the proxy shall serve at the pleasure of the appointing member. A vacancy in the office of proxy shall be filled promptly by appointment of a new proxy.

(e) A person having an "expertise in aviation" means a person who, by way of education, training, business, experience, vocation, or avocation has acquired and possesses particular knowledge of, and familiarity with, the function, operation, and role of airports, or is an elected official of a local agency which owns or operates an airport. The commission shall be constituted pursuant to this section on and after March 1, 1988.

***Action by Designated Body Instead of Commission***

21670.1. (a) Notwithstanding any other provision of this article, if the board of supervisors and the city selection committee of mayors in the county each makes a determination by a majority vote that proper land use planning can be accomplished through the actions of an appropriately designated body, then the body so designated shall assume the planning responsibilities of an airport land use commission as provided for in this article, and a commission need not be formed in that county.

(b) A body designated pursuant to subdivision (a) which does not include among its membership at least two members having an expertise in aviation, as defined in subdivision (e) of Section 21670, shall, when acting in the capacity of an airport land use commission, be augmented so that that body, as augmented, will have at least two members having that expertise. The commission shall be constituted pursuant to this section on and after March 1, 1988.

***Applicability to Counties Having Over 4 Million Population***

21670.2. Sections 21670 and 21670.1 do not apply to counties of more than 4 million population. In such counties, the county regional planning commission has the responsibility for coordinating the airport planning of public agencies within the county. In instances where impasses result relative to this planning, an appeal may be made to the county regional planning commission by any public agency involved. The action taken by the county regional planning commission on such an appeal may be overruled by a four-fifths vote of the governing body of a public agency whose planning led to the appeal.

***Airport Owned by a City, District, or County; Appointment of Certain Members by Cities and Counties***

21671. In any county where there is an airport operated for the general public which is owned by a city or district in another county or by another county, one of the representatives provided by paragraph (1) of subdivision (b) of Section 21670 shall be appointed by the city selection committee of mayors of the cities of the county in which the owner of that airport is located, and one of the representatives provided by paragraph (2) of subdivision (b) of Section 21670 shall be appointed by the board of supervisors of the county in which the owner of that airport is located.

***Term of Office; Removal of Members; Vacancies; Compensation; Staff Assistance; Meetings***

21671.5. Except for the terms of office of the members of the first commission, the term of office of each member shall be four years and until the appointment and qualification of his successor. The members of the first commission shall classify themselves by lot so that the term of office of one member is one year, of two members is two years, of two members is three years, and of two members is four years. The body which originally appointed a member whose term has expired shall appoint his successor for a full term of four years. Any member may be removed at any time and without cause by the body appointing him. The expiration date of the term of office of each member shall be the first Monday in May in the year in which his term is to expire. Any vacancy in the membership of the commission shall be filled for the unexpired term by appointment by the body which originally appointed the member whose office has become vacant. The chairman of the commission shall be selected by the members thereof.

Compensation, if any, shall be determined by the board of supervisors.

Staff assistance, including the mailing of notices and the keeping of minutes, and necessary quarters, equipment, and supplies shall be provided by the county. The usual and necessary operating expenses of the commission shall be a county charge.

Notwithstanding any other provisions of this article, the commission shall not employ any personnel either as employees or independent contractors without the prior approval of the board of supervisors.

The commission shall meet at the call of the commission chairman or at the request of the majority of the commission members.

***Rules and Regulations***

21672. Each commission shall adopt rules and regulations with respect to the temporary disqualification of its members from participating in the review or adoption of a proposal because of conflict of interest and with respect to appointment of substitute members in such cases.

***Initiation of Proceedings for Creation by Owner of Airport***

21673. In any county not having a commission or a body designated to carry out the responsibilities of a commission, any owner of a public airport may initiate proceedings for the creation of a commission by presenting a request to the board of supervisors that a commission be created and showing the need therefor to the satisfaction of the board of supervisors.

***Powers and Duties***

21674. The commission has the following powers and duties, subject to the limitations upon its jurisdiction set forth in Section 21676:

(a) To assist local agencies in ensuring compatible land uses in the vicinity of all new airports and in the vicinity of existing airports to the extent that the land in the vicinity of those airports is not already devoted to incompatible uses.

(b) To coordinate planning at the state, regional, and local levels so as to provide for the orderly development of air transportation, while at the same time protecting the public health, safety, and welfare.

(c) To prepare and adopt an airport land use plan pursuant to Section 21675.

(d) To review the plans, regulations, and other actions of local agencies and airport operators pursuant to Section 21676.

(e) The powers of the commission shall in no way be construed to give the commission jurisdiction over the operation of any airport.

(f) In order to carry out its responsibilities, the commission may adopt rules and regulations consistent with this article.

***Land Use Plan***

21675. (a) Each commission shall formulate a comprehensive land use plan that will provide for the orderly growth of each public airport and the area surrounding the airport within the jurisdiction of the commission, and will safeguard the general welfare of the inhabitants within the vicinity of the airport and the public in general. The commission plan shall include a long-range master plan that reflects the anticipated growth of the airport during at least the next 20 years. In formulating a land use plan, the commission may develop height restrictions on buildings, may specify use of land, and may determine building standards, including soundproofing adjacent to airports, within the planning area. The comprehensive land use plan shall be reviewed as often as necessary in order to accomplish its purposes, but shall not be amended more than once in any calendar year.

(b) The commission may include, within its plan formulated pursuant to subdivision (a), the area within the jurisdiction of the commission surrounding any federal military airport for all the purposes specified in subdivision (a). This subdivision does not give the commission any jurisdiction or authority over the territory or operations of any military airport.

(c) The planning boundaries shall be established by the commission after hearing and consultation with the involved agencies.

***Review of Local General Plans***

21676. (a) Each local agency whose general plan includes areas covered by an airport land use commission plan shall, by July 1, 1983, submit a copy of its plan or specific plans to the airport land use commission. The commission shall determine by August 31, 1983, whether the plan or plans are consistent or inconsistent with the commission's plan. If the plan or plans are inconsistent with the commission's plan, the local agency shall be notified and that local agency shall have another hearing to reconsider its plans. The local agency may overrule the commission after such hearing by a two-thirds vote of its governing body if it makes specific findings that the proposed action is consistent with the purposes of this article stated in Section 21670.

(b) Prior to the amendment of a general plan or specific plan, or the adoption or approval of a zoning ordinance or building regulation within the planning boundary established by the airport land use commission pursuant to Section 21675, the local agency shall first refer the proposed action to the commission. If the commission determines that the proposed action is inconsistent with the commission's plan, the referring agency shall be notified. The local agency may, after a public hearing, overrule the commission by a two-thirds vote of its governing body if it makes specific findings that the proposed action is consistent with the purposes of this article stated in Section 21670.

(c) Each public agency owning any airport within the boundaries of an airport land use commission plan shall, prior to modification of its airport master plan, refer such proposed change to the airport land use commission. If the commission determines that the proposed action is inconsistent with the commission's plan, the referring agency shall be notified. The public agency may, after a public hearing, overrule the commission by a two-thirds vote of its governing body if it makes specific findings that the proposed action is consistent with the purposes of this article stated in Section 21670.

(d) Each commission determination pursuant to subdivision (b) or (c) shall be made within 60 days from the date of referral of the proposed action. If a commission fails to make the determination within that period, the proposed action shall be deemed consistent with the commission's plan.

***Review of Local Plans***

21676.5. (a) If the commission finds that a local agency has not revised its general plan or specific plan or overruled the commission by a two-thirds vote of its governing body after making specific findings that the proposed action is consistent with the purposes of this article as stated in Section 21670, the commission may require that the local agency submit all subsequent actions, regulations, and permits to the commission for review until its general plan or specific plan is revised or the specific findings are made. If, in the determination of the commission, an action, regulation, or permit of the local agency is inconsistent with the commission plan, the local agency shall be notified and that local agency shall hold a hearing to reconsider its plan. The local agency may overrule the commission after the hearing by a two-thirds vote of its governing body if it makes specific findings that the proposed action is consistent with the purposes of this article as stated in Section 21670.

(b) Whenever the local agency has revised its general plan or specific plan or has overruled the commission pursuant to subdivision (a), the proposed action of the local agency shall not be subject to further commission review, unless the commission and the local agency agree that individual projects shall be reviewed by the commission.

***Marin County Override Provisions***

21677. Notwithstanding Section 21676, any public agency in the County of Marin may overrule the Marin County Airport Land Use Commission by a majority vote of its governing body.

***Airport Owner's Immunity***

21678. With respect to a publicly owned airport that a public agency does not operate, if the public agency pursuant to Section 21676 or 21676.5 overrides a commission's action or recommendation, the operator of the airport shall be immune from liability for damages to property or personal injury caused by or resulting directly or indirectly from the public agency's decision to override the commission's action or recommendation.

Added: Court Review

21679. (a) In any county in which there is no airport land use commission or other body designated to assume the responsibilities of an airport land use commission, or in which the commission or other designated body has not adopted an airport land use plan, an interested party may initiate proceedings in a court of competent jurisdiction to postpone the effective date of a zoning change, a zoning variance, the issuance of a permit, or the adoption of a regulation by a local agency, which directly affects the use of land within one mile of the boundary of a public airport within the county.

(b) The court may issue an injunction which postpones the effective date of the zoning change, zoning variance, permit, or regulation until the governing body of the local agency which took the action does one of the following:

(1) In the case of an action which is a legislative act, adopts a resolution declaring that the proposed action is consistent with the purposes of this article stated in Section 21670.

(2) In the case of an action which is not a legislative act, adopts a resolution making findings based on substantial evidence in the record that the proposed action is consistent with the purposes of this article stated in Section 21670.

(3) Rescinds the action.

(4) Amends its action to make it consistent with the purposes of this article stated in Section 21670, and complies with either paragraph (1) or (2) of this subdivision, whichever is applicable.

(c) The court shall not issue an injunction pursuant to subdivision (b) if the local agency which took the action demonstrates that the general plan and any applicable specific plan of the agency accomplishes the purposes of an airport land use plan as provided in Section 21675.

(d) An action brought pursuant to subdivision (a) shall be commenced within 30 days of the decision or within the appropriate time periods set by Section 21167 of the Public Resources Code, whichever is longer.

(e) If the governing body of the local agency adopts a resolution pursuant to subdivision (b) with respect to a publicly owned airport that the local agency does not operate, the operator of the airport shall be immune from liability for damages to property or personal injury from the local agency's decision to proceed with the zoning change, zoning variance, permit, or regulation.

(f) As used in this section, "interested party" means any owner of land within two miles of the boundary of the airport or any organization with a demonstrated interest in airport safety and efficiency.

## RELATED PROVISIONS OF GENERAL PLANNING LAW
## CALIFORNIA GOVERNMENT CODE

65302.3. (a) The general plan, and any applicable specific plan prepared pursuant to Section 65450, shall be consistent with the plan adopted or amended pursuant to Section 21675 of the Public Utilities Code.

(b) Notwithstanding the provisions of Section 65361, the general plan, and any applicable specific plan, shall be amended within 180 days of any amendment to the plan required under Section 21675 of the Public Utilities Code.

(c) In the event that the legislative body does not concur with any provision of the plan required under Section 21675 of the Public Utilities Code, it may satisfy the provisions of this section by adopting findings pursuant to Section 21676 of the Public Utilities Code.

[Note: This section exists only until January 1, 1989.]

# APPENDIX B

## SELECTED SECTIONS OF CALIFORNIA NOISE LAW

This appendix contains selected sections of California State law pertaining to noise near airports and noise insulation of buildings:

- California Administrative Code, Title 21, airport noise standards,
- California Administrative Code, Title 25, noise insulation standards,
- California Health and Safety Code, enabling legislation.

## SUBCHAPTER 6. NOISE STANDARDS

### Article 1. General

**5000. Preamble.**

The following rules and regulations are promulgated in accordance with Article 3, Chapter 4, Part 1, Division 9, Public Utilities Code (Regulation of Airports) to provide noise standards governing the operation of aircraft and aircraft engines for all airports operating under a valid permit issued by the department. These standards are based upon two separate legal grounds: (1) the power of airport proprietors to impose noise ceilings and other limitations on the use of the airport, and (2) the power of the state to act to an extent not prohibited by federal law. The regulations are designed to cause the airport proprietor, aircraft operator, local governments, pilots, and the department to work cooperatively to diminish noise. The regulations accomplish these ends by controlling and reducing the noise in communities in the vicinity of airports.

NOTE: Authority cited: Section 21669, Public Utilities Code. Reference: Sections 21669–21669.4, Public Utilities Code.

**5001. Liberal Construction.**

This subchapter shall be liberally construed and applied to promote its underlying purposes which are to protect the public from noise and to resolve incompatibilities between airports and their surrounding neighbors.

**5002. Constitutionality.**

If any provision of this subchapter or the application thereof to any person or circumstance is held to be unconstitutional, the remainder of the subchapter and the application of such provision to other persons or circumstances shall not be affected thereby.

**5003. Provisions Not Exclusive.**

The provisions of this subchapter are not exclusive, and the remedies provided for in this subchapter shall be in addition to any other remedies provided for in any other law or available under common law. It is not the intent of these regulations to preempt the field of aircraft noise limitation in the state. The noise limits specified herein are not intended to prevent any local government to the extent not prohibited by federal law or any airport proprietor from setting more stringent standards.

**5004. Applicability.**

These regulations establish a mandatory procedure which is applicable to and at all existing and future potential airports in California which are required to operate under a valid permit issued by the department. These regulations are applicable (to the degree not prohibited by federal law) to all operations of aircraft and aircraft engines which produce noise. Only those airports which shall have been determined to have a noise problem (in accordance with Section 5050) will be required to perform noise monitoring.

The regulations established by this subchapter are not intended to set noise levels applicable in litigation arising out of claims for damages occasioned by noise. Nothing herein contained in these regulations shall be construed to prescribe a duty of care in favor of, or to create any evidentiary presumption for use by, any person or entity other than the State of California, the counties and airport proprietors in the enforcement of these regulations.





**5006. Definitions.**

(a) Sound Pressure Level (SPL): The sound pressure level, in decibels (dB), of a sound is 20 times the logarithm to the base of 10 of the ratio of the pressure of this sound to the reference pressure. For the purpose of these regulations, the reference pressure shall be 20 micronewtons/square meter ($2 \times 10^{-4}$ microbar).

(b) Noise Level (NL): Noise level, in decibels, is an A-weighted sound pressure level as measured using the slow dynamic characteristic for sound level meters specified in ASA S1.4—1961, American Standard Specification for General Purpose Sound Level Meters, or latest revision thereof. The A-weighting characteristic modifies the frequency response of the measuring instrument to account approximately for the frequency characteristics of the human ear. The reference pressure is 20 micronewtons/square meter ($2 \times 10^{-4}$ microbar).

(c) Noise Exposure Level (NEL): The noise exposure level is the level of noise accumulated during a given event, with reference to a duration of one second. More specifically, noise exposure level, in decibels, is the level of the time-integrated A-weighted squared sound pressure for a stated time interval or event, based on the reference pressure of 20 micronewtons per square meter and reference duration of one second.

(d) Single Event Noise Exposure Level (SENEL): The single event noise exposure level, in decibels, is the noise exposure level of a single event, such as an aircraft flyby, measured over the time interval between the initial and final times for which the noise level of a single event exceeds the threshold noise level.

(e) Hourly Noise Level (HNL): The hourly noise level, in decibels, is the average (on an energy basis) noise level during a particular hour. Hourly noise level is determined by subtracting 35.6 decibels (equal to 10 $\log_{10}$ 3600) from the noise exposure level measured during the particular hour, integrating for those periods during which the noise level exceeds a threshold noise level.

For implementation in this subchapter of these regulations, the threshold noise level shall be a noise level which is 10 decibels below the numerical value of the appropriate criterion CNEL which is specified in Section 5012. At some microphone locations, sources of noise other than aircraft may contribute to the CNEL. Where the airport proprietor can demonstrate that the accuracy of the CNEL measurement will remain within the required tolerance in Section 5045, the department may grant a waiver to increase the threshold noise level.

(f) Daily Community Noise Equivalent Level (CNEL): Community noise equivalent level, in decibels, represents the average daytime noise level during a 24-hour day, adjusted to an equivalent level to account for the lower tolerance of people to noise during evening and night time periods relative to the daytime period. Community noise equivalent level is calculated from the hourly noise levels by the following:

$$\text{CNEL} = 10 \log (1/24) [\Sigma \text{ antilog } (\text{HNLD}/10) + 3 \Sigma \text{ antilog } (\text{HNLE}/10) + 10 \Sigma \text{ antilog } (\text{HNLN}/10)]$$

Where

HNLD are the hourly noise levels for the period 0700–1900 hours;

HNLE are the hourly noise levels for the period 1900–2200 hours;
HNLN are the hourly noise levels for the period 2200–0700 hours; and Σ means summation.

(g) Annual CNEL: The annual CNEL, in decibels, is the average (on an energy basis) of the daily CNEL over a 12-month period. The annual CNEL is calculated in accordance with the following:

Annual CNEL = $10 \log_{10} [(1/365) \Sigma \text{Antilog } (\text{CNEL}(i)/10]$

Where

CNEL(i) = the daily CNEL for each day in a continuous 12-month period, and Σ means summation.

When the annual CNEL is approximated by measurements on a statistical basis, as specified in Section 5022, the number 365 is replaced by the number of days for which measurements are obtained.

(h) Noise Impact Boundary: Noise impact boundary around an airport consists of the locus of points for which the annual CNEL is equal to the criterion value.

(i) Noise Impact Area: Noise impact area, in square statute miles, is the total land area within the noise impact boundary less that area deemed to have a compatible land use in accordance with Section 5014.

(j) Airport Proprietor: Airport proprietor means the holder of an airport permit issued by the department pursuant to Article 3, Chapter 4, Part 1, Division 9, Public Utilities Code.

(k) Aircraft Operator: Aircraft operator means the legal or beneficial owner of the aircraft with authority to control the aircraft utilization; except where the aircraft is leased, the lessee is the operator.

(*l*) Air Carrier: Air carrier is any aircraft operating pursuant to either a federal or a state certificate of public convenience and necessity, including any certificate issued pursuant to 49 U.S.C. Section 1371 and any permit issued pursuant to 49 U.S.C. Section 1372.

(m) General Aviation: General aviation aircraft are all aircraft other than air carrier aircraft and military aircraft.

(n) Department: Department means the Department of Aeronautics of the State of California.

(o) County: County, as used herein, shall mean the county board of supervisors or its designee authorized to exercise the powers and duties herein specified.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment of subsection (d) filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21).

## Article 2. Airport Noise Limits

**5010. Purpose.**

The purpose of these regulations is to provide a positive basis to accomplish resolution of existing noise problems in communities surrounding airports and to prevent the development of new noise problems. To accomplish this purpose, these regulations establish a quantitative framework within which the various interested parties (i.e., airport proprietors, aircraft operators, local communities, counties and the state) can work together effectively to reduce and





**5011. Methodology for Controlling and Reducing Noise Problems.**

The methods whereby the impact of airport noise shall be controlled and reduced include but are not limited to the following:

(a) Encouraging use of the airport by aircraft classes with lower noise level characteristics and discouraging use by higher noise level aircraft classes;

(b) Encouraging approach and departure flight paths and procedures to minimize the noise in residential areas;

(c) Planning runway utilization schedules to take into account adjacent residential areas, noise characteristics of aircraft and noise sensitive time periods;

(d) Reduction of the flight frequency, particularly in the most noise sensitive time periods and by the noisier aircraft;

(e) Employing shielding for advantage, using natural terrain, buildings, et cetera; and

(f) Development of a compatible land use within the noise impact boundary.

Preference shall be given to actions which reduce the impact of airport noise on existing communities. Land use conversion involving existing residential communities shall normally be considered the least desirable action for achieving compliance with these regulations.

**5012. Airport Noise Criteria.**

Limitations on airport noise in residential communities are hereby established.

(a) The criterion community noise equivalent level (CNEL) is 65 dB for proposed new airports and for vacated military airports being converted to civilian use.

(b) Giving due consideration to economic and technological feasibility, the criterion community noise equivalent level (CNEL) for existing civilian airports (except as follows) is 70 dB until December 31, 1985, and 65 dB thereafter.

(c) The criterion CNEL for airports which have 4-engine turbojet or turbofan air carrier aircraft operations and at least 25,000 annual air carrier operations (takeoffs plus landings) is as follows:

| *Date* | *CNEL in decibels* |
|---|---|
| Effective date of regulations to 12-31-75 | 80 |
| 1-1-76 to 12-31-80 | 75 |
| 1-1-81 to 12-31-85 | 70 |
| 1-1-86 and thereafter | 65 |

**5013. Noise Impact Boundary.**

The noise impact boundary at airports which have a noise problem as determined in accordance with Section 5050 shall be established and validated by measurement in accordance with the procedures given in Article 3 of this subchapter. For proposed new airports, or for anticipated changes of existing airports, the noise impact boundary shall be estimated by applicable acoustical calculation techniques.

The area of land which is within the noise impact boundary and which has incompatible land use is utilized as a measure of the magnitude of the noise problem at an airport. The concepts of noise impact boundary and noise impact area are illustrated in Figure 1.

**5014. Compatible Land Uses Within the Noise Impact Boundary.**

The criterion for the noise impact boundary was established for residential uses including single-family and multiple-family dwellings, trailer parks, and schools of standard construction. Certain other land uses may occur within the boundary but be compatible with the community noise equivalent level and hence be excluded in the calculation of noise impact area. For this purpose, the following land uses are deemed compatible:

(a) Agricultural;
(b) Airport property;
(c) Industrial property;
(d) Commercial property;
(e) Property subject to a navigation easement for noise;
(f) Zoned open space;





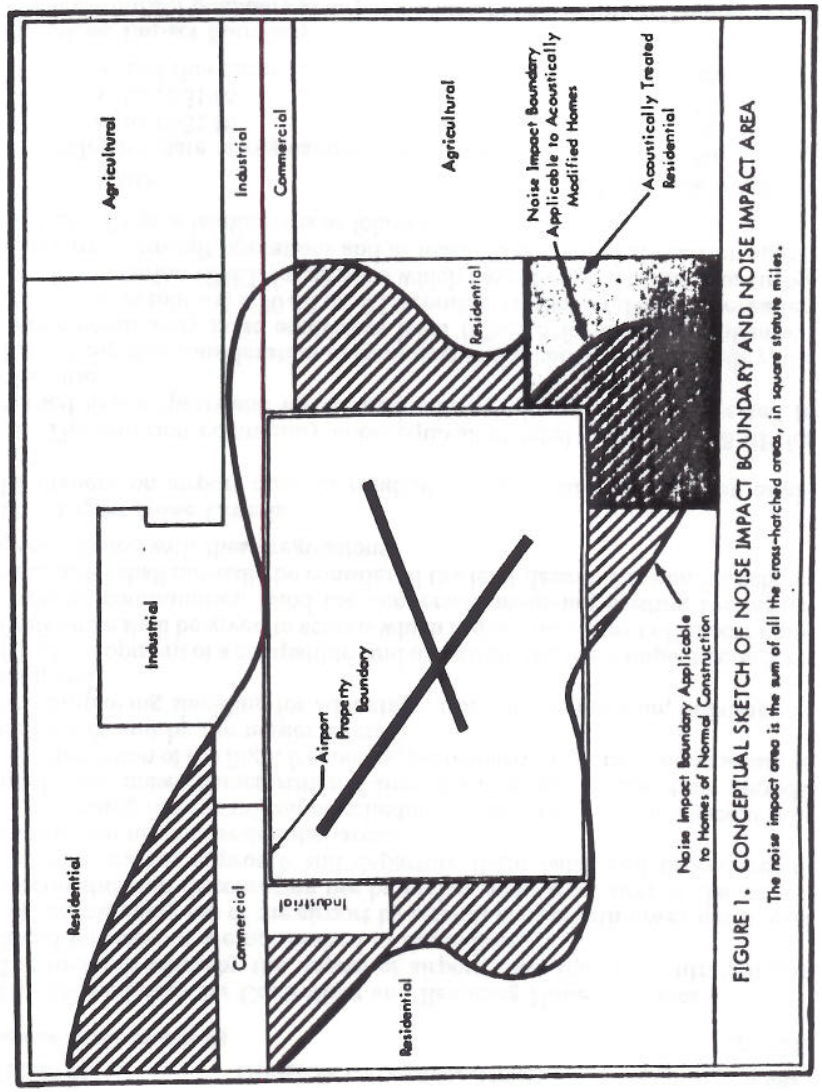



FIGURE 1. CONCEPTUAL SKETCH OF NOISE IMPACT BOUNDARY AND NOISE IMPACT AREA

(g) High rise apartments in which adequate protection against exterior noise has been included in the design and construction, together with a central air conditioning system. Adequate protection means the noise reduction (exterior to interior) shall be sufficient to assure that interior community noise equivalent level in all habitable rooms does not exceed 45 dB during aircraft operations. Acoustical performance of the buildings shall be verified by calculation or measured by qualified officials of the building inspection agency of the city or county in which the buildings are situated;

(h) In the case of existing airports and existing homes only, residential areas in which existing homes have been acoustically treated need not be subject to exterior noise limits quite as strict as those for normal residential construction. For this purpose, the community noise equivalent level on the boundary of such a residential area may be increased by as much as 15 dB over the community noise equivalent level criterion for nonacoustically treated homes. The amount of the increase allowed on the boundary is the difference between the noise level reduction of the treated home and the value 20 decibels which is assumed to be the noise level reduction of an average normal residence. The noise level reduction of a home is defined as the average difference between aircraft noise levels in free space outside of the home and the corresponding noise levels in rooms on the exposed sides of the home.

In carrying out this section, the actual use to which the land is put, not the classification for which the land is zoned, is determinative.

**5015. Changes in Airport Ownership or Control.** In the case of a change in airport ownership or control, the new airport proprietor shall be deemed to be in full compliance with these regulations until such time as the department takes final action on the new proprietor's application for a variance in accordance with Article 13, provided, however, that the new proprietor complies with the following:

(a) The new proprietor shall make application to the department for a variance within twenty (20) days after assuming ownership or control, and

(b) The new proprietor, in operating the airport, shall not permit or authorize any activity in conjunction with the airport which results in an increase of the size of the noise impact area.

NOTE: Authority cited: Section 21243, Public Utilities Code. Reference: Sections 21669–21669.5, Public Utilities Code.

*History:* 1. New section filed 5-30-78 as an emergency, effective upon filing (Register 78, No. 22).
2. Certificate of Compliance filed 9-22-78 (Register 78, No. 38).





Article 3. Establishing and Validating Noise Impact Boundaries for Airports Required to Monitor

**5020. Validation of the Noise Impact Boundary.** For airports with a noise problem (in accordance with Section 5050), the noise impact boundary shall be validated by measurements made at locations specified in Section 5021 and according to frequency requirements specified in Section 5022. These measurements shall be utilized to calculate the daily community noise equivalent levels. These daily CNEL values will then be averaged (on an energy basis) to obtain the annual CNEL at each of the community measurement locations. The location of the noise impact boundary will be considered valid if the value of the annual CNEL lies within ±1.5 dB of the criterion value.

**5021. Community Measurement Locations.** At least twelve (12) locations, approximately equidistant, but not exceeding one and one-half (1.5) statute miles separation, shall be selected along the noise impact boundary. The locations shall be selected such that the maximum extent of the boundary be determined with reference to the airport's flight patterns.

**5022. Frequency of Measurement at Community Locations.**

(a) For airports with 1,000 or more homes within the noise impact boundary based on a CNEL of 70 dB, continuous monitoring is required at those monitoring positions which fall within residential areas. Measurement for at least 48 weeks in a year shall be considered as continuous monitoring.

(b) For all other locations and for all locations at other airports, an intermittent monitoring schedule is allowed. The intermittent monitoring schedule shall be designed so as to obtain the resulting annual CNEL as computed from measurements at each location which will correspond to the value which would be measured by a monitor operated continuously throughout the year at that location, within an accuracy of ±1.5 dB.

Thus, it is required that the intermittent monitoring schedule be designed so as to obtain a realistic statistical sample of the noise at each location. As a minimum, this requires that measurements be taken continuously for 24-hour periods during four 7-day samples throughout the year, chosen such that for each sample, each day of the week is represented, the four seasons of the year are represented, and the results account for the effect of annual proportion of runway utilization. At most airports, these intermittent measurements can be accomplished by a single portable monitoring instrument.

**5023. Initial Establishment of the Noise Impact Boundary.**

The method to be used for initial establishment of the noise impact boundary of airports required to monitor will vary depending upon specific situations. The following guidelines represent one possible method:

(a) Calculate the approximate location of the noise impact boundary using applicable acoustic estimation techniques.

(b) Select convenient measurement locations on this estimated boundary according to Section 5021.

(c) Make a suitable series of CNEL trial measurements along lines perpendicular to the estimated noise impact boundary. For example, two to three measurements over a one-to-seven day period along a line perpendicular to the estimated noise impact boundary should provide sufficient data to define, within the required accuracy, the nominal position of the noise impact boundary.

Due consideration should be given to the number and time period of aircraft operations, mix of aircraft classes, average runway utilization and other measureable factors which would cause a difference between the trial measurements of CNEL and the expected annual average.

(d) Initiate validation measurements of the noise impact boundary following selection of permanent or intermittent monitoring locations to comply with the validation accuracy criterion specified in Section 5020. For permanent measurement locations at which the measured CNEL lies outside this accuracy criterion, suitable auxiliary measurements or analytical methods may be used to extrapolate the measured CNEL to determine the value on the noise impact boundary. Such extrapolation procedures are subject to approval by the department.

**5024. Deviations from Specified Measurement Locations.**

Recognizing the unique geographic and land use features surrounding specific airports, the department will consider measurement plans tailored to fit any airport for which the specified CNEL monitoring locations are impractical. For example, monitors should not be located on bodies of water or at points where other noise sources might interfere with aircraft CNEL measurements, nor are measurements required in regions where land use will clearly remain compatible.





Article 7. Noise Monitoring System Requirements

**5045. General Specifications.**

(a) The noise monitoring system shall provide for the following outputs:

(1) In community (see Section 5020). Hourly noise level for each hour of the day, together with identification of the hour.

(b) The overall accuracy of the noise measurement system shall be ±1.5 dB, determined in accordance with the procedure of the noise measurement system specification given in Sections 5080 through 5080.5 of these regulations.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment of subsection (a) filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21).

**5046. Detailed Specifications.**

Noise monitoring systems shall be in accordance with detailed specifications given in Sections 5080 through 5080.5 of these regulations.

**5047. Field Measurement Precautions.**

Specific locations of the monitoring system, particularly for the community measurement locations, shall be chosen, whenever possible, such that the community noise equivalent level at the location from sources other than aircraft in flight be equal to or less than 55 dB. This objective may be satisfied by selecting the location such that it is in a residential area not immediately adjacent to a noisy industry, freeway, railroad track, et cetera. The measurement microphone shall be placed 20 feet above the ground level, or at least 10 feet above neighboring roof tops, whichever is higher. To the extent practicable, the following precautions shall be followed:

(a) No obstructions which significantly influence the sound field from the aircraft shall exist within a conical space above the measurement position, the cone being defined by an axis along a line of sight normal to the aircraft path and by a half angle of 75 degrees from this axis.

(b) When the foregoing precautions are not practicable, the microphones shall be placed at least 10 feet above neighboring buildings in a position which has a clear line-of-sight view to the path of the aircraft in flight.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21).

**5048. Number of Measurement Systems.**

The frequency of measurement specified in Section 5022 has been designed to limit the number of monitoring systems required. The minimum number of systems required per airport is one for intermittent measurements of the noise impact boundary.

This minimum number will increase where necessary to conform to the requirement that separation distance between monitoring positions on the boundary not exceed one and one-half (1.5) statute miles or when continuous measurements are required on the measurement boundary in accordance with Section 5022.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21)

Article 8. Implementation by Counties

**5050. Counties.**

(a) The county wherein an airport is situated shall enforce this subchapter of these regulations.

(b) In recognition of the requirement to allow the maximum amount of local control and enforcement of this regulation, the county shall determine which of the airports within its boundaries are required to initiate aircraft noise monitoring in accordance with these regulations. The county shall require noise monitoring by the airports within its boundaries that are deemed to have a noise problem as determined by the county. For airports with joint use by both military and civilian aircraft operations, the determination of the existence of a noise problem shall be based upon the civilian operations. In making a determination that a noise problem exists around an airport, the county shall:

(1) Investigate the possible existence of a noise impact area greater than zero based on a CNEL of 70 dB, and determine whether or not people actually reside inside the noise impact boundary;

(2) Review other information that it may deem relevant, including but not limited to complaint history and legal actions brought about by aircraft noise; and

(3) Coordinate with, and give due consideration to the recommendations of, the county airport land use commission (as defined in Public Utilities Code Section 21670).

(c) Any affected or interested person or any government agency disagreeing with the county's findings regarding the existence of a noise problem at a given airport may file an appeal with the department. Upon receipt of such an appeal, the department shall make an investigation and determination as to the validity of the county's findings. The department shall serve by mail the written record of such investigation and determination to the county, the airport proprietor, and the affected or interested person or governmental agency. If the department finds that the county's determination does not correspond to the facts, the county shall adhere to the determination of the department. Whenever the department has served such record, the county, airport proprietor, affected or interested person, or government agency may in writing within 10 days demand a hearing. In such case, the department shall file a statement of issues and shall conduct proceedings in accordance with the Administrative Procedure Act (Chapter 5, Part 1, Division 3, Title 2, Government Code).

(d) For all airports required to perform noise monitoring, the counties shall validate monitoring data supplied by the airport proprietor and shall enforce these regulations in all respects.

(e) The county shall submit quarterly reports to the Department of Aeronautics. Each report is due 45 days after the end of the quarter of the calendar year covered in the report. The report shall contain at least the following information on each airport within the county covered by these regulations:

(1) A map illustrating the location of the noise impact boundary, as validated by measurement, and the location of measurement points, in the four preceding quarters;





(2) The annual noise impact area as obtained from the preceding four calendar quarters, and as obtained in accordance with Article 2 of this subchapter of these regulations;

(3) The daily CNEL measurements, together with identification of the dates on which each measurement was made, number of total aircraft operations during the quarter, estimated number of operations of the highest noise level aircraft class in the quarter, and any other data which is pertinent to the activity during the quarter. In addition, the HNL data shall be retained for at least 3 years, and made available to the department upon request; and

(f) The department will maintain in file, for a period of at least 3 years, all the noise data received pursuant to these regulations. These records shall be maintained in accordance with the provisions of the California Public Records Act (Chapter 3.5, Division 1, Title 1, Government Code).

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment filed 5-23-79; effective thirtieth day thirtieth day thereafter (Register 79, No. 21).

Article 9. Implementation by Aircraft Operators

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Repealer of Article 9 (Section 5055) filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21). For history of former article, see Register 77, No. 10.

Article 10. Implementation by Airport Proprietors

**5060. Monitoring Requirements.**

(a) All airport proprietors shall cooperate with the county in the county's investigations to determine the existence of a noise problem, and shall furnish such data as the county may require.

(b) Each airport proprietor whose airport is determined to have a noise problem shall measure, establish and validate noise impact boundaries, monitor as required in Articles 3, 4 and 7 of this subchapter of these regulations, and shall furnish such data as the county may require.

**5061. Single Event Noise Limit Violations.**

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Repealer filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21). For history of former section, see Register 77, No. 10.

**5062. Noise Impact Area Violations.**

No airport proprietor shall operate his airport with a noise impact area of other than zero unless said operator has a variance as prescribed in Article 13 of this subchapter of these regulations.

**5063. Submittal of Monitoring Plan.**

Each airport proprietor who is required to perform noise monitoring shall submit a description of his monitoring plan to the county and to the department for approval. Such descriptions shall contain at least the following information:

(a) The general monitoring system plan, including at least locations and instrumentation;

(b) Justification for any proposed deviations from the measurement system locations specified in these regulations;

(c) Statistical sampling plan proposed for intermittent monitoring at community locations;

(d) Additional information as pertinent or as requested by the department.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Air Transport Association of America v. Crotti (N.D.Cal. 1975) 389 F.Supp. 58.

HISTORY:

1. Amendment filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21).

**5064. Grounds for Approval.**

Failure of the airport proprietor to comply with the provisions of Subchapter 6 of these regulations constitutes a ground for denial of approval of an airport site within the meaning of Public Utilities Code, Section 21666.

Article 11. Implementation by the Department

**5065. Implementation by the Department.**

The department will review the data submitted quarterly by the counties for the purpose of assessing the degree of compliance with this subchapter of these regulations. The department's review will include, but not be limited to, observation of any changes in boundary monitor positions and any changes in numerical values of CNEL.



Article 12. Schedule of Implementation

**5070. Schedule of Implementation.**

(a) For airports in existence on the effective date of this subchapter of these regulations, counties shall complete their determination of whether or not a noise problem exists within the shortest feasible time after the effective date of these regulations. In no event shall the time for completion of this determination exceed 6 months from the effective date of these regulations.

(b) Each proprietor of an airport that has a noise problem, upon receipt of notification from the county, shall initiate noise monitoring within the shortest feasible time not to exceed 6 months in accordance with this subchapter of these regulations and concurrently shall make application to the department for a temporary variance in accordance with Article 13.

Article 13. Variances

**5075. Variances.**

(a) In granting variances, the department shall be guided by the underlying intent of these regulations as follows:

(1) That the noise impact area surrounding proposed new airports be zero;

(2) That the proprietor of each existing airport having a surrounding noise impact area of zero based on a CNEL of 70 dB take actions to prevent a noise impact area of greater than zero;



(3) That the proprietor of each existing airport having a surrounding noise impact area of greater than zero based on a CNEL of 70 dB take actions to prevent an increase of the airport's noise impact area; and

(4) That the proprietor of each existing airport having a surrounding noise impact area of greater than zero based on a CNEL of 70 dB be required to develop and implement programs to reduce the noise impact area of the airport to an acceptable degree in an orderly manner over a reasonable period of time.

(b) An airport proprietor may request variances from the requirements of any or all of these regulations, except for Sections 5012 and 5013, for periods of not exceeding one year as set forth hereinafter:

(1) The airport proprietor shall apply to the department for a variance.

(2) Such application for variance shall be made upon a form which the department shall make available.

(3) Such application shall set forth the reasons why the airport proprietor believes said variance is necessary. The application shall state the future date by which the airport proprietor expects to achieve compliance with the regulations from which a variance is sought. The application shall set forth an incremental schedule of noise impact area reductions for the intervening time.

(4) The department may grant a variance if the public interest would be satisfied by such a variance. In weighing the public interest, the department's considerations include but are not limited to the following:

(A) The economic and technological feasibility of complying with the noise standards set by these regulations;

(B) The noise impact should the variance be granted;

(C) The value to the public of the services for which the variance is sought; and

(D) Whether the airport proprietor is taking *bona fide* measures to the best of his ability to achieve the noise standards set by these regulations.

(5) The burden of proof shall be upon the applicant for a variance.

(6) On its own motion, or upon the request of an affected or interested person, the department shall hold a public hearing in connection with the approval of an application for a variance. Any interested person may obtain from the department information on pending requests for variances at any time.

(7) The department in granting a variance may impose reasonable conditions which it deems necessary to effectuate the purposes of this subchapter of these regulations.

(8) In the event a variance has been granted, and it reasonably appears that the airport proprietor cannot within the term of the variance achieve compliance with the requirements for which the variance was granted, any application for a further variance from such requirement must be made not less than thirty days before the termination date of the prior variance. In the event timely application is made under the provisions of this subparagraph, the prior variance shall continue in effect until the department acts on the application.

NOTE: Authority cited: Sections 21243 and 21669, Public Utilities Code. Reference: Section 21669, Public Utilities Code.

HISTORY:

1. New subsection (b) (8) filed 5-23-79; effective thirtieth day thereafter (Register 79, No. 21).

# California Noise Insulation Standards

**(California Administrative Code, Title 25, Housing and Community Development, Chapter 1 - State Housing Law Regulations and Earthquake Protection Laws Regulations, Subchapter 4, Section 28; As amended through June 16, 1979)**

## Article 4. New Construction, Additions, Alterations

### 28. Noise Insulation Standards.

Noise insulation standards shall be in accordance with the applicable requirements of California Administrative Code, Title 24, Part 6, Division T25, Chapter 1, Subchapter 1, Article 4, Section T25-28, which reads as follows:

### T25-28. Noise Insulation Standards.

(a) Purpose. The purpose of this section is to establish uniform minimum noise insulation performance standards to protect persons within new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings from the effects of excessive noise, including but not limited to hearing loss or impairment and interference with speech and sleep.

(b) Application and Scope. The provisions of this article relating to noise insulation performance standards apply to new hotels, motels, apartment houses and dwellings other than detached single-family dwellings.

These regulations shall apply to all applications for building permits made subsequent to the effective date of these regulations.

These regulations shall be effective August 22, 1974.

(c) Definitions. The following special definitions shall apply to this article as applicable:

(1) Impact Insulation Class (IIC) - A single number rating for ceiling-floor construction that represents the ability of the construction to isolate impact noise, where measurement procedure is based on ASTM E492-73T and as defined in UBC Standard No. 35-2.

(2) Sound Transmission Class (STC) - A single figure rating for floor-ceiling and interior wall partition construction that represents the ability of the construction to isolate airborne noise, where measurement procedure is based on ASTM E90-70 or ASTM E366-71 and as defined in UBC Standard No. 35-1.

(3) Detached Single-Family Dwelling - Any single-family dwelling which is separated from adjacent property lines by 3 feet or more or is separated from adjacent buildings by 6 feet or more.

(d) Sound Transmission Control Between Dwelling Units.

(1) Wall and Floor-Ceiling Assemblies. Wall and floor-ceiling assemblies separating dwelling units or guest rooms from each other and from public space such as interior corridors and service areas shall provide airborne sound insulation for walls, and both airborne and impact sound insulation for floor-ceiling assemblies.

(2) Airborne Sound Insulation. All such separating walls and floor-ceiling assemblies shall provide an airborne sound insulation equal to that required to meet a Sound Transmission Class (STC) of 50 (45 if field tested) as defined in UBC Standard No. 35-1.

Penetrations or openings in construction assemblies for piping, electrical devices, recessed

cabinets, bathtubs, soffits, or heating, ventilating or exhaust ducts shall be sealed, lined, insulated or otherwise treated to maintain the required ratings.

Dwelling unit entrance doors from interior corridors together with their perimeter seals shall have a Sound Transmission Class (STC) rating of not less than 30 and such perimeter seals shall be maintained in good operating condition.

(3) Impact Sound Insulation. All separating floor-ceiling assemblies between separate units or guest rooms shall provide impact sound insulation equal to that required to meet an Impact Insulation Class (IIC) of 50 (45 if field tested) as defined in UBC Standard No. 35-2. Floor coverings may be included in the assembly to obtain the required rating, and must be retained as a permanent part of the assembly and may only be replaced by other floor covering that provides the same sound insulation required above.

(4) Tested Assemblies. Field or laboratory tested wall or floor-ceiling designs having an STC or IIC of 50 or more as determined by UBC Standard 35-1, 35-2, or 35-3 may be used without any additional field testing when in the opinion of the Building Officials the laboratory tested design has not been compromised by flanking paths. Tests may be required by the Building Official when evidence of compromised separations is noted.

(5) Field Testing. Field testing, when required, shall be done under the supervision of a person experienced in the field of acoustical testing and engineering, who shall forward test results to the Building Official showing that the minimum sound insulation requirements stated above have been met.

(6) Airborne Sound Insulation Field Tests. When required, airborne sound insulation shall be determined according to the applicable Field Airborne Sound Transmission Loss Test procedures of UBC Standard No. 35-3. All sound transmitted from the source room to the receiving room shall be considered to be transmitted through the test partition.

(7) Impact Sound Insulation Field Test. When required, impact sound insulation shall be determined in accordance with UBC Standard No. 35-2.

**Note:** Excerpts from the 1973 UBC Appendix Chapter 35, reproduced with permission of International Conference of Building Officials, 5360 S. Workman Mill Road, Whittier, California.

(e) Noise Insulation from Exterior Sources.

(1) Location and Orientation. Consistent with land use standards, residential structures located in noise critical areas, such as proximity to select system of county roads and city streets (as specified in 186.4 of the State of California Streets and Highways Code), railroads, rapid transit lines, airports, or industrial areas shall be designed to prevent the intrusion of exterior noises beyond prescribed levels with all exterior doors and windows in the closed position. Proper design shall include, but shall not be limited to, orientation of the residential structure, set-backs, shielding, and sound insulation of the building itself.

(2) Interior Noise Levels. Interior community noise equivalent levels (CNEL) with windows closed, attributable to exterior sources shall not exceed an annual of 45 dB in any habitable room.

(3) Airport Noise Sources. Residential structures to be located within an annual CNEL contour (as defined in Title 4, Subchapter 6, California Administrative Code) of 60 require an acoustical analysis showing that the structure has been designed to limit intruding noise to the prescribed allowable levels. CNEL's shall be as determined by the local jurisdiction in accordance with its local general plan.

(4) Vehicular and Industrial Noise Sources. Residential buildings or structures to be located within annual exterior community noise equivalent level contours of 60 dB adjacent to the select system of county roads and city streets (as specified in Section 186.4 of the State of California Streets and Highways Code), freeways, state highways, railroads, rapid-transit lines and industry noise sources shall require an acoustical analysis showing that the proposed building has been designed to limit intruding noise to the allowable interior noise levels prescribed in

Section T25-28 (e) (2). Exception: Railroads, where there are no nighttime (10:00 p.m. to 7:00 a.m.) railway operations and where daytime (7:00 a.m. to 10:00 p.m.) railway operations do not exceed four (4) per day.

(5) Compliance.

(A) Evidence of compliance shall consist of submittal of an acoustical analysis report, prepared under the supervision of a person experienced in the field of acoustical engineering, with the application for building permit. The report shall show topographical relationship of noise sources and dwelling site, predicted noise spectra at the exterior of the proposed dwelling structure considering present and future land use, basis for the prediction (measured or obtained from published data), noise attenuation measures to be applied, and an analysis of the noise insulation effectiveness of the proposed construction showing that the prescribed interior noise level requirements are met. If interior allowable noise levels are met by requiring that windows be unopenable or closed, the design for the structure must also specify the means that will be employed to provide ventilation, and cooling if necessary, to provide a habitable interior environment.

(B) Field Testing. Only when inspection indicates that the construction is not in accordance with the approved design, field testing may be required. Interior noise measurements shall be taken under conditions of typical maximum exterior noise levels within legal limits. A test report showing compliance or noncompliance with prescribed interior allowable levels shall be submitted to the Building Official.

Where a complaint as to noncompliance with this article requires a field test to resolve the complaint, the complainant shall post a bond or adequate funds in escrow for the cost of said testing. Such costs shall be chargeable to the complainant when such field tests show that compliance with these regulations is in fact present. If such tests show noncompliance, then such testing costs shall be borne by the owner or builder.

**Note:** Local Modifications. The governing body of any city or county may, by ordinance, adopt changes or modifications to the requirements of this section as set forth in Section 19722.7 of the Health and Safety Code (T25-28).

# Enabling Legislation

## Health and Safety Code

### Section 17922.6

### Noise Insulation Standards; Adoption, Amendment, and Repeal at State Level

(a) The Office of Noise Control in coordination with the department shall adopt, amend, and repeal rules and regulations which establish uniform minimum noise insulation standards for hotels, motels, apartment houses, and dwellings, other than detached single-family dwellings.

(b) Such standards shall be performance standards in order to require compliance onsite where the hotel, motel, apartment house, or dwelling, other than a detached single-family dwelling, is located.

(c) Such standards shall be sufficient to protect persons within the hotel, motel, apartment house, or dwelling, other than a detached single-family dwelling, from the effects of excessive noise, including, but not limited to, hearing loss or impairment and persistent interference with speech and sleep.

(d) The provisions of this section and the rules and regulation adopted pursuant to this section shall apply equally to those hotels, motels, apartment houses,and dwellings, other than detached single-family dwellings, owned, operated, or maintained by any public entity. The department shall enforce such rules and regulations with respect to any such hotel, motel, apartment house, or dwelling, other than a detached single-family dwelling, which is not subject to the jurisdiction of any local building department.

(e) The provisions of this section and the rules and regulations adopted pursuant to this section shall not apply to detached single-family dwellings.

(f) Such rules and regulations shall become operative six months after their date of adoption.

(g) Sections 17925, 17958, 17958.5, and 17958.7 shall not apply to the provisions of this section.

## Section 17922.7

### Noise Insulation Standards; Changes and Modifications by Local Agencies

(a) Except as otherwise provided in subdivisions (b) and (c) the governing body of every city, county, city and county, and public entity, shall adopt ordinances or regulations imposing the same requirements as are contained in the rules and regulations adopted pursuant to Section 17922.6 within six months after the date of adoption of such rules and regulations. The rules and regulations adopted pursuant to Section 17922.6 shall apply in any city, county, city and county, or to any hotel, motel, apartment house, or dwelling, other than a detached single-family dwelling, which is owned, operated, or maintained by any public entity, if the appropriate governing body fails to adopt such ordinances or regulations within six months after such date of adoption.

(b) In adopting such ordinances or regulations, the governing body of any city, county, city and county, or public entity may make such changes or modifications in the requirements contained in the rules and regulations adopted pursuant to Section 17922.6 as such governing body determines are reasonably necessary because of local conditions, but only if the governing body finds that such ordinances or regulations will require the diminution of the noise levels permitted by the rules and regulations adopted pursuant to Section 17922.6.

(c) Prior to making such modifications or changes pursuant to subdivision (b), the governing body shall make an express finding that such modifications or changes are needed, which finding shall be available as a public record. A copy of such finding, together with the modification or change, shall be filed with the Office of Noise Control.

## Section 17922.8

### Advisory Committee

The Office of Noise Control may appoint an advisory committee to assist the office in reviewing and revising the noise insulation standards previously adopted by the commission.

## Summary of Requirements of California Noise Insulation Standards

Applies to new hotels, motels, apartment houses, and dwellings other than detached single-family dwellings.

**Sound Transmission Control:**

(1) Wall and floor-ceiling assemblies separating dwelling units shall meet a Sound Transmission Class (STC) of 50 (45 if field tested) and an Impact Insulation Class (IIC) of 50 (45 if field tested).

(2) Entrance doors from interior corridors shall have an STC rating of not less than 30.

(3) Laboratory tests of walls and floor-ceiling designs having an STC and/or IIC of 50, may be used to establish an acceptable design.

(4) Field testing of proposed walls and floor-ceiling systems to obtain STC and/or IIC ratings, if required to prove compliance with the code, shall include all flanking paths.

**Noise Insulation from Exterior Sources:**

(1) Interior Community Noise Equivalent Levels (CNEL) shall not exceed 45 dB in any habitable room with all doors and windows closed.

(2) Residential locations having a CNEL greater than 60 dB require an acoustical analysis showing that the structure has been designed to meet the interior CNEL of 45 dB.

(3) CNEL shall be determined by local jurisdictions as part of the general plan (noise element).

(4) Exception: Railroads with only four (4) daytime and no nighttime operations.

## Documentation Requirements

When an acoustical consultant is retained by the architect to insure that the Noise Insulation Standards are met, it shall be appropriate to submit noise control details as part of the contract documents.

Section (e) (5) of the Standard states that "evidence of compliance shall consist of submittal of an acoustical analysis report ... with the application for a building permit." The report must show at least (1) the topographical relationship of noise sources and dwelling units, (2) the exterior noise spectra for both present and future noise sources of concern, (3) an analysis to show the effectiveness of the proposed construction to reduce exterior noise adequately, and (4) a ventilation analysis and design showing that a habitable interior environment will be provided if the interior allowable noise level is to be met with windows closed.

The general layout for the "Noise Control Details and Specifications" may be as follows:

(1) Calculated or measured noise exposure expressed in CNEL at the site. (Documentation should include description of analytical or measurement techniques used in this determination.)

(2) Statement of the required noise isolation and the means by which the design goal will be achieved.

(3) Site plan (showing proximity to intrusive noise sources), unit plans and elevations of noise exposed dwellings.

(4) Party wall, exterior wall, floor-ceiling and roof-ceiling framing details showing STC and IIC ratings (along with laboratory name and test reference number, if using a certified design).

(5) Ventilation system intake and exhaust details.

(6) Window and door details and schedules. (Include pertinent notes on type of glazing, caulking, weatherstripping, etc.)

(7) Specifications regarding noise control for trades (e.g., general, framing, glazing, plumbing, electrical, heating and ventilation, insulation, wallboard, plastering and masonry).

(8) Certification that the design complies with the standard.

APPENDIX C

**AC NO:** 36-1B

**DATE:** 12/5/77

# ADVISORY CIRCULAR

## DEPARTMENT OF TRANSPORTATION
## FEDERAL AVIATION ADMINISTRATION

**SUBJECT:** CERTIFICATED AIRPLANE NOISE LEVELS

1. PURPOSE. This circular provides noise level data for airplanes certificated under FAR Part 36 since its publication on November 18, 1969.

2. BACKGROUND

   a. Within the agency's regulatory program for airplane noise, both present and future rulemaking requires the quantification of airplane noise levels.

   b. Positive progress in the control and abatement of airplane noise has been, and will continue to be, made. A summary listing of existing airplane noise levels will provide both private and public exposure to this progress, as well as offering a common noise level reference for potential future reductions.

3. NOISE LEVELS. Noise levels measured during type certification under FAR Part 36 Appendix C are presented in Appendices I, IA, and II. These appendices include tabulations of engine type, gross weight, and flap settings for various aircraft as well as the measured noise in Effective Perceived Noise Level (EPNdB) compared with the appropriate FAR Part 36, Appendix C, noise level limits (takeoff, sideline, and approach) for each aircraft and configuration. In each case, the measured data have been corrected to sea level, 77° F, 70% relative humidity conditions using the procedures outlined in FAR Part 36. Appendix III shows the certificated airplane noise levels for propeller-driven small airplanes. This appendix includes a tabulation of the engine type, horsepower, and gross weight for the various certificated propeller-driven aircraft along with the measured dBA for flyover as compared to the FAR Part 36, Appendix F noise level for each aircraft.

4. REVISIONS. The airplane noise level listing of this Advisory Circular will be revised and updated periodically.

5. CANCELLATION. Advisory Circular 36-1A, Certificated Airplane Noise Levels, dated July 21, 1975, is cancelled.

CHARLES R. FOSTER
Director of Environmental Quality

* Noise levels for certain new technology commercial jet aircraft (not listed in the following tables) are shown on page C-11.

APPENDIX I
CERTIFICATED AIRPLANE NOISE LEVELS *

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| BOEING | | | | | | | | | | | | | |
| B-727-100 | JT8D-1FCD | 3 | 14.0 | 160.5 | 5 | 96.6 | 98.5 | 99.2 | 104.2 | 30 | 98.9 | 104.2 | 8 |
| B-727-100 | JT8D-1FCD | 3 | 14.0 | 160.5 | 5 | 96.6 | 98.5 | 99.2 | 104.2 | 40 | 104.3 | 104.2 | 8 |
| B-727-100 | JT8D-1FCD | 3 | 14.0 | 169.5 | 5 | 98.5 | 98.9 | 99.1 | 104.4 | 30 | 98.9 | 104.4 | 8 |
| B-727-100 | JT8D-1FCD | 3 | 14.0 | 169.5 | 5 | 98.5 | 98.9 | 99.1 | 104.4 | 40 | 104.3 | 104.4 | 8 |
| B-727-100 | JT8D-7FCD | 3 | 14.0 | 160.5 | 5 | 96.0 | 98.5 | 100.2 | 104.2 | 30 | 98.9 | 104.2 | |
| B-727-100 | JT8D-7FCD | 3 | 14.0 | 160.5 | 5 | 96.0 | 98.5 | 100.2 | 104.2 | 40 | 104.3 | 104.2 | |
| B-727-100 | JT8D-7FCD | 3 | 14.0 | 169.5 | 5 | 97.9 | 98.9 | 100.0 | 104.4 | 30 | 98.9 | 104.4 | |
| B-727-100 | JT8D-7FCD | 3 | 14.0 | 169.5 | 5 | 97.9 | 98.9 | 100.0 | 104.4 | 40 | 104.3 | 104.4 | |
| B-727-100 | JT8D-9FCD | 3 | 14.5 | 160.5 | 5 | 96.1 | 98.5 | 100.2 | 104.2 | 30 | 102.0 | 104.2 | |
| B-727-100 | JT8D-9FCD | 3 | 14.5 | 160.5 | 5 | 96.1 | 98.5 | 100.2 | 104.2 | 40 | 105.8 | 104.2 | |
| B-727-100 | JT8D-9FCD | 3 | 14.5 | 169.5 | 5 | 98.3 | 98.9 | 100.0 | 104.4 | 30 | 102.0 | 104.4 | |
| B-727-100 | JT8D-9F&D | 3 | 14.5 | 169.5 | 5 | 98.3 | 98.9 | 100.0 | 104.4 | 40 | 105.8 | 104.4 | |
| B-727-200 | JT8D-7QN | 3 | 14.0 | 169.5 | 15 | 99.3 | 98.9 | 100.4 | 104.4 | 30 | 101.7 | 104.4 | 8 |
| B-727-200 | JT8D-7QN | 3 | 14.0 | 169.5 | 15 | 99.3 | 98.9 | 100.4 | 104.4 | 40 | 104.9 | 104.4 | 8 |
| B-727-200 | JT8D-7QN | 3 | 14.0 | 172.5 | 15 | 100.0 | 99.0 | 100.4 | 104.4 | 30 | 101.7 | 104.4 | 8 |
| B-727-200 | JT8D-7QN | 3 | 14.0 | 172.5 | 15 | 100.0 | 99.0 | 100.4 | 104.4 | 40 | 104.9 | 104.4 | 8 |
| B-727-200 | JT8D-9QN | 3 | 14.5 | 172.5 | 15 | 99.0 | 99.0 | 100.4 | 104.4 | 30 | 100.4 | 104.4 | |
| B-727-200 | JT8D-9QN | 3 | 14.5 | 172.5 | 15 | 99.0 | 99.0 | 100.4 | 104.4 | 40 | 103.2 | 104.4 | |
| B-727-200 | JT8D-9QN | 3 | 14.5 | 184.8 | 15 | 101.5 | 99.5 | 100.2 | 104.6 | 30 | 100.4 | 104.6 | |
| B-727-200 | JT8D-9QN | 3 | 14.5 | 184.8 | 15 | 101.5 | 99.5 | 100.2 | 104.6 | 40 | 103.2 | 104.6 | |
| B-727-200 | JT8D-15QN | 3 | 15.5 | 184.2 | 5 | 98.8 | 99.5 | 102.2 | 104.6 | 30 | 100.4 | 104.6 | |
| B-727-200 | JT8D-15QN | 3 | 15.5 | 184.2 | 5 | 98.8 | 99.5 | 102.2 | 104.6 | 40 | 103.2 | 104.6 | |
| B-727-200 | JT8D-15QN | 3 | 15.5 | 190.5 | 5 | 100.0 | 99.7 | 102.2 | 104.7 | 30 | 100.4 | 104.7 | |
| B-727-200 | JT8D-15QN | 3 | 15.5 | 190.5 | 5 | 100.0 | 99.7 | 102.2 | 104.7 | 40 | 103.2 | 104.7 | |
| B-727-200 | JT8D-17QN | 3 | 16.0 | 190.5 | 5 | 99.6 | 99.7 | 103.7 | 104.7 | 30 | 100.4 | 104.7 | |
| B-727-200 | JT8D-17QN | 3 | 16.0 | 190.5 | 5 | 99.6 | 99.7 | 103.7 | 104.7 | 40 | 103.2 | 104.7 | |
| B-727-200 | JT8D-17QN | 3 | 16.0 | 203.1 | 5 | 102.0 | 100.2 | 103.5 | 104.9 | 30 | 100.4 | 104.9 | |
| B-727-200 | JT8D-17QN | 3 | 16.0 | 203.1 | 5 | 102.0 | 100.2 | 103.5 | 104.9 | 40 | 103.2 | 104.9 | |
| B-727-200 | JT8D-17RQN | 3 | 16.4 | 197.0 | 5 | 100.2 | 100.0 | 104.5 | 104.8 | 30 | 100.4 | 104.8 | |
| B-727-200 | JT8D-17RQN | 3 | 16.4 | 197.0 | 5 | 100.2 | 100.0 | 104.5 | 104.8 | 40 | 103.2 | 104.8 | |
| B-727-200 | JT8D-17RQN | 3 | 16.4 | 208.0 | 5 | 102.4 | 100.4 | 104.2 | 104.9 | 30 | 100.4 | 104.9 | |
| B-727-200 | JT8D-17RQN | 3 | 16.4 | 208.0 | 5 | 102.4 | 100.4 | 104.2 | 104.9 | 40 | 103.2 | 104.9 | |
| B-737-200 | JT8D-7QN | 2 | 14.0 | 100.5 | 1 | 92.1 | 95.1 | 101.7 | 102.8 | 30 | 99.1 | 102.8 | 8 |
| B-737-200 | JT8D-7QN | 2 | 14.0 | 100.5 | 1 | 92.1 | 95.1 | 101.7 | 102.8 | 40 | 102.1 | 102.8 | 8 |
| B-737-200 | JT8D-7QN | 2 | 14.0 | 109.0 | 1 | 94.7 | 95.7 | 101.3 | 103.1 | 40 | 102.1 | 103.1 | 8 |
| B-737-200 | JT8D-7QN | 2 | 14.0 | 109.0 | 1 | 94.7 | 95.7 | 101.3 | 103.1 | 40 | 102.1 | 103.1 | 8 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 109.0 | 1 | 93.2 | 95.7 | 100.7 | 103.1 | 30 | 101.2 | 103.1 | 8 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 109.0 | 1 | 93.2 | 95.7 | 100.7 | 103.1 | 40 | 104.1 | 103.1 | 8 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 115.5 | 1 | 95.2 | 96.1 | 100.4 | 103.2 | 30 | 101.2 | 103.2 | 8 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 115.5 | 1 | 95.2 | 96.1 | 100.4 | 103.2 | 40 | 105.2 | 103.2 | 8,18 |

* Noise levels for certain new technology commercial jet aircraft are shown on page C-11.

APPENDIX I
CERTIFICATED AIRPLANE NOISE LEVELS

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 114.5 | 1 | 95.1 | 96.1 | 100.7 | 103.2 | 30 | 101.2 | 103.2 | 8,18,20 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 114.5 | 1 | 95.1 | 96.1 | 100.7 | 103.2 | 40 | 105.2 | 103.3 | 8,18,20 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 117.0 | 1 | 95.6 | 96.2 | 100.5 | 103.3 | 30 | 101.2 | 103.3 | 8,18,20 |
| B-737-200 | JT8D-9QN | 2 | 14.5 | 117.0 | 1 | 95.6 | 96.2 | 100.5 | 103.3 | 40 | 105.3 | 103.3 | 8,18,20 |
| B-737-200 | JT8D-9QN | 2 | 15.5 | 115.5 | 1 | 94.4 | 96.1 | 103.1 | 103.2 | 30 | 101.2 | 103.2 | 18,20 |
| B-737-200 | JT8D-15QN | 2 | 15.5 | 115.5 | 1 | 94.4 | 96.1 | 103.1 | 103.2 | 40 | 105.0 | 103.2 | 18,20 |
| B-737-200 | JT8D-15QN | 2 | 15.5 | 117.0 | 1 | 94.9 | 96.2 | 103.1 | 103.3 | 30 | 101.2 | 103.3 | 18,20 |
| B-737-200 | JT8D-15QN | 2 | 15.5 | 117.0 | 1 | 94.9 | 96.2 | 103.1 | 103.3 | 40 | 104.8 | 103.3 | 18,20 |
| B-737-200 | JT8D-15QN | 2 | 16.0 | 115.5 | 1 | 93.6 | 96.1 | 104.4 | 103.2 | 30 | 101.2 | 103.2 | 18,20 |
| B-737-200 | JT8D-17QN | 2 | 16.0 | 115.5 | 1 | 93.6 | 96.1 | 104.4 | 103.2 | 40 | 104.5 | 103.2 | 18,20 |
| B-737-200 | JT8D-17QN | 2 | 16.0 | 122.5 | 1 | 95.2 | 96.5 | 104.2 | 103.4 | 30 | 101.2 | 103.4 | 18,20 |
| B-737-200 | JT8D-17QN | 2 | 16.0 | 122.5 | 1 | 95.2 | 96.5 | 104.2 | 103.4 | 40 | 103.9 | 103.4 | 18,20 |
| B-747-100 | JT9D-3 | 4 | 43.5 | 710.0 | 10 | 115.0 | 108.0 | 101.9 | 108.0 | 30 | 113.6 | 108.0 | 12,13 |
| B-747-100 | JT9D-3Awet | 4 | 45.0 | 735.0 | 10 | 112.4 | 108.0 | 103.3 | 108.0 | 30 | 114.8 | 108.0 | 12,13 |
| B-747-100 | JT9D-7 | 4 | 46.3 | 710.0 | 10 | 110.8 | 108.0 | 102.1 | 108.0 | 30 | 114.3 | 108.0 | 12 |
| B-747-100 | JT9D-7wet | 4 | 47.9 | 735.0 | 10 | 110.7 | 108.0 | 102.1 | 108.0 | 30 | 114.6 | 108.0 | 12 |
| B-747-100 | JT9D-7 | 4 | 46.3 | 710.0 | 10 | 110.5 | 108.0 | 101.8 | 108.0 | 30 | 112.3 | 108.0 | 14 |
| B-747-100 | JT9D-7wet | 4 | 47.9 | 735.0 | 10 | 110.4 | 108.0 | 102.0 | 108.0 | 30 | 112.6 | 108.0 | 14 |
| B-747-100 | JT9D-7 | 4 | 46.3 | 710.0 | 10 | 108.0 | 108.0 | 100.1 | 108.0 | 30 | 107.4 | 108.0 | 15 |
| B-747-100 | JT9D-7wet | 4 | 47.9 | 750.0 | 10 | 109.1 | 108.0 | 100.6 | 108.0 | 30 | 107.5 | 108.0 | 15 |
| B-747-100 | JT9D-7 | 4 | 46.3 | 710.0 | 10 | 106.6 | 108.0 | 99.1 | 108.0 | 30 | 106.9 | 108.0 | 16 |
| B-747-100 | JT9D-7wet | 4 | 47.9 | 750.0 | 10 | 107.7 | 108.0 | 99.6 | 108.0 | 30 | 107.1 | 108.0 | 16 |
| B-747-100 | JT9D-7F | 4 | 48.0 | 750.0 | 10 | 109.4 | 108.0 | 100.3 | 108.0 | 30 | 108.0 | 108.0 | 15 |
| B-747-100 | JT9D-7Fwet | 4 | 50.0 | 750.0 | 10 | 109.4 | 108.0 | 100.9 | 108.0 | 30 | 108.0 | 108.0 | 15 |
| B-747-200 | JT9D-3A | 4 | 43.5 | 767.0 | 10 | 114.1 | 108.0 | 100.6 | 108.0 | 30 | 112.1 | 108.0 | 13,17 |
| B-747-200 | JT9D-3A | 4 | 45.0 | 773.0 | 10 | 112.7 | 108.0 | 100.9 | 108.0 | 30 | 112.4 | 108.0 | 13,17 |
| B-747-200 | JT9D-7 | 4 | 46.3 | 770.0 | 10 | 112.5 | 108.0 | 101.1 | 108.0 | 30 | 111.5 | 108.0 | 12 |
| B-747-200 | JT9D-7wet | 4 | 47.9 | 775.0 | 10 | 111.4 | 108.0 | 101.1 | 108.0 | 30 | 112.0 | 108.0 | 12 |
| B-747-200 | JT9D-3A | 4 | 43.5 | 767.0 | 10 | 110.0 | 108.0 | 98.2 | 108.0 | 30 | 106.5 | 108.0 | 11,13 |
| B-747-200 | JT9D-3Awet | 4 | 45.0 | 773.0 | 10 | 109.1 | 108.0 | 98.7 | 108.0 | 30 | 106.7 | 108.0 | 11,13 |
| B-747-200 | JT9D-3A | 4 | 43.5 | 767.0 | 10 | 108.6 | 108.0 | 97.2 | 108.0 | 30 | 106.0 | 108.0 | 10,13 |
| B-747-200 | JT9D-3Awet | 4 | 45.0 | 773.0 | 10 | 107.7 | 108.0 | 97.7 | 108.0 | 30 | 106.2 | 108.0 | 10,13 |
| B-747-200 | JT9D-7 | 4 | 46.3 | 770.0 | 10 | 108.9 | 108.0 | 98.8 | 108.0 | 30 | 106.7 | 108.0 | 11 |
| B-747-200 | JT9D-7wet | 4 | 47.9 | 785.0 | 10 | 108.8 | 108.0 | 99.2 | 108.0 | 30 | 107.3 | 108.0 | 11 |
| B-747-200 | JT9D-7 | 4 | 46.3 | 770.0 | 10 | 107.4 | 108.0 | 97.8 | 108.0 | 30 | 106.2 | 108.0 | 10 |
| B-747-200 | JT9D-7wet | 4 | 47.9 | 785.0 | 10 | 107.3 | 108.0 | 98.2 | 108.0 | 30 | 106.8 | 108.0 | 10 |
| B-747-200 | JT9D-7F | 4 | 48.0 | 775.0 | 10 | 108.6 | 108.0 | 98.9 | 108.0 | 30 | 107.2 | 108.0 | 11 |
| B-747-200 | JT9D-7Fwet | 4 | 50.0 | 805.0 | 10 | 109.4 | 108.0 | 99.2 | 108.0 | 30 | 107.8 | 108.0 | 11 |
| B-747-200 | JT9D-70A | 4 | 53.0 | 820.0 | 10 | 103.6 | 108.0 | 96.1 | 108.0 | 30 | 105.8 | 108.0 | |
| B-747-200 | CF6-50E | 4 | 52.5 | 775.0 | 10 | 105.3 | 108.0 | 98.4 | 108.0 | 30 | 105.0 | 108.0 | |
| B-747-200 | CF6-50E | 4 | 52.5 | 800.0 | 10 | 106.1 | 108.0 | 98.3 | 108.0 | 30 | 106.1 | 108.0 | |

APPENDIX I
CERTIFICATED AIRPLANE NOISE LEVELS

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| B-747-200 | CF6-50E | 4 | 52.5 | 820.0 | 10 | 106.8 | 108.0 | 98.2 | 108.0 | 30 | 106.1 | 108.0 | |
| B-747-200 | RB211-524B | 4 | 50.1 | 800.0 | 10 | 105.5 | 108.0 | 96.0 | 108.0 | 30 | 107.8 | 108.0 | |
| B-747-SR | JT9D-7A | 4 | 46.95 | 570.0 | 10 | 99.5 | 107.6 | 98.5 | 107.9 | 30 | 106.2 | 107.9 | 10 |
| B-747-SR | JT9D-7A | 4 | 46.95 | 610.0 | 10 | 102.4 | 108.0 | 99.3 | 108.0 | 30 | 106.7 | 108.0 | 11 |
| B-747-SP | JT9D-7A | 4 | 46.95 | 660.0 | 10 | 104.4 | 108.0 | 99.0 | 108.0 | 30 | 103.4 | 108.0 | 11 |
| B-747-SP | JT9D-7A | 4 | 46.95 | 690.0 | 10 | 105.6 | 108.0 | 98.9 | 108.0 | 30 | 103.7 | 108.0 | 11 |
| B-747-SP | JT9D-7F | 4 | 48.0 | 660.0 | 10 | 104.4 | 108.0 | 99.2 | 108.0 | 30 | 103.7 | 108.0 | 11 |
| B-747-SP | JT9D-7Fwet | 4 | 50.0 | 695.0 | 10 | 105.7 | 108.0 | 99.5 | 108.0 | 30 | 104.1 | 108.0 | 11 |
| CESSNA | | | | | | | | | | | | | |
| Model 500 | JT15D-1 | 2 | 2.2 | 11.5 | 15 | 77.7 | 93.0 | 86.1 | 102.0 | 40 | 87.7 | 102.0 | |
| GATES LEARJET | | | | | | | | | | | | | |
| Learjet 24D | CJ610-6 | 2 | 2.95 | 13.5 | 20 | 90.1 | 93.0 | 97.3 | 102.0 | 40 | 100.7 | 102.0 | |
| Learjet 24D | CJ610-6 | 2 | 2.95 | 13.5 | 20 | 91.8 | 93.0 | 99.3 | 102.0 | 40 | 101.7 | 102.0 | 23 |
| Learjet 24D | CJ610-6 | 2 | 2.95 | 13.5 | 20 | 91.8 | 93.0 | 99.3 | 102.0 | 40 | 99.6 | 102.0 | 24 |
| Learjet 24E | CJ610-6 | 2 | 2.95 | 12.9 | 20 | 84.3 | 93.0 | 103.9 | 102.0 | 40 | 95.3 | 102.0 | 8 |
| Learjet 24F | CJ610-6 | 2 | 2.95 | 13.5 | 20 | 85.8 | 93.0 | 103.7 | 102.0 | 40 | 95.3 | 102.0 | 8 |
| Learjet 25C | CJ610-6 | 2 | 2.95 | 15.0 | 20 | 94.0 | 93.0 | 99.3 | 102.0 | 40 | 100.8 | 102.0 | 24 |
| Learjet 25D | CJ610-6 | 2 | 2.95 | 15.0 | 20 | 94.0 | 93.0 | 99.3 | 102.0 | 40 | 102.7 | 102.0 | 24 |
| Learjet 25D | CJ610-6 | 2 | 2.95 | 15.0 | 8 | 90.9 | 93.0 | 103.7 | 102.0 | 40 | 95.2 | 102.0 | 8 |
| Learjet 25F | CJ610-6 | 2 | 2.95 | 15.0 | 8 | 90.9 | 93.0 | 103.7 | 102.0 | 40 | 95.2 | 102.0 | 8 |
| Learjet 35 | TFE731-2 | 2 | 3.5 | 17.0 | 8 | 83.4 | 93.0 | 86.7 | 102.0 | 40 | 92.2 | 102.0 | |
| Learjet 35 | TFE731-2 | 2 | 3.5 | 17.0 | 20 | 84.0 | 93.0 | 86.9 | 102.0 | 40 | 99.1 | 102.0 | |
| Learjet 36 | TFE731-2 | 2 | 3.5 | 17.0 | 8 | 83.4 | 93.0 | 86.7 | 102.0 | 40 | 99.2 | 102.0 | |
| Learjet 36 | TFE731-2 | 2 | 3.5 | 17.0 | 20 | 84.0 | 93.0 | 86.7 | 102.0 | 40 | 99.2 | 102.0 | |
| Learjet 36 | TFE731-2 | 2 | 3.5 | 17.0 | 20 | 84.0 | 93.0 | 86.9 | 102.0 | 40 | 99.1 | 102.0 | |
| Learjet 35A | TFE731-22B | 2 | 3.5 | 18.0 | 8 | 83.6 | 93.0 | 87.4 | 102.0 | 40 | 91.3 | 102.0 | |
| Learjet 36A | TFE731-22B | 2 | 3.5 | 18.0 | 8 | 83.6 | 93.0 | 87.4 | 102.0 | 40 | 91.3 | 102.0 | |
| Learjet M35 | TFE731-22B | 2 | 3.5 | 18.0 | 20 | 84.5 | 93.0 | 87.9 | 102.0 | 40 | 92.2 | 102.0 | |
| Learjet M36 | TFE731-22B | 2 | 3.5 | 18.0 | 20 | 84.5 | 93.0 | 87.9 | 102.0 | 40 | 92.2 | 102.0 | |
| GRUMMAN AMERICAN | | | | | | | | | | | | | |
| Gulfstream II | Spey Mk511-8 | 2 | 11.5 | 62.0 | 20 | 90.9 | 93.0 | 102.7 | 102.0 | 39 | 98.2 | 102.0 | 8 |
| LOCKHEED | | | | | | | | | | | | | |
| 1329-25 Jetstar II | TFE731-3-1E | 4 | 3.7 | 43.75 | 20 | 92.7 | 93.0 | 88.1 | 102.0 | 50 | 97.4 | 102.0 | |
| L-1011 | RB211-22B | 3 | 41.03 | 430.0 | 14 | 95.9 | 105.6 | 95.1 | 107.0 | 42 | 102.8 | 107.0 | 5 |

APPENDIX I
CERTIFICATED AIRPLANE NOISE LEVELS

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| L-1011 | RB211-22B | 3 | 41.03 | 430.0 | 14 | 95.9 | 105.6 | 95.1 | 107.1 | 33 | 102.0 | 107.1 | 5 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 430.0 | 10 | 97.0 | 105.6 | 95.0 | 107.1 | 42 | 103.4 | 107.1 | 6,7 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 416.0 | 10 | 96.1 | 105.4 | 95.1 | 107.0 | 33 | 102.1 | 107.0 | 6,7 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 416.0 | 10 | 96.1 | 105.4 | 95.1 | 107.0 | 33 | 101.5 | 107.0 | 8 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 430.0 | 10 | 97.9 | 105.6 | 95.2 | 107.1 | 42 | 103.4 | 107.1 | 7,9 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 422.0 | 10 | 97.7 | 105.5 | 95.0 | 107.0 | 33 | 102.1 | 107.0 | 7,9 |
| L-1011-1 | RB211-22C | 3 | 42.0 | 396.0 | 10 | 96.0 | 105.0 | 95.2 | 106.8 | 33 | 101.5 | 106.8 | 8,9 |
| McDONNELL DOUGLAS | | | | | | | | | | | | | |
| DC-9-30 | JT8D-7A | 2 | 14.0 | 108.0 | 0 | 95.1 | 95.6 | 97.3 | 103.1 | 50 | 97.3 | 103.1 | 1 |
| DC-9-30 | JT8D-7A | 2 | 14.0 | 94.0 | 0 | 91.7 | 94.6 | 97.8 | 102.7 | 50 | 97.0 | 102.7 | 1 |
| DC-9-30 | JT8D-9 | 2 | 14.5 | 110.0 | 0 | 96.1 | 95.8 | 98.8 | 103.1 | 50 | 99.1 | 103.1 | 1 |
| DC-9-30 | JT8D-9 | 2 | 14.5 | 108.0 | 0 | 95.5 | 95.6 | 98.8 | 103.1 | 50 | 99.0 | 103.1 | 1 |
| DC-9-30 | JT8D-9 | 2 | 14.5 | 103.0 | 0 | 94.3 | 95.3 | 99.0 | 102.9 | | | | 1 |
| DC-9-30 | JT8D-15 | 2 | 15.5 | 114.0 | 0 | 95.8 | 96.0 | 100.5 | 103.2 | 50 | 99.0 | 103.2 | |
| DC-9-30 | JT8D-15 | 2 | 15.5 | 110.0 | 0 | 94.7 | 95.8 | 100.6 | 103.1 | 50 | 98.8 | 103.1 | 1 |
| DC-9-30 | JT8D-15 | 2 | 15.5 | 108.0 | 0 | 94.2 | 95.6 | 100.7 | 103.1 | 50 | 98.4 | 103.1 | 1 |
| DC-9-30 | JT8D-15 | 2 | 15.5 | 98.0 | 0 | 91.2 | 94.9 | 101.1 | 102.8 | | | | |
| DC-9-30 | JT8D-17 | 2 | 16.0 | 121.0 | 0 | 98.0 | 96.5 | 103.0 | 103.4 | 50 | 101.9 | 103.4 | 2 |
| DC-9-30 | JT8D-17 | 2 | 16.0 | 115.0 | 0 | 96.3 | 96.1 | 103.2 | 103.2 | | | | 2 |
| DC-9-30 | JT8D-17 | 2 | 16.0 | 110.0 | 0 | 94.9 | 95.8 | 103.3 | 103.1 | | | | 2 |
| DC-9-40 | JT8D-11 | 2 | 15.0 | 114.0 | 0 | 96.8 | 96.0 | 99.9 | 103.2 | 50 | 99.4 | 103.2 | 1 |
| DC-9-40 | JT8D-11 | 2 | 15.0 | 107.0 | 0 | 95.2 | 95.6 | 99.6 | 103.0 | | | | 1 |
| DC-9-40 | JT8D-15 | 2 | 15.5 | 114.0 | 0 | 95.8 | 96.0 | 100.5 | 103.2 | 50 | 99.4 | 103.2 | 1 |
| DC-9-40 | JT8D-15 | 2 | 15.0 | 105.0 | 0 | 93.3 | 95.4 | 100.8 | 103.0 | | | | 1 |
| DC-9-50 | JT8D-15 | 2 | 15.5 | 121.0 | 0 | 97.8 | 96.5 | 102.2 | 103.4 | 50 | 101.9 | 103.4 | 2 |
| DC-9-50 | JT8D-15 | 2 | 15.5 | 115.0 | 0 | 96.1 | 96.1 | 102.4 | 103.2 | 40 | 101.1 | 103.2 | 2 |
| DC-9-50 | JT8D-15 | 2 | 15.5 | 110.0 | 0 | 94.7 | 95.8 | 102.5 | 103.1 | | | | |
| DC-9-50 | JT8D-17 | 2 | 16.0 | 121.0 | 0 | 98.1 | 96.5 | 103.2 | 103.4 | 50 | 101.9 | 103.4 | 2 |
| DC-9-50 | JT8D-17 | 2 | 16.0 | 118.0 | 0 | 97.2 | 96.3 | 103.3 | 103.3 | 40 | 101.1 | 103.3 | 2 |
| DC-9-50 | JT8D-17 | 2 | 16.0 | 115.0 | 0 | 96.4 | 96.1 | 103.4 | 103.2 | | | | 2 |
| DC-9-50 | JT8D-17 | 2 | 16.0 | 110.0 | 0 | 95.0 | 95.8 | 103.5 | 103.1 | | | | 2 |
| DC-10-10 | CF6-6D | 3 | 39.3 | 440.0 | 5 | 99.0 | 105.8 | 95.1 | 107.1 | 35 | 100.3 | 107.1 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 440.0 | 5 | 99.0 | 105.8 | 95.1 | 107.1 | 50 | 105.4 | 107.1 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 430.0 | 8 | 98.2 | 105.6 | 95.2 | 107.1 | 35 | 99.7 | 107.1 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 430.0 | 8 | 98.2 | 105.8 | 95.2 | 107.1 | 50 | 104.7 | 107.1 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 410.0 | 14 | 96.8 | 105.3 | 95.6 | 106.9 | 35 | 99.2 | 106.9 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 410.0 | 14 | 96.8 | 105.3 | 95.6 | 106.9 | 50 | 104.2 | 106.9 | |
| DC-10-10 | CF6-6D | 3 | 39.3 | 377.5 | 14 | 94.6 | 104.7 | 95.8 | 106.7 | | | | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 440.0 | 8 | 98.2 | 105.8 | 95.4 | 107.1 | 35 | 100.3 | 107.1 | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 440.0 | 8 | 98.2 | 105.8 | 95.4 | 107.1 | 50 | 105.4 | 107.1 | |

APPENDIX I
CERTIFICATED AIRPLANE NOISE LEVELS

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 430.0 | 11 | 97.4 | 105.6 | 95.6 | 107.1 | 35 | 99.7 | 107.1 | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 430.0 | 11 | 97.4 | 105.6 | 95.6 | 107.1 | 50 | 104.7 | 107.1 | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 386.5 | 15 | 94.6 | 104.8 | 96.0 | 106.7 | 35 | 99.2 | 106.7 | |
| DC-10-10 | CF6-6D1 | 3 | 40.3 | 386.5 | 15 | 94.6 | 104.8 | 96.0 | 106.7 | 50 | 104.2 | 106.7 | |
| DC-10-30 | CF6-50A | 3 | 48.4 | 550.0 | 8 | 103.7 | 107.4 | 95.7 | 107.8 | 35 | 103.0 | 107.8 | |
| DC-10-30 | CF6-50A | 3 | 48.4 | 550.0 | 8 | 103.7 | 107.4 | 95.7 | 107.8 | 50 | 108.4 | 107.8 | |
| DC-10-30 | CF6-50A | 3 | 48.4 | 519.6 | 8 | 102.1 | 107.1 | 96.0 | 107.6 | 35 | 102.6 | 107.8 | |
| DC-10-30 | CF6-50A | 3 | 48.4 | 519.6 | 8 | 102.1 | 107.1 | 96.0 | 107.6 | 50 | 108.2 | 107.8 | |
| DC-10-30 | CF6-50A | 3 | 48.4 | 519.6 | 8 | 102.1 | 107.0 | 96.0 | 107.6 | 50 | 107.4 | 107.8 | |
| DC-10-30 | CF6-50C | 3 | 51.0 | 565.0 | 10 | 104.4 | 107.6 | 97.3 | 107.8 | 50 | 108.4 | 107.8 | |
| DC-10-30 | CF6-50C | 3 | 51.0 | 534.4 | 10 | 103.2 | 107.2 | 97.6 | 107.8 | 35 | 103.0 | 107.8 | |
| DC-10-30 | CF6-50C | 3 | 51.0 | 440.0 | 10 | 100.2 | 105.8 | 98.5 | 107.1 | 35 | 102.6 | 107.1 | 3 |
| DC-10-30 | CF6-50C | 3 | 50.4 | 550.0 | 10 | 103.8 | 107.4 | 98.1 | 107.8 | 50 | 108.5 | 107.8 | 3 |
| DC-10-30 | CF6-50C | 3 | 50.4 | 534.4 | 10 | 103.3 | 107.2 | 98.3 | 107.7 | 35 | 103.2 | 107.7 | 3 |
| DC-10-30 | CF6-50C | 3 | 50.4 | 440.0 | 10 | 100.3 | 105.8 | 98.9 | 107.1 | 50 | 108.0 | 107.1 | 4 |
| DC-10-30 | CF6-50C1 | 3 | 51.8 | 590.0 | 6 | 105.3 | 107.9 | 99.3 | 108.0 | 50 | 109.6 | 108.0 | |
| DC-10-30 | CF6-50C1 | 3 | 51.8 | 572.0 | 10 | 104.4 | 107.7 | 99.7 | 107.9 | 35 | 104.2 | 107.9 | |
| DC-10-30 | CF6-50C1 | 3 | 51.8 | 562.0 | 10 | 104.0 | 107.5 | 99.7 | 107.8 | | | | |
| DC-10-30 | CF6-50C1 | 3 | 51.8 | 534.4 | 10 | 103.0 | 107.2 | 99.9 | 107.7 | | | | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 530.0 | 10 | 100.7 | 107.1 | 94.3 | 107.7 | 35 | 100.4 | 107.7 | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 530.0 | 10 | 100.7 | 107.1 | 94.3 | 107.7 | 50 | 105.4 | 107.7 | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 484.0 | 10 | 98.4 | 106.5 | 94.3 | 107.4 | 35 | 99.2 | 107.4 | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 484.0 | 10 | 98.4 | 106.5 | 94.3 | 107.4 | 50 | 104.6 | 107.4 | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 430.0 | 10 | 95.8 | 105.6 | 94.3 | 107.1 | 35 | 98.5 | 107.1 | |
| DC-10-40 | JT9D-20 | 3 | 49.4 | 430.0 | 10 | 95.8 | 105.6 | 94.3 | 107.1 | 50 | 103.8 | 107.1 | |
| DC-10-40 | JT9D-59A | 3 | 51.72 | 590.0 | 10 | 102.6 | 107.9 | 97.0 | 108.0 | 50 | 106.6 | 108.0 | |
| DC-10-40 | JT9D-59A | 3 | 51.72 | 555.0 | 10 | 100.8 | 107.4 | 97.2 | 107.8 | 35 | 105.7 | 107.8 | |
| DC-10-40 | JT9D-59B | 3 | 53.23 | 590.0 | 10 | 102.9 | 107.9 | 97.6 | 108.0 | 50 | 106.6 | 108.0 | |
| DC-10-40 | JT9D-59B | 3 | 53.23 | 555.0 | 10 | 101.4 | 107.4 | 97.8 | 107.8 | 35 | 105.7 | 107.8 | |
| ROCKWELL INTERNATIONAL | | | | | | | | | | | | | |
| Sabre 60 | JT12A-8 | 2 | 3.3 | 20.0 | 0 | 95.0 | 93.0 | 100.3 | 102.0 | 23.5 | 98.5 | 102.0 | |
| Sabre 75A | CF700-2D-2 | 2 | 4.31 | 23.0 | 0 | 90.7 | 93.0 | 91.3 | 102.0 | 25 | 100.2 | 102.0 | |
| Sabre 75A | CF700-2D-2 | 2 | 4.31 | 23.0 | 15 | 90.7 | 93.0 | 91.5 | 102.0 | | | | |

APPENDIX IA
CERTIFICATED AIRPLANE NOISE LEVELS

TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| AEROSPATIALE | | | | | | | | | | | | | |
| SN601 Corvette | JT15D-4 | 2 | 2.5 | 13.9 | 15 | 80.4 | 93.0 | 85.4 | 102.0 | 35 | 89.5 | 102.0 | |
| AIRBUS | | | | | | | | | | | | | |
| A-300B | CF6-50A | 2 | 48.4 | 302.0 | 0 | 90.2 | 103.0 | 95.3 | 106.0 | 25 | 101.3 | 106.0 | 8 |
| A-300B1 | CF6-50A | 2 | 48.4 | 302.0 | 0 | 87.9 | 103.0 | 90.7 | 106.0 | 25 | 101.1 | 106.0 | 8,21 |
| A-300B1 | CF6-50A | 2 | 48.4 | 302.0 | 0 | 87.9 | 103.0 | 90.7 | 106.0 | 15 | 101.8 | 106.0 | 8,21 |
| A-300B2-1A | CF6-50A | 2 | 48.4 | 301.4 | 0 | 87.9 | 103.0 | 90.7 | 106.0 | 25 | 101.1 | 106.0 | 8,21 |
| A-300B2-1A | CF6-50A | 2 | 48.4 | 302.4 | 0 | 87.9 | 103.0 | 90.7 | 106.0 | 15 | 101.8 | 106.0 | 8,21 |
| A-300B2-1A | CF6-50A | 2 | 48.4 | 312.4 | 0 | 89.4 | 103.2 | 92.3 | 106.1 | 25 | 101.3 | 106.1 | 8,21 |
| A-300B2-1A | CF6-50A | 2 | 51.0 | 312.4 | 0 | 89.4 | 103.2 | 92.3 | 106.1 | 15 | 100.8 | 106.1 | 8,21 |
| A-300B2-1C | CF6-50C | 2 | 51.0 | 302.1 | 0 | 87.1 | 103.0 | 91.0 | 106.0 | 25 | 101.1 | 106.0 | 8,21 |
| A-300B2-1C | CF6-50C | 2 | 51.0 | 302.0 | 0 | 87.1 | 103.0 | 91.0 | 106.0 | 15 | 100.8 | 106.0 | 8,21 |
| A-300B2-1C | CF6-50C | 2 | 51.0 | 312.4 | 0 | 88.2 | 103.2 | 92.6 | 106.1 | 25 | 101.3 | 106.1 | 8,21 |
| A-300B2-1C | CF6-50C | 2 | 51.0 | 312.4 | 0 | 88.2 | 103.2 | 92.6 | 106.1 | 15 | 100.8 | 106.1 | 8,21 |
| A-300B2-K-3C | CF6-50C | 2 | 51.0 | 312.4 | 0 | 87.0 | 103.2 | 92.6 | 106.1 | 25 | 101.7 | 106.1 | 8,21 |
| A-300B2-K-3C | CF6-50C | 2 | 51.0 | 312.4 | 0 | 87.0 | 103.2 | 92.6 | 106.1 | 15 | 101.1 | 106.1 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 330.0 | 0 | 89.0 | 103.7 | 92.4 | 106.3 | 25 | 101.9 | 106.3 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 330.0 | 0 | 89.0 | 103.7 | 92.4 | 106.3 | 15 | 101.2 | 106.3 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 336.6 | 0 | 89.6 | 103.8 | 92.4 | 106.3 | 25 | 101.9 | 106.3 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 336.6 | 0 | 89.6 | 103.8 | 92.4 | 106.3 | 25 | 101.2 | 106.3 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 346.5 | 0 | 90.5 | 104.1 | 92.4 | 106.4 | 25 | 101.9 | 106.4 | 8,21 |
| A-300B4-2C | CF6-50C | 2 | 51.0 | 346.5 | 0 | 90.5 | 104.1 | 92.4 | 106.4 | 15 | 101.2 | 106.4 | 8,21 |
| DESSAULT BREGUET | | | | | | | | | | | | | |
| Falcon 20 | CF700-2D-2 | 2 | 4.31 | 28.6 | 10 | 90.0 | 93.0 | 92.3 | 102.0 | 40 | 103.0 | 102.0 | 8 |
| Falcon 10 | TFE731-2 | 2 | 3.23 | 18.7 | 15 | 79.6 | 93.0 | 86.4 | 102.0 | 52 | 95.3 | 102.0 | 8 |
| IAI | | | | | | | | | | | | | |
| 1124 Westwind | TFE731-3-1G | 2 | 3.7 | 22.85 | 12 | 84.2 | 93.0 | 80.3 | 102.0 | 20 | 88.4 | 102.0 | 8 |
| 1124 Westwind | TFE731-3-1G | 2 | 3.7 | 22.85 | 20 | 81.2 | 93.0 | | | | | | 8 |
| VFW FOKKER | | | | | | | | | | | | | |
| F-28 Mk1000 | Spey Mk555-15 | 2 | 9.85 | 65.0 | 6 | 90.0 | 93.0 | 99.5 | 102.0 | 42 | 101.2 | 102.0 | |
| F-28 Mk2000 | Spey Mk555-15 | 2 | 9.85 | 65.0 | 6 | 90.0 | 93.0 | 99.5 | 102.0 | 42 | 101.8 | 102.0 | |

APPENDIX II
CERTIFICATED AIRPLANE NOISE LEVELS

LARGE TRANSPORT CATEGORY AIRCRAFT.

| Airplane | ENGINES | | | TAKEOFF | | | | SIDELINE | | APPROACH | | | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model | No. | ehp | Gr. Wgt. $10^3$ lbs. | Flap Deg. | Meas. EPNdB | Part 36 EPNdB | Meas. EPNdB | Part 36 EPNdB | Flap Deg. | Meas. EPNdB | Part 36 EPNdb | |
| DE HAVILLAND | | | | | | | | | | | | | |
| DHC-7 | PT6A-50 | 4 | 1,120 | 41.0 | 25 | 79.6 | 93.0 | 82.8 | 102.0 | 25 | 92.4 | 102.0 | |
| HAWKER SIDDELEY | | | | | | | | | | | | | |
| HS-748-2A | Mk532-2L | 2 | 2,280 | 44.5 | 15 | 92.5 | 93.0 | 96.3 | 102.0 | 27.5 | 103.8 | 102.0 | |
| LOCKHEED | | | | | | | | | | | | | |
| L 100-30 | 501-D22A | 4 | 4,050 | 155.0 | 17.5 | 98.4 | 98.2 | 93.9 | 104.1 | 35 | 99.1 | 104.1 | |
| SHORTS | | | | | | | | | | | | | |
| SD3-30 | PT6A-45 | 2 | 1,120 | 22.0 | 8 | 88.1 | 93.0 | 83.9 | 102.0 | 35 | 92.8 | 102.0 | |

APPENDIX III

CERTIFICATED AIRPLANE NOISE LEVELS
PROPELLER DRIVEN SMALL AIRPLANES

| Airplane | ENGINES | | | | FLYOVER | | | Notes |
|---|---|---|---|---|---|---|---|---|
| | Model | No. | Hp. | Propeller | Gr. Wgt. | Meas. dBA | Part 36 dBA | |
| BEECH | | | | | | | | |
| B 100 | TPE331-6-252B | 2 | 715 | HC-B4TN-5C/T10173B-12.5 | 11,800 | 77.3 | 82.0 | |
| 58 TC | TSIO-520-L | 2 | 301 | THC-J3YF-2F/SC7663BR | 6,100 | 79.2 | 82.0 | |
| 58 P | TSIO-520-L | 2 | 301 | THC-J3YF-2F/SC7663BR | 6,100 | 79.2 | 82.0 | |
| A 200 | UACL PT6A-38 | 2 | 750 | HC-B3TN-3C/T10178B-3R | 12,500 | 77.0 | 82.0 | |
| 76 | O-360-A1G6D | 2 | 180 | HC-N2YR-2CLUF/SJC7666A,N2YR-CEUF/SC7666A | 3,900 | 77.5 | 82.0 | |
| C 24R | IO-360-A1B6 | 1 | 200 | HC-M2YR-1BF/F7666A-2R | 2,750 | 71.2 | 77.0 | |
| CESSNA | | | | | | | | |
| 182Q | O-470-U | 1 | 230 | C2A34C204/90DCD-8 | 2,950 | 69.1 | 77.9 | |
| TU206G | IO-520-M | 1 | 310 | D3A34C402/90DFA-10 | 3,600 | 75.4 | 81.8 | |
| T207A | TSIO-520-M | 1 | 310 | D3A34C401/90DFA-10 | 3,800 | 76.3 | 82.0 | |
| 180K Land | O-470-U | 1 | 230 | C2A34C204/90DCB-8 | 2,800 | 70.0 | 77.0 | |
| 180K Amphibian | O-470-U | 1 | 230 | C2A34C204/90DCB-0 | 2,950 | 73.37 | 77.9 | |
| A185F | IO-520-D | 1 | 300 | D2A34C58/90AT-4 | 3,350 | 77.9 | 80.3 | |
| R172K | IO-360-K | 1 | 195 | D2A34C203/90DCA-14 | 2,550 | 74.8 | 75.45 | |
| 172N | O-320-H2AD | 1 | 160 | 1C160/DTM7557 | 2,300 | 73.8 | 73.94 | |
| 152 | O-235-L2C | 1 | 110 | IA103/TCM6958 | 1,670 | 65.0 | 71.8 | |
| R172K Float | IO-360-k | 1 | 195 | D2A34C203/90DCA-[illegible] | 2,550 | 77.9 | 75.45 | |
| A185F Amphibian | IO-520-D | 1 | 300 | D2A34C58/90AT-4 | 3,265 | 79.0 | 79.9 | |
| P210N | TSIO-520-P | 1 | 310 | D3A34C402/90DFA-10 | 4,000 | 77.7 | 82.0 | |
| 207A | IO-520-F | 1 | 300 | D3A32C90/82NC-[illegible] | 3,800 | 77.7 | 82.0 | |
| T337H | TSIO-360-H | 2 | 210 | D2AF34C308/90DEA-12,D2AF34C305/L78CBA-2 | 4,630 | 78.4 | 82.0 | |
| MAULE | | | | | | | | |
| M-5-235C | 6A-350-C1 | 1 | 220 | | 2,300 | 67.6 | 73.9 | |
| PIPER | | | | | | | | |
| PA-28-201T | IO-360-C1C | 1 | 200 | HC-C2YK-1 | 2,900 | 68.8 | 77.9 | |
| PA-32-300 | IO-540-K | 1 | 300 | HC-C24K-1B | 3,400 | 79.3 | 80.4 | |
| ROCKWELL | | | | | | | | |
| Commander 112TC | IO-360-C1A6D | 1 | 210 | HC-E2YR-1BF/F8467-7R | 2,850 | 74.82 | 77.27 | |
| Commander 114 | IO-540-T4A5D | 1 | 260 | HC-C2YR-1BF/F8467-7R | 3,140 | 78.47 | 79.03 | |

Notes

1. Engines equipped with P-36 acoustical treatment.
2. Engines equipped with P-36 acoustical treatment, cutback procedures used on takeoff.
3. Center gear retracted.
4. At TOGW of 440K or less and landing weights of 400K or less, the center landing gear retracted.
5. Direct lift control used on approach.
6. Engine flat rated to ISA + 3.8° C.
7. Direct lift control on during approach.
8. Thrust cutback used.
9. Engine flat rated to IAS -2.2° C.
10. -200"B" Nacelle with Fixed Lip Inlet.
11. -200"CN" Nacelle with Fixed Lip Inlet.
12. -100"A" Nacelle with Blow-in Door Inlet.
13. Manufacturer's rating with reference Nacelle.
14. -100"C" Nacelle with Blow-in Door Inlet.
15. -100"CN" Nacelle with Fixed Lip Inlet.
16. -100"D" Nacelle with Fixed Lip Inlet.
17. -200"A" Nacelle with Blow-in Door Inlet.
18. Modified per ECR 936.
19. No thrust cutback used on takeoff.
20. Advanced.
21. ICAO Annex 16 Certification.
22. Appendix F Certification at maximum continous power and 1000' height.
23. Modified per ECR's 1235 and 1184.
24. Modified per ECR 1244.

New Technology Commercial Jet Aircraft

(Noise levels are for heaviest configuration of Aircraft Type)

| Aircraft Type | Maximum Takeoff Weight (lbs) | No. of Engines | Engine Type | Takeoff Noise Level (EPNL) |
|---|---|---|---|---|
| DC-9-80 | 149,500 | 2 | JT8D-209 | 92.2* |
| DC-8-73 | 350,000 | 4 | CFM56-2C1 | 95.7 |
| B 757-200 | 220,000 | 2 | RB211-535C | 85.6* |
| B 767-200 | 300,000 | 2 | JT9D-7R4DCA | 89.8* |
| B 767-200 | 300,000 | 2 | JT 9D-7R4DCA | 93.0 |

*with power cutback

Source: FAA, Office of Environment and Energy

AC NO: 36-2A

DATE: 2/6/78

# ADVISORY CIRCULAR

## DEPARTMENT OF TRANSPORTATION
## FEDERAL AVIATION ADMINISTRATION

**SUBJECT:** MEASURED OR ESTIMATED (UNCERTIFICATED) AIRPLANE NOISE LEVELS

1. PURPOSE. This circular provides estimates of noise levels or measured noise levels from airplanes not certificated to FAR Part 36.

2. BACKGROUND

   a. Both present and future rulemaking activities require knowledge of the noise levels of aircraft that may be operated in the United States. Advisory Circular (AC) 36-1B was published December 5, 1977, which lists the results of significant noise certification actions. To supplement that tabulation this circular provides estimates or measurements of the noise from airplanes not required to meet FAR Part 36 standards.

   b. Progress in the control and abatement of airplane noise has been, and will continue to be, made. A summary listing of existing airplane noise levels will provide both private and public exposure to this progress, as well as offering a common noise level reference for potential future reductions.

3. NOISE LEVELS

   a. The noise levels were measured or estimated for each airplane as they might occur during type certification tests conducted under FAR Part 36. However, it should be specifically noted that the estimated levels do not represent the results of actual tests, and the measured noise levels contained in this circular were obtained from tests which were made for purposes other than type certification.

   b. These noise levels were obtained from data submitted to the Federal Aviation Administration (FAA) by the manufacturers

and from the International Civil Aviation Organization. While the FAA has attempted to verify the reasonableness of these numbers by comparison with those from certified aircraft and (in some instances) by independent measurements, the FAA does not warrant these estimates.

c. Appendices I and IA show the measured or estimated levels for turbojet powered airplanes. Appendix II shows the measured or estimated levels for large transport category aircraft, and Appendix IV contains the levels for civil supersonic airplanes. These appendices include tabulations of engine type, thrust or equivalent shaft horsepower and gross weight for various aircraft as well as the measured Effective Perceived Noise Level in decibels (EPNdB) compared with the appropriate FAR part 36 noise level limits (takeoff, sideline and approach) for each aircraft. Appendix III shows the noise levels for propeller driven small airplanes. This appendix includes a tabulation of the engine type, horsepower and gross weight for the various aircraft along with the measured A-weighted sound level in decibels (dBA) for flyover as compared to the FAR Part 36, Appendix F noise levels for each aircraft. Appendix V shows the noise levels for rotary wing aircraft. This appendix includes a tabulation of the engine type, horsepower or equivalent shaft horsepower, rotor size and aircraft weight along with measured EPNL for a level flyover at 500 ft. altitude. In each case, the FAR Part 36 standard sea level, 77°F, 70% relative humidity conditions have been assumed.

4. REVISIONS. The airplane noise level listing of this Advisory Circular will be revised and updated periodically.

5. CANCELLATION. Advisory Circular 36-2, Estimated (Uncertificated) Noise Levels of Aircraft, dated September 21, 1976, is cancelled.

CHARLES R. FOSTER
Director of Environmental Quality

APPENDIX I
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

TURBOJET POWERED AIRCRAFT

| Airplane | Model | ENGINES No. | Thrust $10^3$ lbs. | $Gr_3$ Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BOEING** | | | | | | | | | | | |
| B-707-120 | JT3C-6 | 4 | 13.5 | 258.0 | 113.0 | 102.0 | 109.0 | 105.5 | 111.0 | 105.5 | 1 |
| B-706-120B | JT3D-3 | 4 | 18.0 | 258.0 | 108.0 | 102.0 | 108.0 | 105.5 | 118.0 | 105.5 | 1 |
| B-707-220 | JT4A-3 | 4 | 15.8 | 248.0 | 105.0 | 101.8 | 111.0 | 105.4 | 110.0 | 105.4 | 1 |
| B-707-320 | JT4A-11 | 4 | 17.5 | 316.0 | 107.0 | 103.5 | 110.0 | 106.0 | 108.0 | 106.0 | 1 |
| B-707-320B | JT3D-3B | 4 | 18.0 | 328.0 | 113.0 | 103.7 | 108.0 | 106.2 | 119.0 | 106.2 | 1 |
| B-707-320C | JT3D-3B | 4 | 18.0 | 332.0 | 114.0 | 104.0 | 108.0 | 106.5 | 120.0 | 106.5 | 1 |
| B-707-420 | RCo. Mk508 | 4 | 17.5 | 316.0 | 116.0 | 103.5 | 112.0 | 106.0 | 112.0 | 106.0 | 1 |
| B-720 | JT3C-7 | 4 | 12.0 | 230.0 | 108.0 | 101.0 | 109.0 | 105.4 | 108.0 | 105.4 | 1 |
| B-720B | JT3D-1 | 4 | 17.0 | 235.0 | 104.0 | 101.0 | 108.0 | 105.4 | 117.0 | 105.4 | 1 |
| B-727-100 | JT8D-1 | 3 | 14.0 | 161.0 | 100.0 | 98.5 | 102.0 | 104.0 | 110.0 | 104.0 | 1 |
| B-727-100C | JT8D-7 | 3 | 14.0 | 160.5 | 96.5 | 98.5 | 100.0 | 104.0 | 110.0 | 104.0 | 1 |
| B-727-200 | JT8D-9 | 3 | 14.5 | 172.5 | 101.o | 99.0 | 100.5 | 104.5 | 109.5 | 104.5 | 1 |
| B-727-200 | JT8D-15 | 3 | 15.5 | 190.5 | 102.0 | 100.0 | 102.0 | 105.0 | 109.5 | 105.0 | 1 |
| B-737-100 | JT8D-9 | 2 | 14.5 | 111.0 | 96.0 | 96.0 | 100.0 | 103.0 | 111.0 | 103.0 | 1 |
| B-737-200 | JT8D-9 | 2 | 14.5 | 110.7 | 93.5 | 96.0 | 100.5 | 103.0 | 111.5 | 103.0 | 1 |
| B-737-200C | JT8D-15 | 2 | 15.5 | 115.5 | 94.5 | 96.0 | 103.0 | 103.5 | 111.5 | 103.5 | 1 |
| **DOUGLAS (McDONNELL DOUGLAS)** | | | | | | | | | | | |
| DC8 Series 10 | JT3C-6 | 4 | 13.5 | 273.0 | 113.0 | 102.4 | 109.0 | 105.9 | 111.0 | 105.9 | 1 |
| DC8 Series 20 | JT4A-3 | 4 | 15.8 | 276.0 | 105.0 | 102.4 | 111.0 | 105.9 | 111.0 | 105.9 | 1 |
| DC8 Series 30 | JT4A-9 | 4 | 16.8 | 315.0 | 113.0 | 103.5 | 109.0 | 106.0 | 111.0 | 106.0 | 1 |
| DC8 Series 40 | RCo. 12 | 4 | 17.5 | 315.0 | 113.0 | 103.5 | | | 115.0 | 106.0 | 1 |
| DC8-50 | JT3D-1 | 4 | 17.0 | 300.0 | 115.0 | 103.0 | 106.0 | 106.0 | 116.0 | 106.0 | 1 |
| DC8-50 | JT3D-3B | 4 | 18.0 | 315.0 | 114.0 | 103.5 | 106.0 | 106.0 | 118.0 | 106.0 | 1 |
| DC8-55 | JT3D-3B | 4 | 18.0 | 328.0 | 116.0 | 103.7 | 106.0 | 106.2 | 118.0 | 106.2 | 1 |
| DC8-61 | JT3D-3B | 4 | 18.0 | 328.0 | 116.0 | 103.7 | 106.0 | 106.2 | 118.0 | 106.2 | 1 |
| DC8-62 | JT3D-3B | 4 | 18.0 | 335.0 | 112.0 | 104.0 | 104.0 | 106.5 | 112.0 | 106.5 | 1 |

APPENDIX I
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

TURBOJET POWERED AIRCRAFT

| Airplane | Model | ENGINES No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DC8-62 | JT3D-3B | 4 | 18.0 | 350.0 | 115.0 | 104.0 | 104.0 | 106.5 | 112.0 | 106.5 | 1 |
| DC8-62 | JT3D-7 | 4 | 19.0 | 350.0 | 112.0 | 104.0 | 106.0 | 106.5 | 115.0 | 106.5 | 1 |
| DC8-63 | JT3D-3B | 4 | 18.0 | 350.0 | 115.0 | 104.0 | 104.0 | 106.5 | 112.0 | 106.5 | 1 |
| DC8-63 | JT3D-7 | 4 | 19.0 | 355.0 | 112.0 | 104.1 | 106.0 | 106.5 | 115.0 | 106.5 | 1 |
| DC9-10 | JT8D-1 | 2 | 14.0 | 90.7 | 90.0 | 94.5 | 102.0 | 102.5 | 109.0 | 102.5 | 1 |
| DC9-10 | JT8D-5 | 2 | 12.25 | 86.3 | 90.0 | 94.1 | 98.0 | 102.4 | 109.0 | 102.4 | 1 |
| DC9-10 | JT8D-7 | 2 | 14.0 | 90.7 | 90.0 | 94.5 | 102.0 | 102.5 | 109.0 | 102.5 | 1 |
| DC9-20 | JT8D-9 | 2 | 14.5 | 98.0 | 90.0 | 95.0 | 103.0 | 103.0 | 109.0 | 103.0 | 1 |
| DC9-30 | JT8D-1 | 2 | 14.0 | 98.0 | 91.0 | 90.0 | 102.0 | 103.0 | 109.0 | 103.0 | 1 |
| DC9-30 | JT8D-7 | 2 | 14.0 | 108.0 | 93.0 | 95.8 | 102.0 | 103.0 | 110.0 | 103.0 | 1 |
| DC9-30 | JT8D-9 | 2 | 14.5 | 114.0 | 97.0 | 96.0 | 103.0 | 103.5 | 110.0 | 103.5 | 1 |
| DC9-30 | JT8D-11 | 2 | 15.0 | 114.0 | 95.0 | 96.0 | 103.0 | 103.5 | 109.0 | 103.5 | 1 |
| DC9-80 | JT8D-109 | 3 | 16.0 | 140.0 | 90.8 | 90.6 | 93.5 | 96.2 | 98.8 | 99.8 | 1 |
| GENERAL DYNAMICS | | | | | | | | | | | |
| CV 880 22 | CJ-805-3 | 4 | 11.2 | 184.0 | 115.0 | 99.5 | 109.0 | 104.5 | 106.0 | 104.5 | 1 |
| CV 880 22M | CJ-805-3B | 4 | 11.65 | 193.0 | 117.0 | 99.9 | 109.0 | 105.5 | 106.0 | 105.5 | 1 |
| CV 990A | CJ-805-23 | 4 | 16.1 | 253.0 | 110.0 | 102.0 | 111.0 | 105.5 | 112.0 | 105.5 | 1 |
| LEARJET (GATES LEARJET) | | | | | | | | | | | |
| Learjet 23 | CJ-610-1 | 2 | 2.85 | 12.5 | 96.1 | 93.0 | 103.4 | 102.0 | 96.7 | 102.0 | 1 |
| LOCKHEED | | | | | | | | | | | |
| 1329 Jetstar | JT12A-8 | 4 | 3.3 | 42.0 | 106.6 | 93.0 | 103.3 | 102.0 | 107.5 | 102.0 | 1 |
| NORTH AMERICAN ROCKWELL (ROCKWELL INTERNATIONAL) | | | | | | | | | | | |
| Sabre 40A | JT12A-8 | 2 | 3.3 | 19.6 | 100.3 | 93.0 | 100.2 | 102.0 | 98.5 | 102.0 | 1 |

## APPENDIX IA
## MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

### TURBOJET POWERED AIRCRAFT

| Airplane | ENGINES Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **BAC** | | | | | | | | | | | |
| VC10 Series 1100 | RCo. 42 | 4 | 20.37 | 314.0 | 110.2 | 103.4 | 113.2 | 106.0 | 114.8 | 106.0 | |
| Super VC10 | RCo. 43 | 4 | 21.8 | 335.0 | 110.1 | 104.0 | 113.5 | 106.5 | 115.1 | 106.5 | |
| 1-11 Srs 300/400 | Spey Mk511 | 2 | 11.4 | 98.9 | 94.2 | 106.5 | 102.4 | 104.6 | 102.4 | 104.6 | |
| 1-11 Series 500 | Spey Mk512 | 2 | 12.55 | 99.65 | 102.4 | 95.1 | 108.0 | 102.9 | 105.7 | 102.9 | |
| 1-11 Series 500 | Spey Mk512 | 2 | 12.55 | 104.5 | 101.8 | 95.5 | 108.0 | 103.0 | 105.7 | 103.0 | |
| **HAWKER SIDDELEY** | | | | | | | | | | | |
| Comet 4 | RA29 Mk524 | 4 | 10.5 | 162.0 | 103.0 | 98.5 | 104.0 | 104.2 | 112.0 | 104.2 | 1 |
| Comet 4B | RA29 Mk525 | 4 | 10.5 | 158.0 | 102.0 | 98.5 | 104.0 | 104.2 | 112.0 | 104.2 | 1 |
| Comet 4C | RA29 Mk525B | 4 | 10.5 | 162.0 | 103.0 | 98.5 | 104.0 | 104.2 | 112.0 | 104.2 | 1 |
| Trident 1 | RB163 Mk505-5 | 3 | 10.05 | 115.0 | 100.0 | 96.0 | 100.0 | 103.2 | 108.0 | 103.2 | 1 |
| Trident 1E | RB163 Mk511-5 | 3 | 11.4 | 130.0 | 108.0 | 97.0 | 106.0 | 103.6 | 109.0 | 103.6 | 1 |
| Trident 2E | RB163 Mk512-5 | 3 | 11.96 | 143.5 | 108.0 | 97.9 | 106.0 | 104.0 | 109.0 | 104.0 | 1 |
| Trident 3B | RB163 Mk512-5 | 4 | 11.6 | 150.0 | 104.0 | 98.0 | 105.0 | 104.0 | 110.0 | 104.0 | 1,2 |
| | RB162 | | 5.25 | | | | | | | | |
| HS 125 Series 1A | Viper 521 | 2 | 3.0 | 19.55 | 88.0 | 93.0 | 99.0 | 102.0 | 103.0 | 102.0 | 1 |
| HS 125 Series 3 | Viper 522 | 2 | 3.36 | 21.0 | 89.0 | 93.0 | 99.0 | 102.0 | 104.0 | 102.0 | 1 |
| HS 125-400 | Viper 522 | 2 | 3.36 | 23.3 | 90.0 | 93.0 | 99.0 | 102.0 | 104.0 | 102.0 | 1 |
| HS 125-600 | Viper 601-22 | 2 | 3.75 | 25.0 | 89.0 | 93.0 | 99.0 | 102.0 | 105.0 | 102.0 | 1 |
| **IAI** | | | | | | | | | | | |
| 1121 Commodore | CJ610-5 | 2 | 2.95 | 18.5 | 100.9 | 93.0 | 104.2 | 102.0 | 107.0 | 102.0 | |
| 1123 Westwind | CJ610-9 | 2 | 3.1 | 20.7 | 100.9 | 93.0 | 105.0 | 102.0 | 106.0 | 102.0 | |

APPENDIX IA
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

TURBOJET POWERED AIRCRAFT

| Airplane | Model | ENGINES No. | Thrust $10^3$ lbs. | $Gr_3$ Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| MESSERSCHMITT-BOLKOW-BLOHM | | | | | | | | | | | |
| HFB 320 Hansa | CJ610-5 | 2 | 2.95 | 20.2 | 100.9 | 93.0 | 105.0 | 102.0 | 106.0 | 102.0 | |
| SUD-AVIATION | | | | | | | | | | | |
| Caravelle III | RA29 Mk527 | 2 | 11.4 | 101.4 | 104.0 | 95.1 | 109.0 | 102.9 | 110.0 | 102.9 | 1 |
| Caravelle VIN | RA29 Mk531 | 2 | 12.2 | 105.8 | 104.0 | 95.5 | 111.0 | 103.0 | 106.5 | 103.0 | 1 |
| Caravelle VIR | Avon 533R | 2 | 12.6 | 110.2 | 104.0 | 96.0 | 111.0 | 103.0 | 107.0 | 103.0 | 1 |
| Caravelle 10R | JT8D-7 | 2 | 14.0 | 114.6 | 97.0 | 96.0 | 102.0 | 106.5 | 107.5 | 106.5 | 1 |
| VFW-FOKKER | | | | | | | | | | | |
| VFW 614 | M45H Mk501 | 2 | 7.2 | 44.0 | 90.5 | 93.0 | 92.2 | 102.0 | 97.1 | 102.0 | 1 |

APPENDIX II
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

LARGE TRANSPORT CATEGORY AIRCRAFT

| Airplane | Model | ENGINES No. | shp. | Gr. Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **AEROSPATIALE** | | | | | | | | | | | |
| Nord 262C | Bastan VIIA | 2 | 1,065 | 22.93 | 90.0 | 93.0 | 92.0 | 102.0 | 99.0 | 102.0 | 1 |
| **FOKKER** | | | | | | | | | | | |
| F-27 Mk.200 | Mk532-7 | 2 | 2,050 | 43.49 | 90.6 | 93.0 | 102.0 | 102.0 | 100.3 | 102.0 | 1 |
| F-27 Mk.400/600 | Mk532-7R | 2 | 2,140 | 43.50 | 89.0 | 93.0 | 92.5 | 102.0 | 99.0 | 102.0 | 1 |
| **LOCKHEED** | | | | | | | | | | | |
| L-188 | 501-D13 | 4 | 3,750 | 116.0 | 95.0 | 96.1 | 93.0 | 103.2 | 99.0 | 103.2 | 1 |
| L-100-50 | 501-D22A | 4 | 4,200 | 170.0 | 99.8 | 99.0 | 93.5 | 104.4 | 98.2 | 104.4 | 1 |
| L-400 | 501-D22A | 2 | 4,591 | 84.0 | 92.7 | 94.0 | 91.7 | 102.3 | 97.5 | 102.3 | 1 |

Notes

1. Thrust cutback used.
2. Aircraft equipped with boost engine.

APPENDIX III
MEASURED OR ESTIMATED NOISE LEVELS FOR UNCERTIFICATED AIRPLANES

PROPELLER DRIVEN SMALL AIRPLANES

| Airplane | Model | ENGINES No. | Hp. | Propeller | FLYOVER Gr. Wgt. | M/Est. dBA | Part 36 dBA | Notes |
|---|---|---|---|---|---|---|---|---|
| **BEECH** | | | | | | | | |
| C 18 S | R-985-AN-1 | 2 | 400 | Ham.2D-30-237 | 7,850 | 86.0 | 82.0 | |
| 23 | O-320-D2B | 1 | 160 | HC-82XL-6F | 2,300 | 70.0 | 73.9 | |
| C23 | O-320-D2B | 1 | 180 | Sens.76EM8S5-O-60 | 2,450 | 70.0 | 74.9 | |
| A23-24 | IO-360-A2B | 1 | 200 | McC.1B235/BFA7762 | 2,550 | 78.0 | 75.6 | |
| A24R | IO-360-A1B | 1 | 200 | McC.2D34C9-N | 2,750 | 74.0 | 76.7 | |
| B24R | IO-360-A1B6 | 1 | 200 | HC-M2YR-1BF/F7666-2R | 2,750 | 72.0 | 76.7 | |
| 35 | E-185-11 | 1 | 165 | B-215-107 | 2,550 | 71.0 | 75.6 | |
| C35 | E-225-8 | 1 | 185 | B-215-107 | 2,700 | 74.0 | 76.3 | |
| D35 | E-225-8 | 1 | 185 | HC-A2X20-4A1 | 2,725 | 70.0 | 76.5 | |
| E35 | E-225-8 | 1 | 185 | B-215-107 | 2,725 | 75.0 | 76.5 | |
| F35 | E-225-8 | 1 | 185 | B-215-107 | 2,750 | 73.0 | 76.7 | |
| G35 | E-225-8 | 1 | 185 | B-215-107 | 2,775 | 70.0 | 76.8 | |
| 35S | IO-520-BA | 1 | 285 | McC.2A36C23 | 3,300 | 86.0 | 80.0 | |
| V35 | IO-520-B | 1 | 285 | McC.2A36C23-CP | 3,400 | 80.0 | 80.6 | |
| V35 | TSIO-520-D | 1 | 285 | PHC-A3VF-4 | 3,400 | 83.0 | 80.6 | |
| V35B | IO-520-BA | 1 | 285 | McC.3A32C76/S82NB-2 | 3,400 | 78.0 | 80.6 | |
| V35B | TSIO-520-D | 1 | 285 | McC.2A32C76 | 3,400 | 83.0 | 80.6 | |
| 35-33 | IO-470-J | 1 | 225 | BHC-92ZF-1D1 | 2,900 | 79.0 | 77.6 | |
| 35-A33 | IO-470-K | 1 | 225 | F-12 | 3,000 | 81.0 | 78.2 | |
| 35-B33 | IO-470-K | 1 | 225 | BHC-92ZF-1D1 | 3,000 | 78.0 | 78.2 | |
| 35-C33 | IO-470-K | 1 | 225 | McC.2A36C23-CD | 3,050 | 80.0 | 78.5 | |
| 35-C33A | IO-520-B | 1 | 285 | McC.2A36C23-CP | 3,300 | 86.0 | 80.0 | |
| F33 | IO-470-K | 1 | 225 | McC.2A36C23 | 3,050 | 80.0 | 78.5 | |
| F33A | IO-520-B | 1 | 285 | McC.2A36C23 | 3,400 | 81.0 | 80.6 | |
| 36 | IO-520-B | 1 | 285 | McC.2A36C23-CP | 3,600 | 83.0 | 81.8 | |
| G50 | IGSO-480-A1A6 | 2 | 230 | HC-93Z20-2C1 | 7,150 | 89.0 | 82.0 | |
| 56TC | TIO-541-E1B4 | 2 | 380 | HC-F3YR-2 | 5,990 | 82.0 | 82.0 | |
| 60 | TIO-541-E1A4 | 2 | 320 | HC-F3YR-2 | 6,725 | 87.0 | 82.0 | |

APPENDIX III
MEASURED OR ESTIMATED NOISE LEVELS FOR UNCERTIFICATED AIRPLANES

PROPELLER DRIVEN SMALL AIRPLANES

| Airplane | Model | ENGINES No. | Hp. | Propeller | FLYOVER Gr. Wgt. | M/Est. dBA | Part 36 dBA | Notes |
|---|---|---|---|---|---|---|---|---|
| A60 | TIO-541-E1A4 | 2 | 380 | HC-F3YR-2 | 6,775 | 90.0 | 82.0 | |
| A60 | TIO-541-E1A4 | 2 | 323 | HC-F3YR-2 | 6,775 | 86.0 | 82.0 | |
| 65 | IGSO-480-A1A6 | 2 | 320 | HC-93Z20-2C1 | 7,700 | 90.0 | 82.0 | |
| D95A | IO-360-B1B | 2 | 180 | HC-92WK-2B | 4,200 | 78.0 | 82.0 | |
| 95-A55 | IO-470L | 2 | 260 | McC.2AF34C55-D78FF-0 | 4,880 | 83.0 | 82.0 | |
| 95-B55 | IO-470L | 2 | 260 | BHC-C2YF-2CHR/FC8465-6 | 5,100 | 84.0 | 82.0 | |
| 95-B55 | IO-470L | 2 | 260 | PHC-3YF-2F/FC-7663-2R | 5,100 | 78.0 | 82.0 | |
| 95-D55 | IO-520C | 2 | 285 | McC.3AF32C75 | 5,300 | 83.0 | 82.0 | |
| 95-E55 | IO-520C | 2 | 285 | PHC-C3YF-2/FC7663-2R | 5,300 | 81.0 | 82.0 | |
| 58 | IO-520C | 2 | 285 | PHC-J3YF-2F/FC7663-2R | 5,400 | 82.0 | 82.0 | |
| BELLANCA (CHAMPION) | | | | | | | | |
| 7 ECA | O-200-A | 1 | 100 | McC.1A100ACM6948 | 1,650 | 69.0 | 70.0 | |
| 7 GCAA | O-320-A2B | 1 | 150 | McC.1A170/7448 | 1,650 | 76.0 | 70.0 | |
| 7 GCB | O-320-A2B | 1 | 150 | McC.1A170/7448 | 1,650 | 70.0 | 70.0 | |
| 8 GCBC | O-360-A2A | 1 | 180 | McC.1A200FA/7846 | 2,150 | 79.0 | 73.0 | |
| CESSNA | | | | | | | | |
| 150D | O-200-A | 1 | 100 | McC.1A101 | 1,600 | 67.0 | 69.7 | |
| F150L | O-200-A | 1 | 100 | McC.1A101/HCM6948 | 1,600 | 69.0 | 69.7 | |
| F150J | O-240-A | 1 | 130 | McC.1A135/BRM7150 | 1,600 | 72.5 | 69.7 | |
| FRA-150L | O-240-A | 1 | 130 | McC.1A135/Brm7150 | 1,600 | 73.0 | 69.7 | |
| 170 | C-145-2 | 1 | 145 | McC.1A170/DM7656 | 2,200 | 73.0 | 73.3 | |
| 170A | O-340-A1A | 1 | 170 | HC-82XL-1D/8433-12 | 2,200 | 70.0 | 73.3 | |
| 170B | C-145-2 | 1 | 145 | McC.1A170/DM7656 | 2,200 | 75.0 | 73.3 | |
| 172 | O-300-A | 1 | 145 | McC.1A172/EM7653 | 2,300 | 72.0 | 74.0 | |
| F172L | O-320-E2D | 1 | 150 | McC.1C160/CTM7553 | 2,300 | 74.0 | 74.0 | |
| FR172F | IO-360-D | 1 | 210 | McC.D2A34C67L | 2,220 | 81.0 | 73.4 | |
| FR172G | IO-360-D | 1 | 210 | McC.D2A34C67L | 2,220 | 77.0 | 73.4 | |

# APPENDIX III
# MEASURED OR ESTIMATED NOISE LEVELS FOR UNCERTIFICATED AIRPLANES

## PROPELLER DRIVEN SMALL AIRPLANES

| Airplane | Model | ENGINES No. | Hp. | Propeller | FLYOVER Gr. Wgt. | M/Est. dBA | Part 36 dBA | Notes |
|---|---|---|---|---|---|---|---|---|
| 175 | 6A-350-C2 | 1 | 180 | McC.2A31C21/84S-6 | 2,350 | 86.0 | 74.2 | |
| 175A | O-360-A1D | 1 | 180 | HC-C2YK-1 | 2,350 | 72.0 | 74.2 | |
| 175B | O-360-A1D | 1 | 180 | McC.2D36C14/78KM-4 | 2,350 | 74.0 | 74.2 | |
| 177 | O-360-A1F6 | 1 | 180 | McC.2D34C202 | 2,500 | 74.0 | 75.2 | |
| F177RG | IO-360-A1B6 | 1 | 200 | McC.B2D34C206/78TA | 2,800 | 76.0 | 77.0 | |
| 180 | O-470-J | 1 | 225 | HC-82XF-1-DB | 2,800 | 76.0 | 77.0 | |
| 180 | O-470-J | 1 | 225 | HC-82XF-1C | 2,800 | 78.0 | 77.0 | |
| 182H | O-470-R | 1 | 230 | McC.2A34C50 | 2,800 | 76.0 | 77.0 | |
| 182P | O-470-R | 1 | 230 | McC.2A34C203 | 2,950 | 78.0 | 77.9 | |
| A185F | IO-520-D | 1 | 285 | McC.D2A34C58/90AT-9.5 | 3,350 | 82.0 | 80.3 | |
| A188B | IO-520-D | 1 | 285 | McC.D2A34C58/90AT-8 | 4,000 | 85.0 | 82.0 | |
| TU-206-C | TSIO-520-C | 1 | 285 | McC.D3A32C90/82NC | 3,600 | 77.0 | 81.8 | |
| T207 | TSIO-520-G | 1 | 285 | McC.D2A34C78-L | 3,800 | 82.0 | 82.0 | |
| 210 | IO-470-E | 1 | 260 | McC.D2A36C33 | 3,800 | 77.0 | 82.0 | |
| T210G | TSIO-520-C | 1 | 285 | McC.D3A32C88/82NC-2 | 3,400 | 78.0 | 80.6 | |
| T210L | TSIO-520-H | 1 | 285 | McC.D3A32C88/82NC-2 | 3,800 | 82.0 | 82.0 | |
| 310C | IO-470-D | 2 | 260 | HC-A2XF-2 | 4,830 | 84.0 | 82.0 | |
| 310F | IO-470-D | 2 | 260 | HC-A2XF-2 | 4,830 | 81.0 | 82.0 | |
| 310N | IO-470-V | 2 | 260 | McC.D3AF32C80/82NC-4 | 5,200 | 80.0 | 82.0 | |
| 310Q | IO-470-VO | 2 | 260 | McC.D3AF32C71/84JF-3 | 5,300 | 86.0 | 82.0 | |
| 310Q | IO-470-VO | 2 | 260 | McC.3AF32C87/82NC-4 | 5,300 | 81.0 | 82.0 | |
| T310P | TSIO-520-B | 2 | 285 | McC.D2AF34C71L | 5,400 | 82.0 | 82.0 | |
| T310R | TSIO-520-B | 2 | 285 | McC.3AF32C87/82NC-4 | 5,500 | 84.0 | 82.0 | |
| 320A | TSIO-470-B | 2 | 260 | HC-A2XF-2 | 5,200 | 82.0 | 82.0 | |
| 320C | TSIO-470-D | 2 | 260 | McC.D2AF34C54 | 5,200 | 83.0 | 82.0 | |
| 337F | IO-360-C | 2 | 210 | McC.D2AF34C | 4,630 | 85.0 | 82.0 | |
| 340 | TSIO-520-K | 2 | 285 | McC.3AF32C87/82NC-4 | 5,975 | 83.0 | 82.0 | |
| 401 | TSIO-520-E | 2 | 300 | McC.3AF32C87 | 6,300 | 79.0 | 82.0 | |
| 414 | TSIO-520-J | 2 | 310 | McC.3AF32C93 | 6,350 | 82.0 | 82.0 | |
| 421 | GTSIO-520-D | 2 | 375 | McC.3AF34C92 | 7,450 | 83.0 | 82.0 | |
| 421B | GTSIO-520-H | 2 | 375 | McC.3AF34C92 | 7,450 | 81.0 | 82.0 | |

APPENDIX III
MEASURED OR ESTIMATED NOISE LEVELS FOR UNCERTIFICATED AIRPLANES

PROPELLER DRIVEN SMALL AIRPLANES

| Airplane | Model | ENGINES No. | Hp. | Propeller | Gr. Wgt. | FLYOVER M/Est. dBA | Part 36 dBA | Notes |
|---|---|---|---|---|---|---|---|---|
| **GRUMMAN AMERICAN** | | | | | | | | |
| AA-1A | O-235-C2C | 1 | 108 | McC.1A105SCM7153 | 1,560 | 70.0 | 69.4 | |
| AA-5 | O-320-E2G | 1 | 150 | McC.1C172BTM7359 | 2,200 | 72.0 | 73.3 | |
| **MAULE** | | | | | | | | |
| M-4-210C | IO-369-A | 1 | 195 | McC.D2A34C67 | 2,300 | 76.0 | 73.9 | |
| M-4-220C | 6A-350-C1 | 1 | 194 | McC.2A31C21 | 2,300 | 76.0 | 73.9 | |
| **MOONEY** | | | | | | | | |
| M 20 C | O-360-A1D | 1 | 180 | HC-C2YK-1A | 2,575 | 74.0 | 75.6 | |
| M 20 C | O-360-A1D | 1 | 180 | McC.2D34C53A | 2,575 | 74.0 | 75.6 | |
| M 20 E | IO-360-A1A | 1 | 200 | HC-C2YK-1A | 2,575 | 74.0 | 75.6 | |
| M 20 F | IO-360-A1A | 1 | 200 | HC-C2YK-1B | 2,740 | 75.0 | 76.6 | |
| M 22 | TIO-541-A1A | 1 | 310 | HC-C2YK-1B/8475-4 | 3,680 | 80.0 | 82.0 | |
| **PIPER** | | | | | | | | |
| PA-18-150 | O-320-A2B | 1 | 150 | M74DM-56 | 1,750 | 70.0 | 70.6 | |
| PA-18-150 | O-320-A2B | 1 | 150 | M74DM-O-50 | 1,750 | 72.0 | 70.6 | |
| PA-22-135 | O-290-D2 | 1 | 135 | M74DM | 1,950 | 74.0 | 71.8 | |
| PA-23-160 | O-320-B1A | 2 | 160 | HC-82XG-2B | 3,800 | 75.0 | 82.0 | |
| PA-23-250 | TIO-540-C1A | 2 | 250 | HC-E2YR-2RB | 5,200 | 77.0 | 82.0 | |
| PA-24-250 | O-540-A1D5 | 1 | 250 | HC-A2XK-1 | 2,800 | 76.0 | 77.0 | |
| PA-24-260 | IO-540-R1A5 | 1 | 260 | HC-E2YR-1B | 2,900 | 76.0 | 77.6 | |
| PA-28-140 | O-320-E2A | 1 | 150 | M74DM-O-60 | 2,150 | 73.0 | 73.0 | |
| PA-28-151 | O-320-E3D | 1 | 150 | 74DM6-O-58 | 2,325 | 75.0 | 74.1 | |
| PA-28-180 | O-360-A3A | 1 | 180 | M76 | 2,400 | 74.0 | 74.6 | |
| PA-28-180 | O-360-A4A | 1 | 180 | 76EM8S5-O-60 | 2,400 | 78.0 | 74.6 | |

APPENDIX III
MEASURED OR ESTIMATED NOISE LEVELS FOR UNCERTIFICATED AIRPLANES

PROPELLER DRIVEN SMALL AIRPLANES

| | | ENGINES | | | FLYOVER | | | |
|---|---|---|---|---|---|---|---|---|
| Airplane | Model | No. | Hp. | Propeller | Gr. Wgt. | M/Est. dBA | Part 36 dBA | Notes |
| PA-28-180 | IO-360-B1E | 1 | 180 | HC-C2YK-1 | 2,500 | 73.0 | 75.2 | |
| PA-28-200 | IO-360-C1C | 1 | 200 | HC-C2YK-1 | 2,600 | 77.0 | 75.8 | |
| PA-28-235 | O-540-B4B5 | 1 | 235 | HC-C2YK-1 | 2,900 | 77.0 | 77.6 | |
| PA-30 | IO-320-C1A | 2 | 160 | HC-E2YL-2B | 3,600 | 76.0 | 81.8 | |
| PA-31 | TIO-540-A2B | 2 | 310 | HC-E3YR-2A | 6,500 | 81.0 | 82.0 | |
| PA-31 | TIO-540-A1A | 2 | 310 | HC-E2YR-2B | 6,500 | 86.0 | 82.0 | |
| PA-31P | TIGO-541-E1A | 2 | 425 | HC-C3YN-2L | 7,800 | 85.0 | 82.0 | |
| PA-31-350 | TIO-540-J2BD/LTIO-540-J2BD | 2 | 350 | HC-E3YR-2AF/HC-E3YR-2ALF | 7,000 | 87.0 | 82.0 | |
| PA-32-260 | O-540-E4D5 | 1 | 260 | HC-C2YK-1B | 3,400 | 81.0 | 80.6 | |
| PA-32-300 | IO-540-K1A5 | 1 | 300 | HC-C2YK-1B | 3,400 | 83.0 | 80.6 | |
| PA-34-200 | IO-360-C1E6 | 2 | 200 | HC-C2YK-2 | 4,200 | 79.0 | 82.0 | |
| PA-34-200T | TSIO-360-E/LTSIO-360-E | 2 | 215 | BHC-C2YF-2/FC8459-8R/FJC8459-8R | 4,570 | 77.0 | 82.0 | |
| ROCKWELL INTERNATIONAL | | | | | | | | |
| 112 | IO-360-C1D6 | 1 | 200 | HC-E2YR-1BF/F7666-A | 2,550 | 72.0 | 75.6 | |
| 680 | GSO-480-A1A6 | 2 | 320 | HC-83X20-2C | 6,750 | 88.0 | 82.0 | |
| 680FL | IGSO-540-B1A | 2 | 360 | HC-B3Z30-2B | 8,500 | 79.0 | 82.0 | |
| TED SMITH | | | | | | | | |
| Aerostar 601 | IO-540-P1A5 | 2 | 290 | HC-C3YR/C8468-8R | 5,700 | 84.0 | 82.0 | |

APPENDIX IV
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

CIVIL SUPERSONIC AIRCRAFT

| Aircraft | ENGINES Model | No. | Thrust $10^3$ lbs. | Gr. Wgt. $10^3$ lbs. | TAKEOFF M/Est. EPNdB | TAKEOFF Part 36 EPNdB | SIDELINE M/Est. EPNdB | SIDELINE Part 36 EPNdB | APPROACH M/Est. EPNdB | APPROACH Part 36 EPNdB | Notes |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CONCORDE | | | | | | | | | | | |
| Concorde | 0-593/M-602 | 4 | 38.5 | 400.0 | 119.5 | | 112.0 | | 116.5 | | |
| TUPOLEV | | | | | | | | | | | |
| TU-144 | NK-144 | 4 | 38.58 | 360.0 | 110.0 | | 114.0 | | 110.0 | | |

APPENDIX V
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

ROTARY WING AIRCRAFT

| Airplane | Model | ENGINES No. | Hp./shp | ROTOR Diameter Main/Tail | No. of Blades Main/Tail | FLYOVER Max Gr. Wgt. | Meas. Gr. Wgt. | Meas EPNL @ 500 ft. |
|---|---|---|---|---|---|---|---|---|
| AEROSPATIALE | | | | | | | | |
| SA 321 | Tur. Turmo 3C | 3 | 1,550 | 18.9m/4.0m | 6/5 | 28,660 | 24,240 | 92.8 |
| SA 330 | Tur. Turmo 4C | 2 | 1,435 | 15.0m/3.04m | 4/5 | 15,430 | 12,214 | 93.6 |
| SA 342 | Tur. Astazou 3A | 1 | 870 | 10.5m/.695m | 3/13 | 3,970 | 3,189 | 85.5 |
| SA 360 | Tur. Astazou 16A | 1 | 1,050 | 11.5m/.9m | 4/13 | 5,950 | 4,190 | 89.9 |
| AGUSTA | | | | | | | | |
| A 109 | All. 250-C20B | 2 | 420 | 11.0m/2.0m | 4/2 | 5,400 | 5,200 | 94.2 |
| BELL | | | | | | | | |
| Model 47G | Lyc. VO-540-B1B | 1 | 305 | 11.32m/1.78m | 2/2 | 2,950 | 2,850 | 90.2 |
| Model 206L | All. 250-C20 | 1 | 400 | 10.16m/1.57m | 2/2 | 3,900 | 3,420 | 89.4 |
| Model 212 | P&W PT6T-3 | 1 | 1,800 | 14.69m/2.59m | 2/2 | 10,500 | 9,600 | 98.2 |
| BOEING VERTOL | | | | | | | | |
| Model 234 | Lyc. T55-L-11C | 2 | 3,750 | 18.29m/18.29m | 1/1 | 45,000 | 41,000 | 107.0 |
| HUGHES | | | | | | | | |
| 300C | Lyc. HIO-360-D1A | 1 | 190 | 8.18m/1.3m | 3/2 | 1,900 | 1,800 | 82.0 |
| 369A | All. T63-A-5A | 1 | 317 | 8.03m/1.3m | 4/2 | 2,700 | 2,412 | 91.1 |
| 500D | All. 250-C20B | 1 | 420 | 8.05m/1.3m | 5/2 | 3,000 | 1,850 | 88.7 |

APPENDIX V
MEASURED OR ESTIMATED NOISE LEVELS FROM UNCERTIFICATED AIRPLANES

ROTARY WING AIRCRAFT

| Airplane | Model | ENGINES No. | Hp./shp | ROTOR Diameter Main/Tail | No. of Blades Main/Tail | FLYOVER Max Gr. Wgt. | Meas. Gr. Wgt. | Meas EPNL @ 500 ft. |
|---|---|---|---|---|---|---|---|---|
| **MIL** | | | | | | | | |
| Mi-6A | Sol. D-25V(TV-2BM) | 2 | 5,500 | 35.0m/6.3m | 5/4 | 93,700 | 93,696 | 101.3 |
| **SIKORSKY** | | | | | | | | |
| S-61 | GE T58-GE-10 | 2 | 1,400 | 18.9m/3.23m | 5/5 | 19,000 | 18,725 | 89.5 |
| S-64 | P&W JFTD12-5A | 2 | 4,800 | 21.95m/4.88m | 6/4 | 47,000 | 42,900 | 96.1 |
| **WESTLAND** | | | | | | | | |
| 606 Lynx | RR BS.360-07-26 | 2 | 750 | 12.8m/2.21m | 4/4 | 9,500 | 9,500 | 96.9 |

## APPENDIX D

## SELECTED EXPERIENCES WITH HELICOPTER OPERATIONS

Los Angeles Convention Center Temporary Heliport

At one of the annual meetings of the Helicopter Association International, a temporary permit was granted to operate a shuttle service between the Center and downtown. All incoming and outgoing flights were routed over the adjacent freeway. Landing and take-off flight paths were selected such that the helicopters flew only over the Center's property. During the four day shuttle service, no noise complaints were received. There was one inquiry - a citizen wanted to know what had happened to cause so many helicopters to be in the area.

30th Street, 60th Street and Wall Street Heliports in New York Located Along the Hudson River

Landings and take-offs are made over the River, and a major thoroughfare is between the heliports and nearby business districts. Noise has not been a serious problem, even though these heliports have a large number of movements per day.

Public Use Heliport Located on Pier #4 in Baltimore

Landings and take-offs occur over water. There have been no noise problems.

Rooftop Heliport on Cobo Hall in Detroit

A large parking garage adjacent to the Cobo Hall heliport acts as a buffer. Routes into and out of the heliport are over water. Again, no noise problems exist.

Rooftop Heliport on First Pennsylvania Bank

In this case, flight paths over several thoroughfares are used. To my knowledge, no complaints have been made about noise.

Penzance Heliport*, England

Located in a semi-rural area, this is a scheduled service, up to 24 movements per day, operated by British Airways Helicopters, Limited. Seventy residential homes lie within 800 to 2000 feet of the heliport site. Dwellings are not overflown and there have been very few complaints. The local authorities state that noise problems have never caused serious concern. Also, the helicopter operators ". . . have always been cooperative and this must go on record as being one of the main reasons why service operates without giving annoyance to local residents."

Battersea Heliport*, London, England

Heliport is situated on the River Thames in 'built up area' five miles from center of city. There are 30 to 40 movements per day. The local area consists generally of high rise buildings. A noise limit criterion is in effect which limits the size of helicopters permitted to use the heliport, although exceptions are made. The level of complaints is extremely low. The few complaints received are usually a result of banking turns prior to approaching the heliport.

*Information and experiences of these heliports were furnished courtesy of Dr. John Leverton, Westland Helicopters.

Source: Proceedings of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation. "Heliport Noise" by Charles M. Cox, Bell Helicopter Textron. February 1983. NASA Contract NAS2-10815 (44).

## APPENDIX E

## MODEL RESIDENTIAL NOISE INSULATION REQUIREMENTS

A. SECTION 1 - RECOMMENDED BUILDING REQUIREMENTS FOR A MINIMUM NOISE LEVEL REDUCTION OF 25 dB.

1.1 Compliance: Compliance with the following standards shall be deemed to meet requirements for a minimum noise level reduction of 25 decibels.

1.2 General:

a. Brick veneer, masonry blocks, or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.

b. At the penetration of exterior walls by pipes, ducts or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

c. Window and/or through-the-wall ventilation units shall not be used.

d. Through-the-wall/door mailboxes shall not be used.

1.3 Exterior Walls:

a. Exterior walls, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-30.

b. Masonry walls having a surface weight of at least 25 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered.

c. Stud walls shall be at least 4" in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco or brick veneer.

(1) Interior surface of the exterior walls shall be of gypsum board or plaster at least ½" thick, installed on the studs.

(2) Continuous composition board, plywood or gypsum board sheathing at least ½" thick shall cover the exterior side of the wall studs behind wood or metal siding. Asphaltic or wood shake shingles or plaster (stucco) are acceptable in lieu of siding.

SOURCE: The Parry Company, "Recommended Building Requirements and Their Incremental Costs for Residences in Areas with High Noise Levels", P.O. Box 1102, Half Moon Bay, CA, Dec. 1982 (45).

(3) Sheathing panels shall be covered on the exterior with overlapping building paper.

(4) Insulation material at least R-11 shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

1.4 Windows:

a. Windows other than as described in this section shall have a laboratory sound transmission class rating of at least STC-28.

b. Glass shall be at least 3/16" thick.

c. All operable windows shall be weather-stripped and airtight when closed so as to conform to an air infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T

d. Glass of fixed-sash windows shall be sealed in an airtight manner with a nonhardening sealant or a soft elastomer gasket or gasket tape.

e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230 or TT-S-00153.

1.5 Doors:

a. Doors other than as described in this section shall have a laboratory sound transmission class rating of at least STC-26.

b. All exterior side-hinged doors shall be solid-core wood or insulated hollow metal at least 1 3/4" thick and shall be fully weather-stripped.

c. Exterior sliding doors shall be weather-stripped with an efficient airtight gasket system with performance as specified in Section 1.4c. The glass in the sliding doors shall be at least 3/16" thick.

d. Glass in doors shall be sealed in an airtight nonhardening sealant or in a soft elastomer gasket or glazing tape.

e. The perimeter of door frames shall be sealed airtight to the exterior wall construction as described in Section 1.4e.

1.6 Roofs:

a. Combined roof and ceiling construction other than described in this section and Section 1.7 shall have a laboratory sound transmission class rating of at least STC-39.

b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of ½" composition board, plywood or gypsum board sheathing topped by roofing as required.

c. Open beam roof construction shall follow the energy insulation standard method for batt insulation.

d. Skylights shall conform to the window standard of Section 1.4.

1.7 Ceilings:

a. Gypsum board or plaster ceilings at least ½" thick shall be provided where required by Section 1.6b, above. Ceilings shall be substantially airtight with a minimum number of penetrations.

b. Glass fiber or mineral wool insulation at least R-19 shall be provided above the ceiling between joists.

1.8 Floors: Openings to any crawl spaces below the floor of the lowest occupied rooms shall not exceed 2% of the floor area of the occupied rooms.

1.9 Ventilation:

a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors or other openings to the exterior. The attic inlet and

discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1"-thick coated glass fiber, and shall be at least 5 feet long with one 90-degree bend.

b. Gravity vent openings in attics shall not exceed code minimum in number and size.

c. All vent ducts (except kitchen and sewer gas) connecting the interior space to the outdoors, except domestic range exhaust ducts, shall contain at least a 5-foot length of internal sound-absorbing duct lining. Each duct shall be provided with a bend in the duct such that there is no direct line-of-sight through the duct from the venting cross-section to the room-opening cross-section. Duct lining shall be coated glass fiber duct liner at least 1" thick.

d. Fireplaces shall be provided with well-fitted dampers.

B. SECTION 2 - RECOMMENDED BUILDING REQUIREMENTS FOR A MINIMUM LEVEL REDUCTION OF 30 dB.

2.1 Compliance: Compliance with the following standards shall be deemed to meet requirements for a minimum noise level reduction of 30 decibels.

2.2 General:

a. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtights. All joints shall be grouted or caulked airtight.

b. At the penetration of exterior walls by pipes, ducts or conduits the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

c. Window and/or through-the-wall ventilation units shall not be used.

d. Operational-vented fireplaces shall not be used.

e. All sleeping spaces shall be provided with a carpeted floor.

f. Through-the-wall/door mailboxes shall not be used.

2.3 Exterior Walls:

a. Exterior walls, other than as described below, shall have a laboratory sound transmission class rating of at least STC-35.

b. Masonry walls having a surface weight of at least 40 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered.

c. Stud walls shall be at least 4" in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco or brick veneer.

(1) Interior surface of the exterior walls shall be of gypsum board or plaster at least 1/2" thick, installed on the studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer or stucco. If the exterior is siding on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.

(2) Continuous composition board, plywood, plaster (stucco), or gypsum board sheathing at least 3/4" thick shall cover the exterior side of the wall studs behind wood or metal siding.

(3) Sheathing panels shall be covered on the exterior with overlapping building paper.

(4) Insulation material at least R-11 shall be installed continuously throughout the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

2.4 Windows:

a. Windows, other than described in this section, shall have a laboratory sound transmission class rating of at least STC-33.

b. Glass of double-glazed windows shall be at least 1/8" thick. Panes of glass shall be separated by a minimum 1/2" airspace.

c. Double-glazed windows shall employ fixed sash or efficiently weather-stripped, operable sash. The sash shall be rigid and weather-stripped with material that

is compressed airtight when the window is closed so as to conform to an infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.

d. Glass of fixed-sash windows shall be sealed in an airtight manner with a nonhardening sealant or a soft elastomer gasket or glazing tape.

e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

2.5 Doors:

a. Doors, other than described in this section, shall have a laboratory sound transmission class rating of at least STC-33.

b. Double-door construction is required for all door openings to the exterior. Openings fitted with side-hinged doors shall have one solid-core wood or insulated hollow metal core door at least 1 3/4" thick separated by an airspace of at least 3" from another door, which can be a storm door. Both doors shall be tightly fitted and weather-stripped.

c. The glass of double-glazed sliding doors shall be separated by a minimum ½" airspace. Each sliding frame shall be provided with an efficiently airtight weather-stripping material as specified in Section 2.4c.

d. Glass of all doors shall be at least 3/16" thick. Glass of double sliding doors shall not be equal in thickness.

e. The perimeter of door frames shall be sealed air-tight to the exterior wall construction as indicated in Section 2.4e.

f. Glass of doors shall be set and sealed in an air-tight nonhardening sealant or a soft elastomer gasket or glazing tape.

2.6 Roofs:

a. Combined roof and ceiling construction, other than described in this section and Section 2.7, shall have a laboratory sound transmission class rating of at least STC-44.

b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of 3/4" composition board, plywood, or gypsum board sheathing topped by roofing as required.

c. Open beam roof constuction shall follow the energy insulation standard method for batt insulation, except use 1" plywood decking with shakes or other suitable roofing material in place of 1/2" plywood.

d. Window or dome skylights shall have a laboratory sound transmission class rating of at least STC-33 :

2.7 Ceilings:

a. Gypsum board or plaster ceilings at least 5/8" thick shall be provided where required by Section 2.6b, above. Ceilings shall be substantially airtight, with a minimum number of penetrations.

b. Glass fiber or mineral wool insulation of at least R-19 shall be provided above the ceiling between joists.

2.8 Floors: The floor of the lowest occupied rooms shall be slab on fill, below grade, or over a fully enclosed basement or crawl space. All door and window openings in the fully enclosed basement shall be tightly fitted.

2.9 Ventilation:

a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without the need to open any windows, doors, or other openings to the exterior. The attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1"-thick coated glass fiber, and shall be at least 5 feet long with one 90-degree bend.

b. Gravity vent openings in attics shall not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 3 feet in length containing internal 1" thick coated fiberglass sound-absorbing duct lining. Each duct shall have a lined 90-degree bend in the duct such that there is no direct line-of-sight from the exterior through the duct into the attic.

c. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust and sewer gas ducts, shall contain at least a 10-foot length of internal sound-absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line-of-sight through the duct from the venting cross-section to the room-opening cross-section. Duct lining shall be coated glass fiber duct liner at least 1" thick.

d. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a self-closing baffle plate across the exterior termination which allows proper ventilation. The duct shall be provided with a 90-degree bend.

C. SECTION 3 - RECOMMENDED BUILDING REQUIREMENTS FOR A MINIMUM NOISE LEVEL REDUCTION OF 35 dB.

3.1 Compliance: Compliance with the following standards shall be deemed to meet requirements for a minimum noise level reduction of 35 decibels.

3.2 General:

a. Brick veneer, masonry blocks or stucco exterior walls shall be constructed airtight. All joints shall be grouted or caulked airtight.

b. At the penetration of exterior walls by pipes, ducts or conduits, the space between the wall and pipes, ducts or conduits shall be caulked or filled with mortar.

c. Window and/or through-the-wall ventilation units shall not be used.

d. Operational-vented fireplaces shall not be used.

e. All sleeping spaces shall be provided with a carpeted floor.

f. Through-the-wall/door mailboxes shall not be used.

g. No glass or plastic skylight shall be used.

3.3 Exterior Walls:

a. Exterior walls, other than as described below, shall have a laboratory sound transmission class rating of at least STC-40.

b. Masonry walls having a surface weight of at least 75 pounds per square foot do not require a furred (stud) interior wall. At least one surface of concrete block walls shall be plastered.

c. Stud walls shall be at least 4" in nominal depth and shall be finished on the outside with siding-on-sheathing, stucco or brick veneer.

(1) Interior surface of the exterior walls shall be of gypsum board or plaster at least 5/8" thick, installed on studs. The gypsum board or plaster may be fastened rigidly to the studs if the exterior is brick veneer. If the exterior is stucco or siding-on-sheathing, the interior gypsum board or plaster must be fastened resiliently to the studs.

(2) Continuous composition board, plywood, plaster (stucco) or gypsum board sheathing at least 1" thick shall cover the exterior side of the wall studs behind wood or metal siding.

(3) Sheathing panels shall be butted tightly and covered on the exterior with overlapping building paper.

(4) Insulation material at least R-19 shall be installed continuously through the cavity space behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

3.4 Windows:

a. Windows, other than described in this section, shall have a laboratory sound transmission class rating of at least STC-38.

b. Glass of double-glazed windows shall be at least 3/1 thick. Panes of glass shall be separated by a minimum 1/2" airspace and shall not be equal in thickness.

c. Double-glazed windows shall employ fixed sash or efficiently weather-stripped, operable sash. The sash shall be rigid and weather-stripped with material that is compressed airtight when the window is closed so as to conform to an infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.

d. Glass of windows shall be sealed in an airtight manner with a nonhardening sealant or a soft elastomer gasket or glazing tape.

e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

3.5 Doors:

a. Doors, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-38.

b. Double-door construction is required for all door openings to the exterior. The door shall be side-hinged and shall be solid-core wood or insulated hollow metal, at least 1 3/4" thick, separated by a vestibule or enclosed porch at least 3 feet in length. Both doors shall be tightly fitted and weather-stripped.

c. The perimeter of door frames shall be sealed airtight to the exterior wall construction as specified in Section 3.4d.

d. Glass of all doors shall be at least 3/16" thick. Glass of double sliding doors shall not be equal in thickness.

behind the exterior sheathing and between wall studs. Insulation shall be glass fiber or mineral wool.

3.4 Windows:

a. Windows, other than described in this section, shall have a laboratory sound transmission class rating of at least STC-38.

b. Glass of double-glazed windows shall be at least 3/16 thick. Panes of glass shall be separated by a minimum 1/2" airspace and shall not be equal in thickness.

c. Double-glazed windows shall employ fixed sash or efficiently weather-stripped, operable sash. The sash shall be rigid and weather-stripped with material that is compressed airtight when the window is closed so as to conform to an infiltration test not to exceed 0.5 cubic foot per minute per foot of crack length in accordance with ASTM E-283-65-T.

d. Glass of windows shall be sealed in an airtight manner with a nonhardening sealant or a soft elastomer gasket or glazing tape.

e. The perimeter of window frames shall be sealed airtight to the exterior wall construction with a sealant conforming to one of the following Federal specifications: TT-S-00227, TT-S-00230, or TT-S-00153.

3.5 Doors:

a. Doors, other than as described in this section, shall have a laboratory sound transmission class rating of at least STC-38.

b. Double-door construction is required for all door openings to the exterior. The door shall be side-hinged and shall be solid-core wood or insulated hollow metal, at least 1 3/4" thick, separated by a vestibule or enclosed porch at least 3 feet in length. Both doors shall be tightly fitted and weather-stripped.

c. The perimeter of door frames shall be sealed airtight to the exterior wall construction as specified in Section 3.4d.

3.6 Roofs:

a. Combined roof and ceiling construction other than as described in this section and Section 3.7 shall have a laboratory sound transmission class rating of at least STC-49.

b. With an attic or rafter space at least 6" deep, and with a ceiling below, the roof shall consist of 1" composition board, plywood or gypsum board sheathing topped by roofing as required.

c. Open beam roof construction shall follow the energy insulation standard method for batt insulation, except use clay or concrete tiles in place of shakes.

3.7 Ceilings:

a. Gypsum board or plaster ceilings at least 5/8" thick shall be provided where required by Section 3.6. Ceilings shall be substantially airtight, with a minumum number of penetrations. The ceiling panels shall be mounted on resilient clips or channels.

b. Glass fiber or mineral wool insulation at least R-30 thick shall be provided above the ceiling between joists.

3.8 Floors: The floors of the lowest occupied rooms shall be slab on fill or below grade.

3.9 Ventilation:

a. A mechanical ventilation system shall be installed that will provide the minimum air circulation and fresh air supply requirements for various uses in occupied rooms without need to open any windows, doors or other openings to the exterior. The attic inlet and discharge openings shall be fitted with sheet metal transfer ducts of at least 20 gauge steel, which shall be lined with 1"-thick coated glass fiber, and shall be at least 10 feet long with one 90-degree bend.

b. Gravity vent openings in attics shall not exceed code minimum in number and size. The openings shall be fitted with transfer ducts at least 6 feet in length containing internal sound-absorbing duct lining. Each duct shall have a lined 90-degree bend in the duct such that there is no direct line-of-sight from the exterior through the duct into the attic.

c. All vent ducts connecting the interior space to the outdoors, excepting domestic range exhaust and sewer gas ducts, shall contain at least a 10-foot length of internal sound-absorbing duct lining. Each duct shall be provided with a lined 90-degree bend in the duct such that there is no direct line-of-sight through the duct from the venting cross-section to the room opening cross-section. Duct lining shall be coated glass fiber duct liner at least 1" thick.

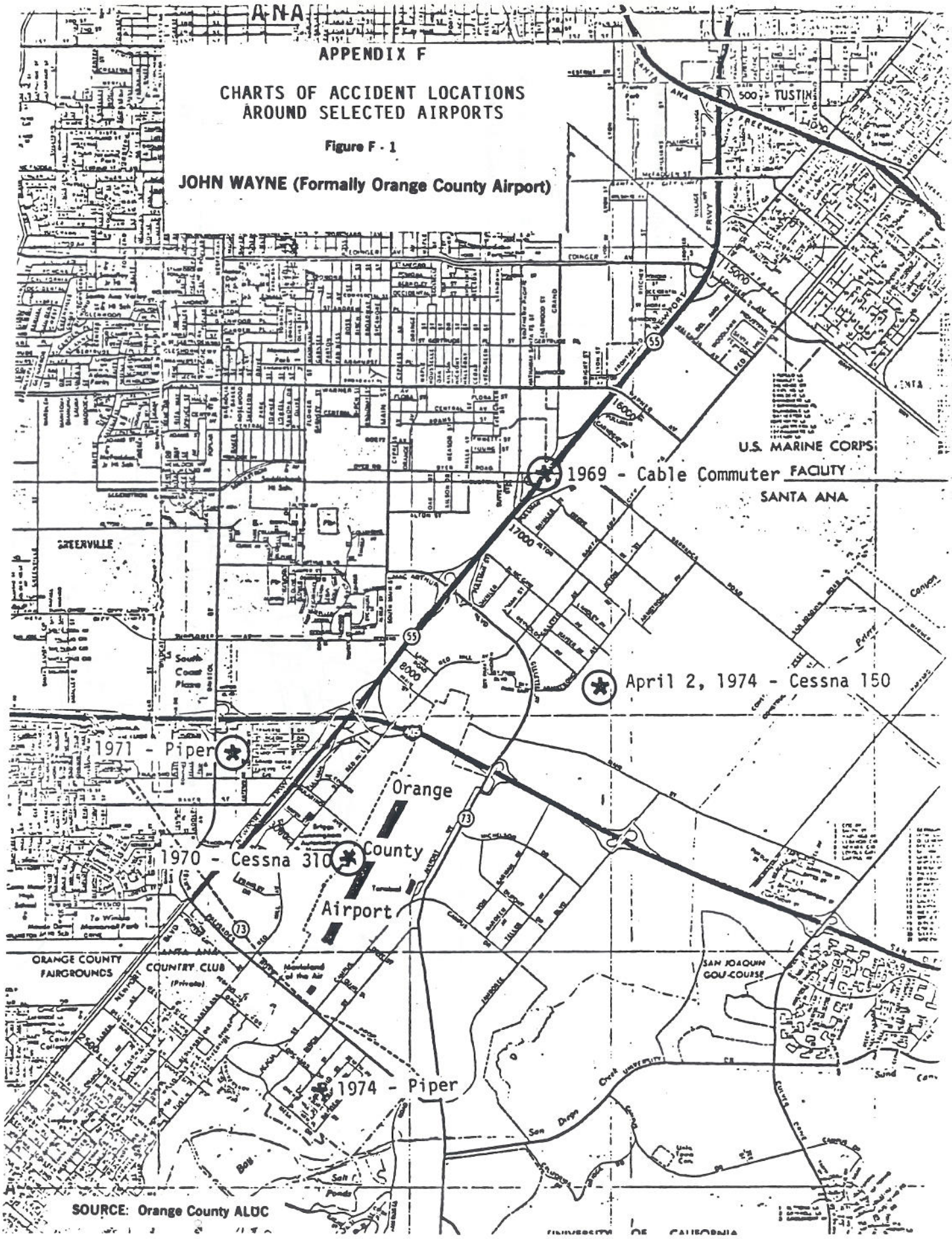
d. Domestic range exhaust ducts connecting the interior space to the outdoors shall contain a self-closing baffle plate across the exterior termination which allows proper ventilation. The duct shall be provided with a 90-degree bend.

# APPENDIX F

## CHARTS OF ACCIDENT LOCATIONS AROUND SELECTED AIRPORTS

**Figure F - 1**

**JOHN WAYNE (Formally Orange County Airport)**



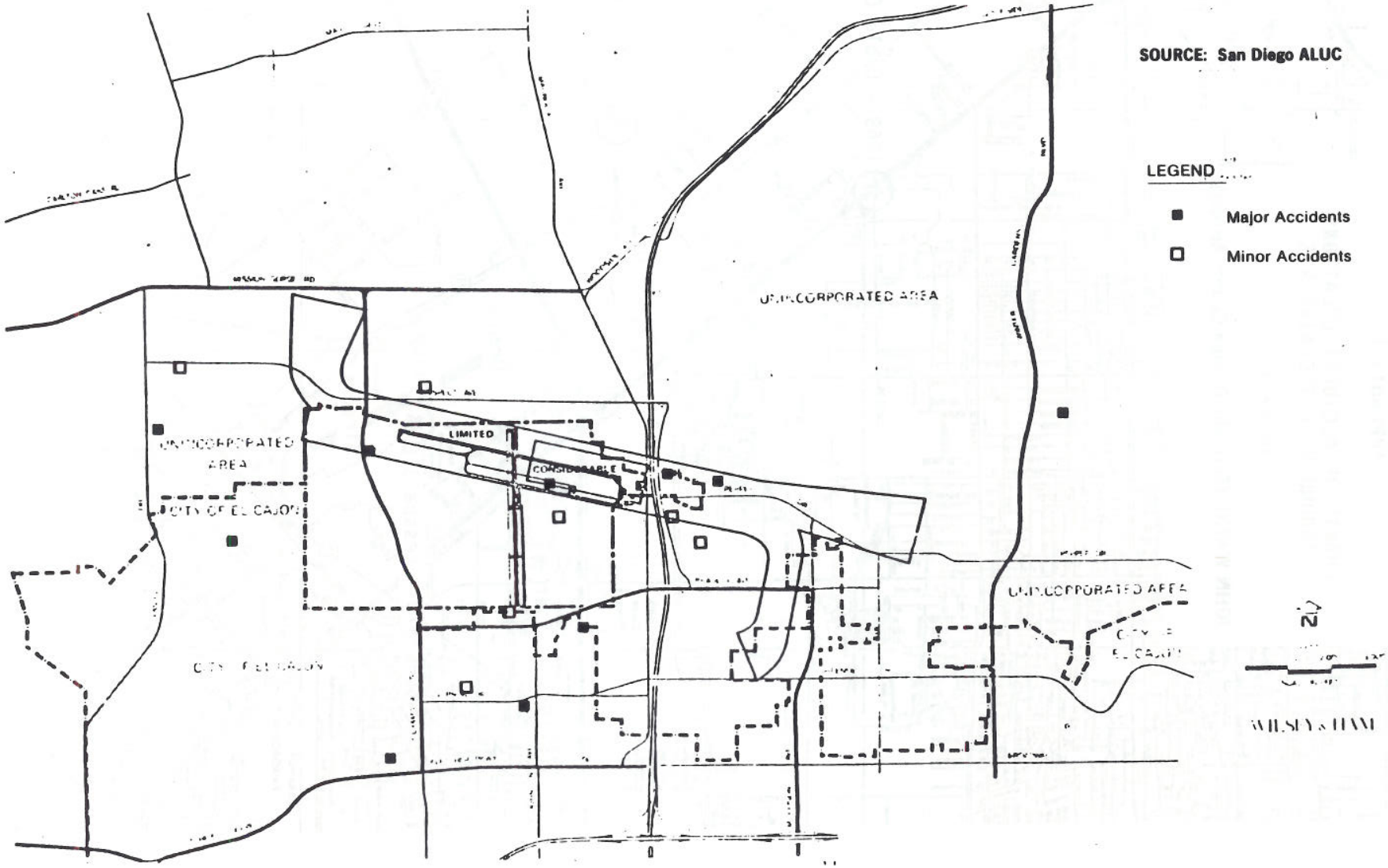



Figure F - 2
GILLESPIE FIELD

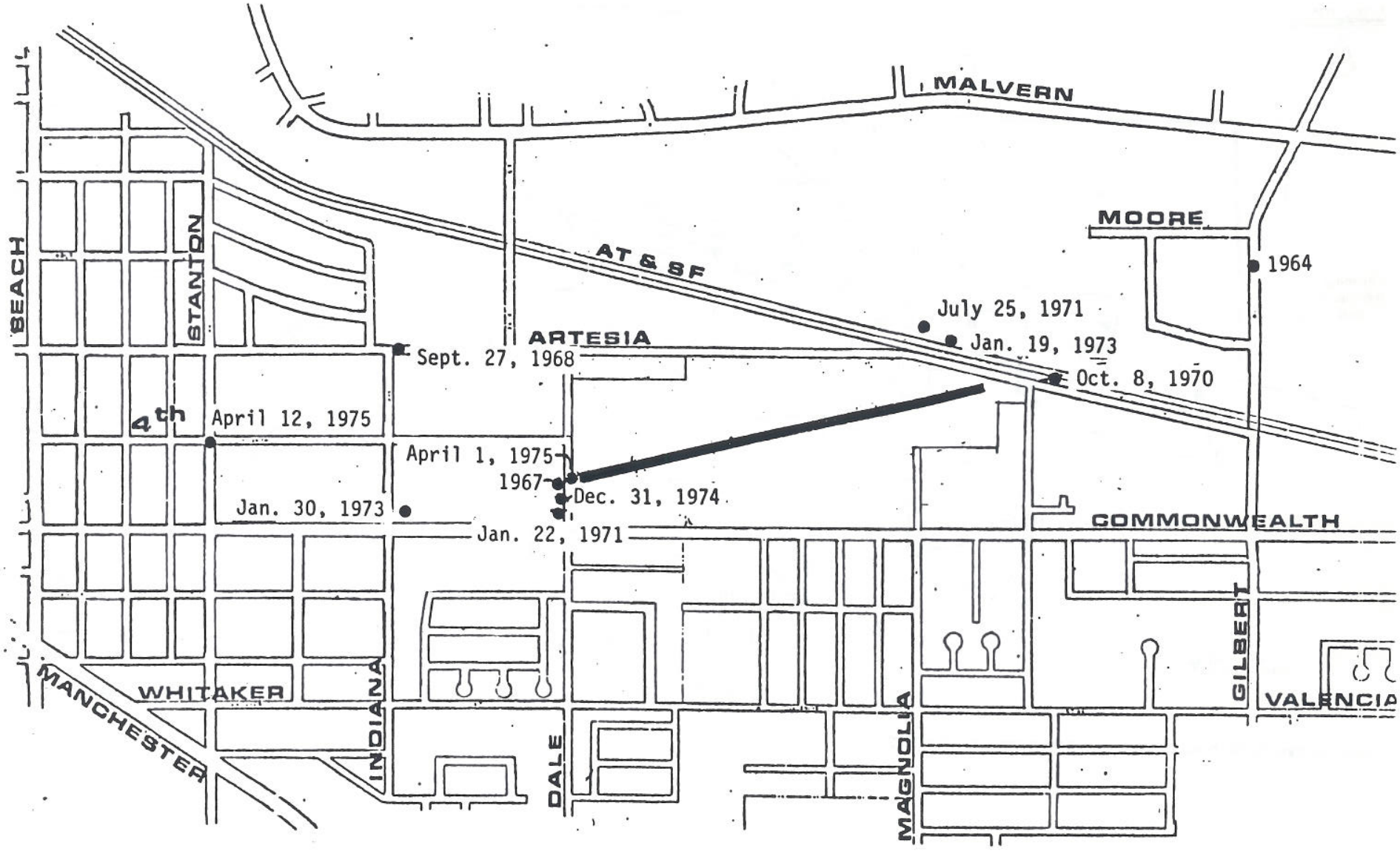
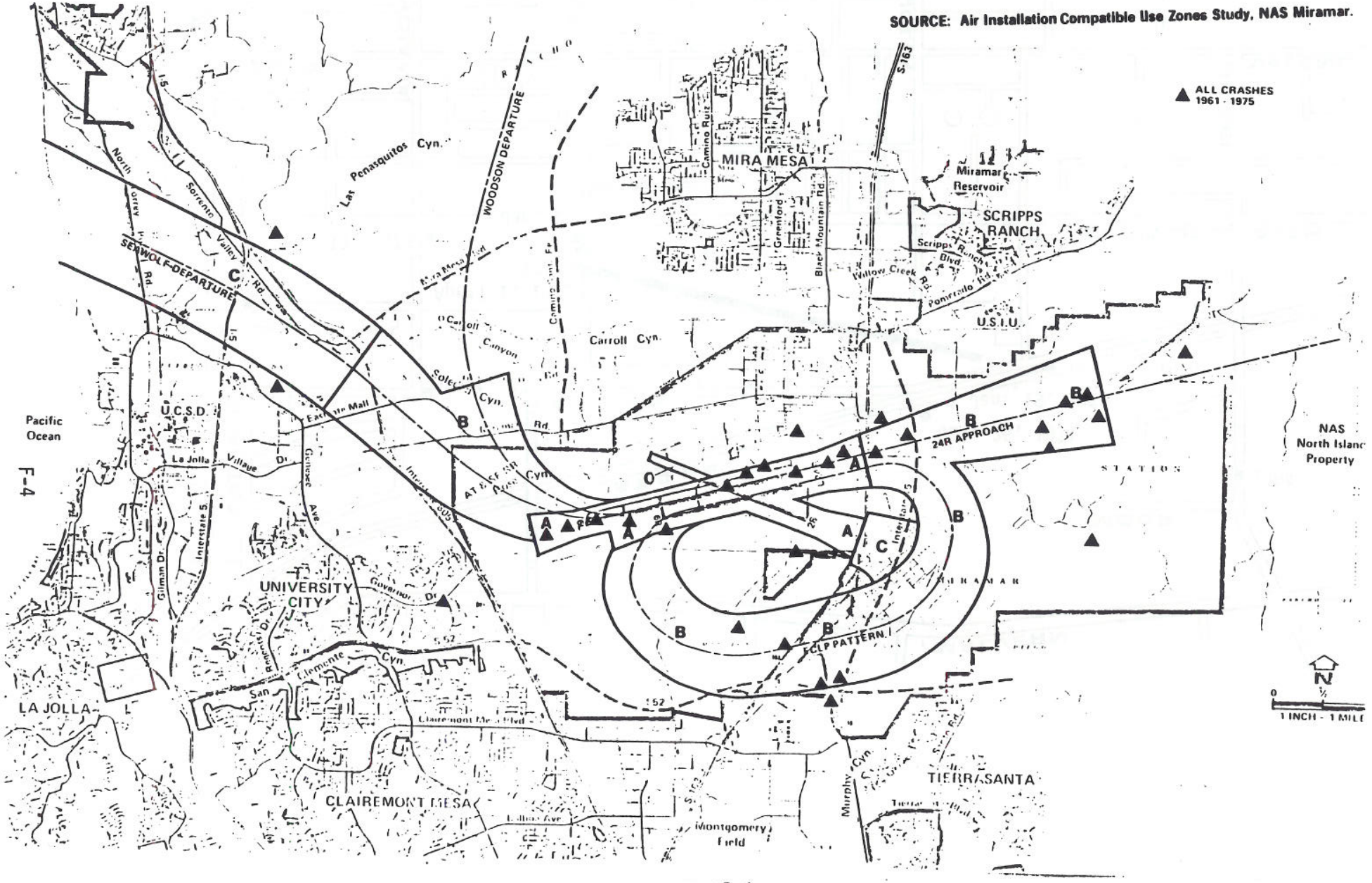



Figure F - 3
**FULLERTON AIRPORT**


SOURCE: Air Installation Compatible Use Zones Study, NAS Miramar.
ALL CRASHES 1961 - 1975
MIRA MESA
Miramar Reservoir
SCRIPPS RANCH
U.S.I.U.
Las Penasquitos Cyn.
WOODSON DEPARTURE
SEAWOLF DEPARTURE
Carroll Cyn.
Camino Ruiz
Greenford
Black Mountain Rd.
Scripps Ranch Blvd.
Willow Creek Rd.
Pomerado Rd.
S-163
North Torrey Pines Rd.
Sorrento Valley Rd.
I-5
Mira Mesa Blvd.
Carroll Canyon
Soledad Cyn.
Eastgate Mall
Pacific Ocean
U.C.S.D.
La Jolla Village Dr.
Genesee Ave.
Interstate 5
Gilman Dr.
Interstate 805
AT & SF SR
24R APPROACH
STATION
NAS North Island Property
MIRAMAR
UNIVERSITY CITY
Governor Dr.
Regents Dr.
San Clemente Cyn.
S-52
FCLP PATTERN
LA JOLLA
Clairemont Mesa Blvd.
CLAIREMONT MESA
Ballina Ave.
Montgomery Field
Murphy Cyn.
TIERRASANTA
Tierrasanta Blvd.
N
0
1 INCH - 1 MILE

re F - 4

N. IRAI

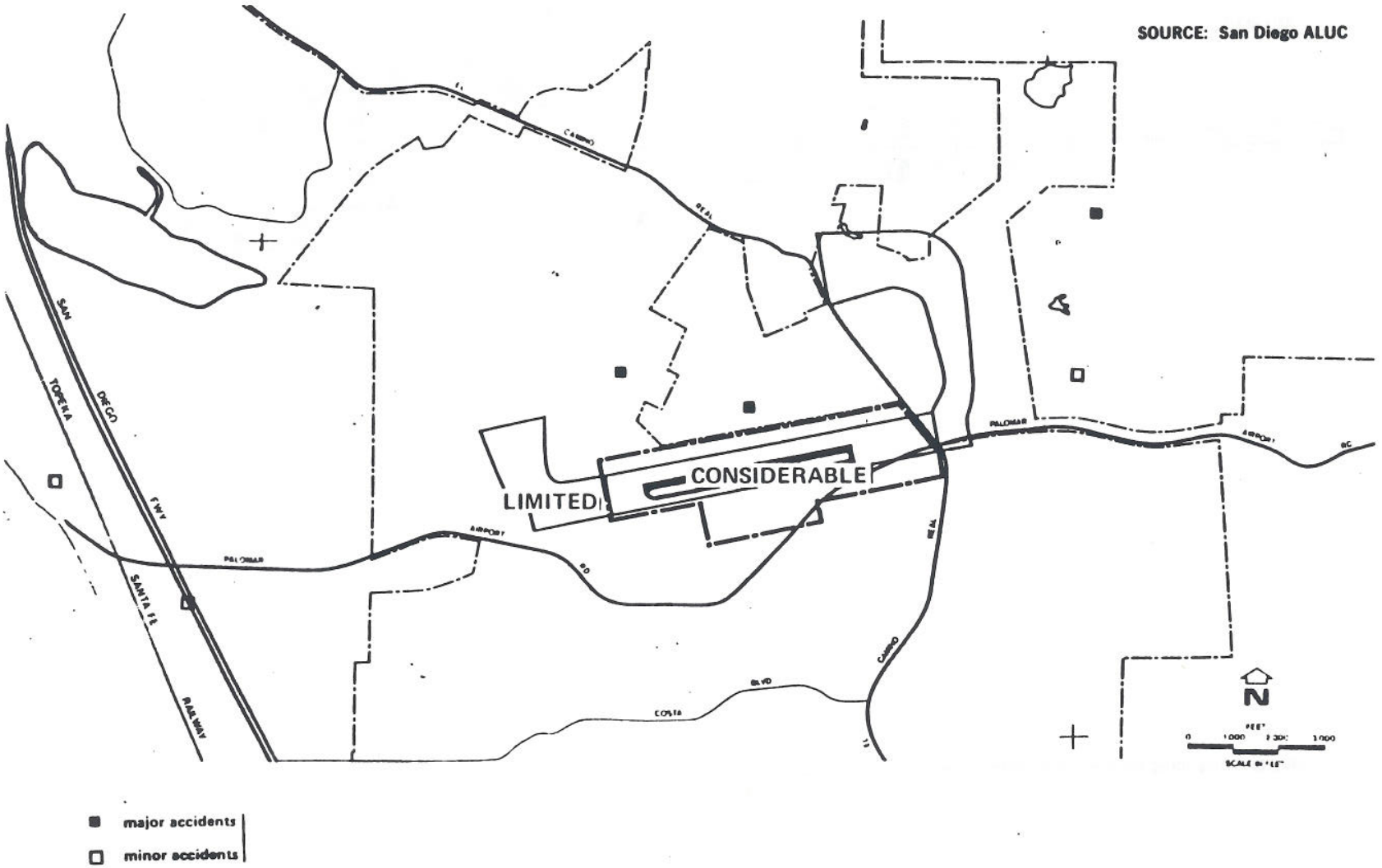
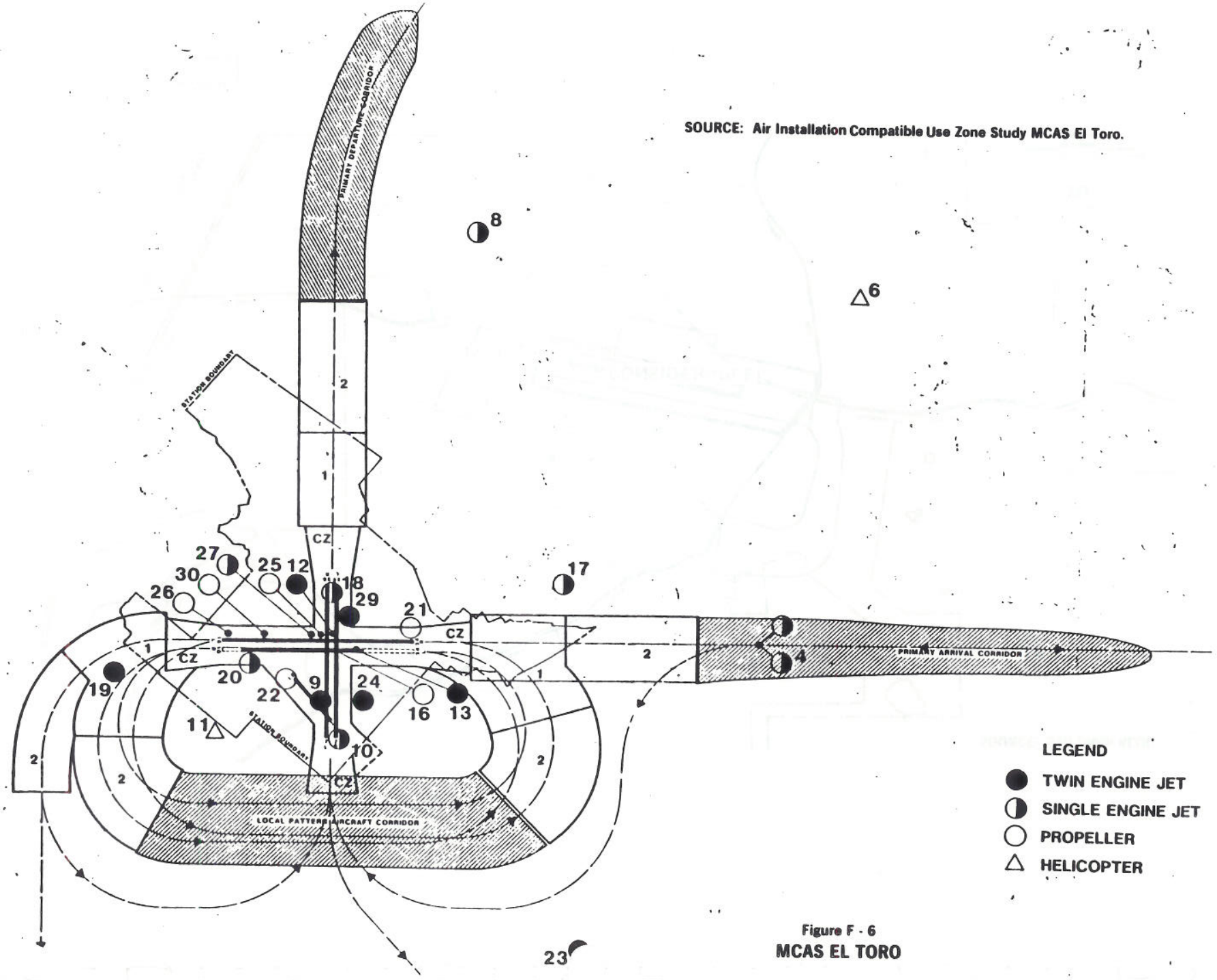



Figure F - 5
**PALOMAR AIRPORT**




SOURCE: Air Installation Compatible Use Zone Study MCAS El Toro.

Figure F - 6
MCAS EL TORO

# APPENDIX G

## METHODS FOR DETERMINING CONCENTRATIONS OF PEOPLE IN SAFETY ZONES

One significant basis used in this plan for limiting the density of people in the vicinity of the airport is the number of people who can be present in a given area at any one time. If a proposed use is expected to generate more than 50 persons per acre, it will be considered incompatible in Approach Zones 2 and 3. This appendix provides some guidance on how to make that people per acre determination.

The most difficult part of making a persons per acre determination is estimating the number of people likely to use a particular facility. For the purposes of this plan, the Uniform Building Code will be used as an initial standard for determining persons per use. The chart on E - 2, taken from the 1976 Edition of the UBC (Table 33-A), indicates the required number of square feet per occupant. This may be translated into a maximum occupancy by simply dividing the minimum square footage requirement into the total floor area of a particular building. For example, the maximum occupancy of a 10,000 square foot drinking establishment is 67 persons (10,000 sq. ft. ÷ 15 sq. ft. = 667). Because on-site surveys of the existing commercial uses in the area of the airport indicate that even at the busiest times of the day the office and retail uses (except restaurants and bars) are only 40% to 50% of UBC maximum occupancy, we will assume that at any one time only 50% of UBC maximum occupancy will be present in a particular building. Therefore, the steps necessary to estimate concentrations of people are as follows:

1) Gross square feet of parcel divided by 43,560 (sq. ft. in acre) equals size of parcel in acres;

2) Divide square footage of proposed building by square feet per occupant as required by the UBC to establish maximum occupancy.

3) Multiply maximum occupancy by 50% to establish maximum number of persons expected to be present in use at any one time.

4) Divide number of persons expected (from #4) by gross acres (from #1).

5) If the resulting number is 50 or less, the proposal will be consistent with the land use policies (assuming any other conditions are met). If the number is greater than 50, the project would be deemed inconsistent and should be revised.

It should be noted here that the above-described process is but one method of determining concentrations of people. Other methods include analysis of existing similar uses in similar locations or a showing by a project proponent of the precise details of the proposal relative to probable number of people to be attracted to the site (i.e., see Appendix H).

| | Use | Square Feet Per Occupant |
|---|---|---|
| 1. | Aircraft Hangars (No Repair) | 500 |
| 2. | Auction Room | 7 |
| 3. | Assembly Areas, Concentrated Use (without fixed seats) Auditoriums Bowling Alleys (assembly areas) Churches and Chapels Dance Floors Lodge Rooms Reviewing Stands Stadiums | 7 |
| 4. | Assembly Areas, Less-Concentrated Use Conference Rooms Dining Rooms Drinking Establishments Exhibit Rooms Gymnasiums Lounges Skating Rinks Stages | 15 |
| 5. | Children's Homes and Homes for the Aged | 80 |
| 6. | Classrooms | 20 |
| 7. | Dormitories | 50 |
| 8. | Dwellings | 300 |
| 9. | Garage, Parking | 200 |
| 10. | Hospitals and Sanitariums-Nursing Homes | 80 |
| 11. | Hotels and Apartments | 200 |
| 12. | Kitchen-Commercial | 200 |
| 13. | Library Reading Room | 50 |
| 14. | Locker Rooms | 50 |
| 15. | Mechanical Equipment Room | 300 |
| 16. | Nurseries for Children (Day-care) | 50 |
| 17. | Offices | 100 |
| 18. | School Shops and Vocational Rooms | 50 |
| 19. | Stores - Retail Sales Rooms | |
| | Basement | 20 |
| | Ground Floor | 30 |
| | Upper Floors | 50 |
| 20. | Warehouses | 300 |
| 21. | All Others | 100 |

Examples:

A. The proposal is for a 12,000 square foot grocery store on a 63,000 square foot parcel.

Steps:

1) 63,000 sq. ft. ÷ 43,560 sq. ft. (in an acre) = 1.45 acre

2) 12,000 sq. ft. ÷ 30 sq. ft./occupant = 400 (max. building occupancy)

3) 400 max. bldg. occup. x 50% = 200 (persons expected at any one time)

4) 200 persons ÷ 1.45 acre = 138 persons per acre

Under this example, 138 persons per acre would represent a reasonable estimate and the use would be considered incompatible.

B. The proposal is for a 3,000 square foot real estate office on a 16,500 square foot parcel.

Steps:

1) 16,500 sq. ft. ÷ 43,560 sq. ft. (acre) = .38 acre

2) 3,000 sq. ft. ÷ 100 sq. ft./occupant = 30 (max. building occupancy)

3) 30 max. bldg. occup. x 50% = 15 persons

4) 15 persons ÷ .38 = 39 persons per acre

Under this example, the use would be estimated to generate 39 persons per acre and would therefore be considered compatible in Approach Zones 2 and 3, assuming all other conditions were met.

Source: Sacramento Airport Land Use Commission

## APPENDIX H

## SURVEYS OF COMMERCIAL LOT COVERAGE AND CONCENTRATIONS OF PEOPLE

AIRPORT LAND USE COMMISSION
800 H Street, Suite 300, Sacramento, CA 95814

MEMORANDUM JUNE 25, 1980

TO: MEMBERS OF THE EXECUTIVE AIRPORT CLUB ADVISORY COMMITTEE

FROM: JIM HARNISH, ALUC Staff

RE: EXISTING LAND USE SURVEY

In order that the Committee members have a reference for the land use standards under consideration, ALUC staff has done a limited land use survey of the commercial areas in APZ-2 and APZ-3 of Runway 02 (at Florin Road and South Land Park Drive).

The lot coverage ranged from 16% to 35%. At 3:00 p.m. on a Tuesday afternoon (assuming 1-2 persons per car), the persons per acre average was 9 to 48. Persons per 40 square feet of floor space averaged around .1 to .2. Most of the concentrations of people were far below the existing ALUC policy. However, most were inconsistent with the Santa Clara County 10/25 standard. They were also measured at a non-peak period. It should be noted that the parking lots were generally less than 1/2 full.

Conclusions from this brief survey are that the current commercial development in this area may be compatible with existing ALUC policy, given the very low lot coverage. However, in peak periods (e.g. weekends in general and bingo nights for the bingo parlor) the uses probably exceed the 25/50 standard.

JNH:pal

AIRPORT LAND USE COMMISSION
SACRAMENTO REGIONAL AREA PLANNING COMMISSION
800 H Street, Suite 300, Sacramento, CA 95814

MEMORANDUM

JULY 11, 1980

TO: EXECUTIVE AIRPORT CLUP ADVISORY COMMITTEE

FROM: JIM HARNISH, ALUC Staff

RE: LOT COVERAGE SURVEY

Staff had provided a sample of lot coverage percentages at the last meeting. Committee members requested the survey be expanded to cover other commercial areas in the APZ-2 and 3 Zones around the airport.

The other two areas were surveyed and all three are summarized below:

LOT COVERAGE SURVEY
(Commercial Uses Only)

Intersection Fruitridge Rd. & 24th Street:

- 4.03 acres total
- average parcel coverage = 29.5%
- range of coverage 11.3 to 42.5

Area of Freeport Blvd./Claudia Dr./35th Ave. (excluding Lanai):

- 8.5 acres total
- average parcel coverage = 19.7%
- range of coverage 10.7 to 35.1

Area of Freeport Blvd./Florin Rd./So. Land Park Drive:

- 19.9 acres total
- average parcel coverage = 19.8%
- range of coverage 14.6 to 34.6

Based on the survey of lot coverage, it is not unreasonable to establish a 20% coverage standard.

JNH:JB:pal

AIRPORT LAND USE COMMISSION
SACRAMENTO REGIONAL AREA PLANNING COMMISSION
800 H Street, Suite 300, Sacramento, CA 95814

MEMORANDUM JULY 15, 1980

TO: EXECUTIVE AIRPORT CLUP ADVISORY COMMITTEE

FROM: ALUC STAFF

RE: APPROACH ZONE FIELD COUNT

The following charts show the results of an on-site survey of patronage and the approximate people-per-acre calculations applied to commercial areas located in three of the approach zones to Executive Airport. Some difficulties associated with this type of survey are noted on the charts. In addition, the time of day and day of the week will cause variations. For example, the Bingo parlor is in operation Monday, Wednesday and Friday evenings and Sunday afternoons.

Based on the approximate people-per-acre assignments, it can be concluded that uses such as bars, gambling establishments and other uses which concentrate a large number of people in a relatively small area should be considered non-compatible uses in the approach zone. The retail sales and office uses surveyed appear to have patronage far below the established Uniform Building Code occupancy maximums. If the UBC-based standard were used to determine the 50 people-per-acre factor, the retail sales and office uses all would be compatible in AZs- 2 and 3.

APPROXIMATE PEOPLE-PER-ACRE
BASED UPON ON-SITE SURVEY

| | Friday 7-11-80 2:00 PM | Friday 7-11-80 5:00 PM | Sunday 7-13-80 2:00 PM |
|---|---|---|---|
| Bank of Alex Brown (1.4 acres) | 14.3 ppa* | 25.0 ppa | .7 ppa |
| Manor Drug Complex Bel Air/Straw Hat Longs Drug Complex (13.1 acres) | 18.2 ppa | 21.6 ppa | 11.1 ppa |
| Bingo Parlor Complex (1.4 acres) | 147.4 approx. ppa at 75% of seating capacity | | 85.5 ppa |
| Crossroads (4.3 acres) | 9.3 ppa | 12.3 ppa | .93 ppa |
| Mangan Park Pool (.4 acres) | 375 ppa | -- | 187.5 ppa |
| SW Corner Fruitridge Road Complex (2.1 a (Swiss Buda-.02 a | 26.6 ppa | 32.4 ppa 2000 ppa | 18.6 ppa |

* ppa = people per acre

NOTE: In cases where people counts were not known, approximations were based on automobile counts with a 1 person = 1 auto assumption.

SUMMARY OF ON-SITE SURVEY

| | Friday 7-11-80 2:00 PM | Friday 7-11-80 5:00 PM | Sunday 7-13-80 2:00 PM |
|---|---|---|---|
| Bank of Alex Brown | 20 people 18 cars | 35 people 30 cars | 1 car |
| Minor Drug Complex Bel Air/Straw Hat Longs Drug Complex | Peop. Cars 53 } = 195 112+ } 74+ = 93 | Peop. Cars 40 } Lot 80% 166+ } Full 77 cars | Peop. Cars 116+ } 96 29 cars |
| Bingo Parlor Complex | Approx. seating capacity = 275 | | 124 cars |
| Crossroads | 40 people 43 cars | 53 cars | 4 cars |
| Mangan Park Pool | Approx. 150 children | -- | Approx. 75 children |
| SW Corner Fruitridge Road Complex (Swiss Buda) | 58 cars | 68 cars 40 people | 39 cars |

NOTE: Where a (+) follows a count, it is based on known existence of employees in areas not reachable to count.

JNH:pal

# APPENDIX I

US Department
of Transportation
**Federal Aviation
Administration**

Western-Pacific Region

P.O. Box 92007
Worldway Postal Center
Los Angeles, CA 90009

## EXAMPLES OF TYPES OF DETERMINATIONS ISSUED BY FAA UNDER F.A.R. PART 77

1) 83-AWP-383-OE: Notice is not required.

2) 83-AWP-321-OE: Proposal does not exceed FAR Part 77; Marking and lighting are not necessary.

3) 83-AWP-377-OE: Proposal does not exceed FAR Part 77; Marking and lighting are recommended.

4) 83-AWP-394-OE: Proposal exceeds Part 77. In-house FAA study reveals project is not a hazard.

5) 83-AWP-375-OE: Proposal exceeds Part 77. In-house FAA study reveals project is not a hazard; however, marking and lighting are recommended.

6) 81-AWP-818-OE: Proposal exceeds Part 77. Proposal has been circularized for comment. Study completed and found to be no hazard, conditional on obstruction lights.

7) 83-AWP-58-OE: Proposal being circularized. Request for comments prior to determination.

8) 81-AWP-776-OE: Proposal exceeds Part 77. Proposal has been circularized for comment. Study completed and found to be a hazard.

DO NOT REMOVE CARBONS

Form Approved O.M.B. No. 04-R0001

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

# NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

**FOR FAA USE ONLY**

AERONAUTICAL STUDY NO.
83-AWP-323-OE

FAA will either return this form or issue a separate acknowledgement.

A. The proposed structure:
- [X] Does not require a notice to FAA.
- [ ] Would not exceed any obstruction standard of Part 77 and would not be a hazard to air navigation.
- [ ] Should be obstruction [ ] marked [ ] lighted per FAA Advisory Circular 70/7460-1, Chapter(s) _____
- [X] Obstruction marking and lighting are not necessary.
- [ ] Requires supplemental notice. Use FAA form enclosed.

B. FCC [X] was [ ] was not advised.

REMARKS

ISSUING OFFICE:
WESTERN-PACIFIC

REVIEWING OFFICER: LC Stanson — DATE: 4-22-83

**1. NATURE OF STRUCTURE**

| A. TYPE | B. CLASS | C. PROPOSED LENGTH OF TIME TO COMPLETE (Months) |
|---|---|---|
| [X] NEW CONSTRUCTION [ ] ALTERATION | [X] PERMANENT [ ] TEMPORARY | Six |

**2. NAME AND ADDRESS OF INDIVIDUAL, COMPANY, CORPORATION, ETC. PROPOSING THE CONSTRUCTION OR ALTERATION** (Number, Street, City, State and Zip Code)

TO
Millicom of Tucson, Inc.
1799 Swann ST., N.W.
Washington, D.C. 20009

**3. COMPLETE DESCRIPTION OF STRUCTURE** (Include effective radiated power of proposed or modified AM, FM or TV station and assigned frequency; size and configuration of power transmission line in vicinity of FAA facilities as appropriate.)

150-ft. free-standing tower. E.R.P.to be 100 watts or less at frequencies between 870-890 MHZ for Domestic Public Radio Telephone Service.

**4. LOCATION OF STRUCTURE**

| A. COORDINATES (To nearest second) LATITUDE | | | LONGITUDE | | | B. NEAREST CITY OR TOWN, AND STATE | | |
|---|---|---|---|---|---|---|---|---|
| 31 | 51 | 59 | 110 | 59 | 1 | Continental AZ | (1) DISTANCE FROM 4B: 1 MILES | (2) DIRECTION FROM 4B: SSE |

| C. NAME OF NEAREST AIRPORT, HELIPORT, OR SEAPLANE BASE | (1) DISTANCE FROM NEAREST POINT OF NEAREST RUNWAY | (2) DIRECTION FROM AIRPORT |
|---|---|---|
| Continental | 2 | N |

D. DESCRIPTION OF LOCATION OF SITE WITH RESPECT TO HIGHWAYS, STREETS, AIRPORTS, PROMINENT TERRAIN FEATURES, EXISTING STRUCTURES, ETC. (Attach a highway, street, or any other appropriate map or sketch locating and showing the relationship of construction site to nearest airport(s). If more space is required, continue on a separate sheet of paper and attach to this notice.)

See attached map

THIS DETERMINATION EXPIRES 13-6-83
UNLESS APPLICATION IS MADE TO THE FCC FOR A CONSTRUCTION PERMIT BEFORE THAT DATE. IF IT IS OTHERWISE EXTENDED, REVISED OR TERMINATED.
PLEASE ADVISE DATE OF [illegible]

**5. HEIGHT AND ELEVATION** (Complete A, B and C to the nearest foot)

| | | 6. WORK SCHEDULE DATES | |
|---|---|---|---|
| A. ELEVATION OF SITE ABOVE MEAN SEA LEVEL | 2845 ft | A. BEGINNING | Oct 83 |
| B. HEIGHT OF STRUCTURE INCLUDING APPURTENANCES AND LIGHTING (if any) ABOVE GROUND, OR WATER IF SO SITUATED | 160 ft | B. END | April 84 |
| C. OVERALL HEIGHT ABOVE MEAN SEA LEVEL (A + B) | 3005 ft | | |

**7. OBSTRUCTION MARKED AND OR LIGHTED IN ACCORDANCE WITH CURRENT FAA ADVISORY CIRCULAR 70/7460-1, OBSTRUCTION MARKING AND LIGHTING**

| | YES | NO |
|---|---|---|
| A. MARKED | | |
| B. AVIATION RED OBSTRUCTION LIGHTS | | |
| C. HIGH INTENSITY WHITE OBSTRUCTION LIGHTS | | |
| D. DUAL LIGHTING SYSTEM | | |

I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge.

| DATE | TEL. NO. (Give area code) | TYPED NAME, TITLE OF PERSON FILING NOTICE | SIGNATURE |
|---|---|---|---|
| 3/1/83 | (202) 483-7117 | Jorge F. Calderon | Jorge F. Calderon |

Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1101). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1472(a)).

FAA Form 7460-1 (4-79) USE PREVIOUS EDITION

DO NOT REMOVE CARBONS

DO NOT REMOVE CARBONS

Form Approved O M B No. 2120-0001

U S DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

# NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

**FOR FAA USE ONLY**

AERONAUTICAL STUDY NO.
83-AWP-321-OE

FAA will either return this form or issue a separate acknowledgement

A The proposed structure
- ☐ Does not require a notice to FAA.
- ☒ Would not exceed any obstruction standard of Part 77 and would not be a hazard to air navigation.
- ☐ Should be obstruction ☐ marked ☐ lighted per FAA Advisory Circular 70/7460-1, Chapter(s) _____
- ☒ Obstruction marking and lighting are not necessary.
- ☐ Supplemental notice required after FAA form enclosed.

B FCC ☒ will ☐ will not be required

REMARKS

1 NATURE OF STRUCTURE

| A TYPE | B CLASS | C PROPOSED LENGTH OF TIME TO COMPLETE (Months) |
|---|---|---|
| ☒ NEW CONSTRUCTION ☐ ALTERATION | ☒ PERMANENT ☐ TEMPORARY | 2 |

2 NAME AND ADDRESS OF INDIVIDUAL, COMPANY, CORPORATION, ETC. PROPOSING THE CONSTRUCTION OR ALTERATION (Number, Street, City, State and Zip Code)

TO CELLNET/OXNARD
14901 QUORUM DRIVE
SUITE 740
DALLAS, TEXAS 75240

3 COMPLETE DESCRIPTION OF STRUCTURE (Include antenna structure and supporting structure, if guyed indicate number of guy wires and their spacing. If AM, FM or TV antenna indicate frequency, size and configuration of array. If temporary, indicate date of dismantling. Describe accessory facilities such as buildings, roads, etc. to be constructed.)

245' AGL SELF SUPPORTING TOWER WITH 10' ANTENNA MOUNTED ON TOP

ISSUING OFFICE
WESTERN-PACIFIC
BY (Signature)
L.C. Haroon
DATE
4-22-83

4 LOCATION OF STRUCTURE

| A COORDINATES (To nearest second) LATITUDE | | | LONGITUDE | | | B NEAREST CITY OR TOWN AND STATE | | |
|---|---|---|---|---|---|---|---|---|
| 34 | 23 | 58 | 118 | 49 | 55 | FILLMORE, CA. | | |

| C DISTANCE FROM (B) | D DIRECTION FROM (B) |
|---|---|
| 3.0 MILES | 95° |

| E NAME OF NEAREST AIRPORT, HELIPORT OR SEAPLANE BASE | F DISTANCE FROM NEAREST POINT OF NEAREST RUNWAY | G DIRECTION FROM AIRPORT |
|---|---|---|
| ~~AGUA DULCE AIRPARK~~ | 161,198' | |

H DESCRIPTION OF LOCATION OF SITE WITH RESPECT TO HIGHWAYS, STREETS, AIRPORTS, PROMINENT TERRAIN FEATURES, EXISTING STRUCTURES, ETC. (Attach sketch, preferably on USGS quad map, or a scaled drawing showing the relationship of the proposed structure to the nearest airport(s). Additionally, for construction near highways, include distance to nearest highway and identify highway by name or number. If more space is needed, use an 8½ by 11 inch sheet of paper and attach to this notice.)

33 HOPPER CANYON ROAD

THIS DETERMINATION EXPIRES 12-1-83
UNLESS APPLICATION IS MADE TO THE FCC FOR A CONSTRUCTION PERMIT BEFORE THAT DATE, OR IT IS OTHERWISE EXTENDED, REVISED OR TERMINATED.

PLEASE ADVISE DATE OF APPLICATION TO FAA/WSC.

5 HEIGHT AND ELEVATION (Complete A, B, and C to the nearest foot)

| | | |
|---|---|---|
| A ELEVATION OF SITE ABOVE MEAN SEA LEVEL | 590 | A BEGINNING: UPON FCC APPROVAL |
| B HEIGHT OF STRUCTURE INCLUDING APPURTENANCES AND LIGHTING (if any) ABOVE GROUND, OR WATER IF SO SITUATED | 255 | B END |
| C OVERALL HEIGHT ABOVE MEAN SEA LEVEL (A + B) | 845 | |

7 OBSTRUCTION MARKED AND/OR LIGHTED IN ACCORDANCE WITH CURRENT FAA ADVISORY CIRCULAR 70/7460-1 OBSTRUCTION MARKING AND LIGHTING

| | YES | NO |
|---|---|---|
| A MARKED | X | |
| B AVIATION RED OBSTRUCTION LIGHTS | X | |
| C HIGH INTENSITY WHITE OBSTRUCTION LIGHTS | | X |
| D DUAL LIGHTING SYSTEM | | X |

I HEREBY CERTIFY that all of the above statements made by me are true, complete and correct to the best of my knowledge

| DATE | TEL. NO (Give area code) | TYPED NAME, TITLE OF PERSON FILING NOTICE | SIGNATURE |
|---|---|---|---|
| 3/4/83 | 214/458-9405 | Terry A. Patriquin<br>Technical Coordinator | Terry A. Patriquin |

*Notice is required by Part 77 of the Federal Aviation Regulations (14 C F R Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958 as amended (49 U S C 1101). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958 as amended (49 U S C 1472(a)).*

DO NOT REMOVE CARBONS

Form Approved O.M.B. No. 04-R0001

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

82-11-26

# NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

**FOR FAA USE ONLY**

AERONAUTICAL STUDY NO. 83-AWP-377-OE

FAA will either return this form or issue a separate acknowledgement.

A. The proposed structure:

☐ Does not require a notice to FAA.

☒ Would not exceed any obstruction standard of Part 77 and would not be a hazard to air navigation.

☒ Should be obstruction ☒ marked ☒ lighted per FAA Advisory Circular 70/7460-1, Chapter(s) 3-4-5

☐ Obstruction marking and lighting are not necessary.

☒ Requires supplemental notice. Use FAA form enclosed.

B. FCC ☒ was ☐ was not advised.

REMARKS:

ISSUING OFFICE: WESTERN-PACIFIC

REVIEWING OFFICER: L.C. Stanson

DATE: 4-27-83

1. NATURE OF STRUCTURE

A. TYPE: ☒ NEW CONSTRUCTION ☐ ALTERATION

B. CLASS: ☒ PERMANENT ☐ TEMPORARY

C. PROPOSED LENGTH OF TIME TO COMPLETE (Months)

2. NAME AND ADDRESS OF INDIVIDUAL, COMPANY, CORPORATION, ETC. PROPOSING THE CONSTRUCTION OR ALTERATION (Number, Street, City, State and Zip Code)

TO

MCI Airsignal, Inc.
2000 M Street, N.W.
Washington, DC 20036

3. COMPLETE DESCRIPTION OF STRUCTURE (Include effective radiated power of proposed or modified AM, FM or TV station and assigned frequency; size and configuration of power transmission line in vicinity of FAA facilities as appropriate).

12' Mobile Radio Antenna
280' Tower
292' Total

CELL: 3
MAX E.R.P.: 100 Watts

FREQUENCY: 870.03 - 879.99 MHz Group

4. LOCATION OF STRUCTURE

A. COORDINATES (To nearest second)

| LATITUDE ° | ' | " | LONGITUDE ° | ' | " |
|---|---|---|---|---|---|
| 32 | 02 | 45 | 110 | 51 | 26 |

B. NEAREST CITY OR TOWN, AND STATE: Littletown, AZ

(1) DISTANCE FROM 4B: 5.4 MILES

(2) DIRECTION FROM 4B: SSE

C. NAME OF NEAREST AIRPORT, HELIPORT, OR SEAPLANE BASE: Tucson International

(1) DISTANCE FROM NEAREST POINT OF NEAREST RUNWAY: 5.5 miles

(2) DIRECTION FROM AIRPORT: SSE

D. DESCRIPTION OF LOCATION OF SITE WITH RESPECT TO HIGHWAYS, STREETS, AIRPORTS, PROMINENT TERRAIN FEATURES, EXISTING STRUCTURES, ETC. (Attach a highway, street, or any other appropriate map or scaled drawing showing the relationship of construction site to nearest airport(s). If more space is required, continue on a separate sheet of paper and attach to this notice.)

4.2 miles S of Rt 10, 5.4 miles SSE of Littletown, AZ

THIS DETERMINATION EXPIRES 12-6-83 UNLESS APPLICATION IS MADE TO THE FCC FOR A CONSTRUCTION PERMIT BEFORE THAT DATE OR IS OTHERWISE EXTENDED, REVISED OR TERMINATED

PLEASE ADVISE DATE OF APPLICATION

5. HEIGHT AND ELEVATION (Complete A, B and C to the nearest foot)

| | |
|---|---|
| A. ELEVATION OF SITE ABOVE MEAN SEA LEVEL | 2840 |
| B. HEIGHT OF STRUCTURE INCLUDING APPURTENANCES AND LIGHTING (if any) ABOVE GROUND, OR WATER IF SO SITUATED | 292 |
| C. OVERALL HEIGHT ABOVE MEAN SEA LEVEL (A + B) | 3132 |

6. WORK SCHEDULE DATES

A. BEGINNING: After FCC Grant

B. END

7. OBSTRUCTION MARKED AND OR LIGHTED IN ACCORDANCE WITH CURRENT FAA ADVISORY CIRCULAR 70 7460-1, OBSTRUCTION MARKING AND LIGHTING

*If Required

| | YES | NO |
|---|---|---|
| A. MARKED | * | |
| B. AVIATION RED OBSTRUCTION LIGHTS | * | |
| C. HIGH INTENSITY WHITE OBSTRUCTION LIGHTS | * | |
| D. DUAL LIGHTING SYSTEM | * | |

I HEREBY CERTIFY that all of the above statements made by me are true, complete, and correct to the best of my knowledge.

| DATE | TEL. NO. (Give area code) | TYPED NAME, TITLE OF PERSON FILING NOTICE | SIGNATURE |
|---|---|---|---|
| 3/4/83 | (202)429-9660 | William Miller | [signature] |

Notice is required by Part 77 of the Federal Aviation Regulations (14 C.F.R. Part 77) pursuant to Section 1101 of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1101). Persons who knowingly and willfully violate the Notice requirements of Part 77 are subject to a fine (criminal penalty) of not more than $500 for the first offense and not more than $2,000 for subsequent offenses, pursuant to Section 902(a) of the Federal Aviation Act of 1958, as amended (49 U.S.C. 1472(a)).

FAA Form 7460-1 (4-79) USE PREVIOUS EDITION

DO NOT REMOVE CARBONS

US Department
of Transportation

**Federal Aviation Administration**

FAA, Western-Region
P.O. Box 92007
World Way Postal Center
Los Angeles, CA 90009
Attn: AWP-530

IN REPLY REFER TO
**AERONAUTICAL STUDY NO.** 83-AWP-394-OE

# ACKNOWLEDGMENT OF NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

| | | | |
|---|---|---|---|
| **SPONSOR** | Westel-Ventura Company<br>801 41st Street<br>Miami Beach, Florida 33140 | **CONSTRUCTION LOCATION**<br>PLACE NAME<br>Port Hueneme, CA | |
| | | LATITUDE<br>34°06'47" | LONGITUDE<br>119°03'34" |
| **CONSTRUCTION PROPOSED** | DESCRIPTION<br>3' antenna atop existing 60' tower | HEIGHT (IN FEET)<br>ABOVE GROUND<br>63' | ABOVE MSL<br>1343' |

The Federal Aviation Administration hereby acknowledges receipt of notice dated 3-5-83 concerning the proposed construction or alteration described above.

A study has been conducted under the provisions of Part 77 of the Federal Aviation Regulations to determine whether the proposed construction would be an obstruction to air navigation, whether it should be marked and lighted to enhance safety in air navigation, and whether supplemental notice of start and completion of construction is required to permit timely charting and notification to airmen. The findings of that study are as follows:

☒ The proposed construction would not exceed FAA obstruction standards and would not be a hazard to air navigation. However, the following applies to the construction proposed.

- ☐ The structure should be obstruction marked and lighted per FAA Advisory Circular AC 70/7460-1, "Obstruction Marking and Lighting."
- ☐ Supplemental notice is required at least 48 hours before the start of construction (use the enclosed FAA form).
- ☒ Supplemental notice is required within five days after construction reaches its greatest height (use the enclosed FAA form).

☐ The proposed construction would exceed FAA obstruction standards and further aeronautical study is necessary to determine whether it would be a hazard to air navigation. Pending completion of any further study, it is presumed the construction would be a hazard to air navigation. Further study:

- ☐ Has been initiated by the FAA.
- ☐ May be requested by the sponsor within 30 days of date of this acknowledgement.

☐ If the proposed structure were reduced in height to not exceed ft. above ground level ( ft. above sea level), it would not exeed Part 77 obstruction standards.

If the structure is subject to the licensing authority of the Federal Communications Commission, a copy of this acknowledgment will be sent to that Agency.

**Notice is required anytime the project is abandoned or the proposal is modified.** (Use the enclosed FAA form).

This determination expires 12/7/83 unless application is made to the FCC for a construction permit before that date, or it is otherwise extended, revised or terminated.

SIGNED Lynore Stanson TITLE Air Traffic Technical Specialist

ISSUED IN Hawthorne, CA I-5 ON April 28, 1983

FAA FORM 7460-7 (4-82)

U.S. GOVERNMENT PRINTING OFFICE 1982—801 314

US Department of Transportation

**Federal Aviation Administration**

FAA, Western Region
P.O. Box 92007
World Way Postal Center
Los Angeles, CA 90009
Attn: AWP-530

IN REPLY REFER TO
**AERONAUTICAL STUDY NO.** 83-AWP-375-OE

# ACKNOWLEDGMENT OF NOTICE OF PROPOSED CONSTRUCTION OR ALTERATION

| | | | |
|---|---|---|---|
| **SPONSOR** | Motorola, Inc.<br>99-1180 Iwaena Street<br>Aiea, Hawaii 96701 | **CONSTRUCTION LOCATION**<br>PLACE NAME<br>Honolulu, Hawaii | |
| | | LATITUDE<br>21°30'20" | LONGITUDE<br>158°01'38" |
| **CONSTRUCTION PROPOSED** | DESCRIPTION<br>60' self supporting radio tower and 2 - 6' side mounted dishes | HEIGHT (IN FEET)<br>ABOVE GROUND<br>60' | ABOVE MSL<br>1002' |

The Federal Aviation Administration hereby acknowledges receipt of notice dated 3/10/83 concerning the proposed construction or alteration described above.

A study has been conducted under the provisions of Part 77 of the Federal Aviation Regulations to determine whether the proposed construction would be an obstruction to air navigation, whether it should be marked and lighted to enhance safety in air navigation, and whether supplemental notice of start and completion of construction is required to permit timely charting and notification to airmen. The findings of that study are as follows:

☒ The proposed construction would ~~not~~ exceed FAA obstruction standards and would not be a hazard to air navigation. However, the following applies to the construction proposed.

- ☒ The structure should be obstruction marked and lighted per FAA Advisory Circular AC 70/7460-1, "Obstruction Marking and Lighting." Chapter 3-4-5 & 9
- ☒ Supplemental notice is required at least 48 hours before the start of construction (use the enclosed FAA form).
- ☒ Supplemental notice is required within five days after construction reaches its greatest height (use the enclosed FAA form).

☐ The proposed construction would exceed FAA obstruction standards and further aeronautical study is necessary to determine whether it would be a hazard to air navigation. Pending completion of any further study, it is presumed the construction would be a hazard to air navigation. Further study:

- ☐ Has been initiated by the FAA
- ☐ May be requested by the sponsor within 30 days of date of this acknowledgement.

☐ If the proposed structure were reduced in height to not exceed ____ ft. above ground level (____ ft. above sea level), it would not exeed Part 77 obstruction standards.

If the structure is subject to the licensing authority of the Federal Communications Commission, a copy of this acknowledgment will be sent to that Agency.

**Notice is required anytime the project is abandoned or the proposal is modified.** (Use the enclosed FAA form).
This determination expires 12/7/83 unless application is made to the FCC for a construction permit before that date, or it is otherwise extended, revised or terminated.

SIGNED Lynore C. Stanson TITLE Air Traffic Technical Specialist

ISSUED IN Hawthorne, CA I-6 ON April 28, 1983

FAA FORM 7460-7 (4-82) U.S. GOVERNMENT PRINTING OFFICE 1982--601 314

**DEPARTMENT OF TRANSPORTATION**
**FEDERAL AVIATION ADMINISTRATION**

Western-Pacific Region - AWP-530
P.O. Box 92007
Worldway Postal Center
Los Angeles, CA 90009

IN REPLY REFER TO
AERONAUTICAL STUDY
NO. 81-AWP-818-OE

## DETERMINATION OF NO HAZARD TO AIR NAVIGATION

| | | |
|---|---|---|
| SPONSOR | Douglas Development Company<br>c/o Aviation Systems Associates, Inc.<br>1650 South Pacific Coast Highway, #311<br>Redondo Beach, California 90277 | CONSTRUCTION LOCATION<br>PLACE NAME<br>Irvine, California<br>LATITUDE: 33°40'16" / LONGITUDE: 117°51'25" |
| CONSTRUCTION PROPOSED | DESCRIPTION: Commercial office building | HEIGHT (IN FEET)<br>ABOVE GROUND: 200' / ABOVE MSL: 244' |

An aeronautical study of the proposed construction described above has been completed under the provisions of Part 77 of the Federal Aviation Regulations. Based on the study it is found that the construction would have no substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the construction would not be a hazard to air navigation provided the following conditions are met:

Conditions:

The structure should be obstruction lighted in accordance with FAA Advisory Circular AC 70/7460-1, Chapter 5.

Supplemental notice of construction is required any time the project is abandoned (use the enclosed FAA form), or

( X ) At least 48 hours before the start of construction (use the enclosed FAA form).
( X ) Within five days after the construction reaches its greatest height (use the enclosed FAA form).
( ) Not required.

This determination expires on November 30, 1983 unless:
(a) extended, revised or terminated by the issuing office;
(b) the construction is subject to the licensing authority of the Federal Communications Commission and an application for a construction permit is made to the FCC on or before the above expiration date. In such case the determination expires on the date prescribed by the FCC for completion of construction, or on the date the FCC denies the application.

This determination is subject to review if an interested party files a petition on or before May 21, 1982. In the event a petition for review is filed, it should be submitted in triplicate to the Chief, Airspace Obstruction and Airports Branch, AT-240, Federal Aviation Administration, Washington, D.C. 20590, and contain a full statement of the basis upon which it is made.

This determination becomes final on May 31, 1982 unless a petition for review is timely filed, in which case the determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review.

An account of the study findings, aeronautical objections, if any, registered with the FAA during the study, and the basis for the FAA's decision in this matter will be found on the following page(s).

If the structure is subject to the licensing authority of the FCC, a copy of this determination will be sent to that Agency.

SIGNATURE: Jerry D. Luce
Jerry D. Luce
TITLE: Chief, Airspace and Procedures Branch
Air Traffic Division

ISSUED IN: Hawthorne, California
ON: April 20, 1982

FAA Form 7460-9 (4-71) C FAA I-7 6

Background

The proposed building located approximately 3,150 feet east of the airport reference point of Orange County-John Wayne Airport exceeds Federal Aviation Regulations Part 77.23(a)(5) - Horizontal Surface as outlined in 77.25(a)(2) - by 40 feet.

The building was first proposed in 1981 at a height of 237 feet (281 feet above Mean Sea Level). A determination was made that at that height the building would be a hazard to air navigation because of intrusion into a rotary-wing aircraft flyway, and possible interference with the VFR traffic pattern for Runway 1R/19L. The FAA's primary concern was that helicopters transitting the John Wayne Airport traffic area in an east-west direction would have less than 300 feet of vertical separation from the building when maintaining 500 feet AGL (300 feet below the VFR traffic pattern).

When notified of the hazard determination, the proponent submitted a new proposal for a building to be 200 feet (244 feet AMSL). At the new height, helicopters traversing the area at 500 feet AGL would have 300 feet vertical separation from both the building and the VFR traffic pattern. The thirty-seven foot reduction in height has the additional effect of moving the building 1480 feet farther from the runway based on a standard 40:1 slope for departures.

Study

The new proposal was circulated by the FAA to all parties of known or potential interest in this project, and comments were invited to be received by March 31, 1982. A synopsis of the comments are as follows:

a. Murry L. Cable, Airport Manager, John Wayne Airport, objected to the proposal for two reasons. He was concerned because this building, if constructed, would be the first to violate the Irvine Company Avigation Easement of March 17, 1964 and that others might follow to hamper the utilization of the airport. His second concern was that the building might alter routes used by helicopters arriving and departing John Wayne Airport which could create noise and/or safety problems.

b. Alfred W. Brady, Secretary/Planner of the Airport Land Use Commission for Orange County, objected to the proposed building. Like Mr. Cable, he expressed concern over encroachment by this and possibly other buildings in the future upon the airspace around John Wayne Airport. He referred to Sections 21674, 21675, and 21661.5 of the California Public Utilities Code as well as the Irvine Company Avigation Easement of March 17, 1964, and the responsibility each places upon the commission. He asked, in his letter to the original proposal, a copy of which was attached to this reply, that we "consider the question of public safety" without offering any specific instances of hazards or the remedies.

The FAA has reviewed the study and considered all comments. We have conducted interviews and made personal observation of the air traffic in the vicinity of John Wayne Airport.

Conclusion

The proposed construction will have no substantial adverse effect on air navigation and is determined to be no hazard, conditional upon proper obstruction lighting.

There will be no effect to Instrument Flight Rules (IFR) arrival or departure procedures. There will be 600 feet of vertical separation between the building and the runway 1R/19L downwind leg traffic, and 300 feet between the building and helicopters overflying the airport.

There will be no substantial adverse effect on helicopters arriving and departing John Wayne Airport from and to the east as their normal flight path is presently north of the proposed building.

The proposed structure would have no effect on proposed future development of the airport or established navigational aids.

We have no comments regarding the Irvine Company Avigation Easement of March 17, 1964 or Sections of the California Public Utility Code as they do not apply to our regulations or our determination.

This determination, issued in accordance with FAR Part 77, concerns the effect of this proposal on the safe and efficient use of navigable airspace by aircraft and does not relieve the sponsor of any compliance responsiblities relating to any law, ordinance, or regulation of any federal, state or local governmental body.

This detemination does not include temporary construction equipment such as cranes, derricks, etc., which may be used during the actual construction phase of this proposal. Such equipment which has a height greater than the proposed structure and a height which would exceed the notice standards of part 77 of the Federal Aviation Regulations require separate notice. If prior notice for temporary construction equipment is required, please complete and return FAA Form 7460-1.

Any request for extension of the effective period of the determination should be submitted not less than 15 days prior to the expiration date.

**DEPARTMENT OF TRANSPORTATION**
**FEDERAL AVIATION ADMINISTRATION**

IN REPLY REFER TO
AERONAUTICAL STUDY
No83-AWP-58-OE

FAA, Western Region
P.O. Box 92007
World Way Postal Center
Los Angeles, CA 90009, ATTN: AWP-530

## AERONAUTICAL STUDY OF PROPOSED CONSTRUCTION OR ALTERATION

| | | | |
|---|---|---|---|
| SPONSOR | Center Town Office Building<br>c/o Aviation Systems Assoc., Inc.<br>1650 So. Pacific Coast Hwy, Suite 311<br>Redondo Beach, CA 90277 | CONSTRUCTION LOCATION<br>PLACE NAME<br>Costa Mesa, CA | |
| | | LATITUDE<br>33°41'34" | LONGITUDE<br>117°52'54" |
| CONSTRUCTION PROPOSED | DESCRIPTION<br>20 story office building | HEIGHT (IN FEET)<br>ABOVE GROUND<br>292' | ABOVE MSL<br>325' |

A notice has been filed with the Federal Aviation Administration that the above described structure is proposed for construction. As proposed the structure would exceed the standards of Subpart C of Part 77 of the Federal Aviation Regulations and would be identified as an obstruction to air navigation. Accordingly, the FAA is conducting an aeronautical study of the proposal to determine its effect upon the safe and efficient use of the navigable airspace by aircraft and on the operation of air navigation facilities.

In the study, consideration will be given to all facts relevant to the effect of the proposal on existing and planned airspace use; air navigation facilities; airports; aircraft operations, procedures and minimum flight altitudes; and the air traffic control system. However, only those plans on file with the FAA, on the date the notice concerning the above described proposed construction was received, will be considered.

Interested persons are invited to participate in the aeronautical study by submitting comments to the FAA office issuing this notice. To be eligible for consideration, comments must be relevant to the effect the proposed construction would have on aviation, provide sufficient detail to permit a clear understanding, and be received on or before May 27, 1983. Please refer to the aeronautical study number printed in the upper right hand corner of this notice.

This notice may be reproduced and recirculated by any interested person.

The proposed building is located approximately one mile northwest of John Wayne - Orange Co. Airport, Santa Ana, Calif. The structure was originally studied as 81-AWE-769-OE at 232' AGL/265' AMSL. The sponsor has now proposed to revise the structure to 292' AGL/325' AMSL. At this height, it exceeds Part 77 as follows:

77.23(a)(2), by 71' - A height greater than 200' above airport elevation (54') within 3 nautical miles of the airport reference point.

77.23(a)(3), by 25' - a height that increases a minimum instrument flight altitude within a terminal area as follows:

Category A,B & C aircraft circling procedures would be raised from 600' to 640' and Category D aircraft circling procedures would be raised from 620' to 640' for the following instrument approach procedures:

SIGNED Jerry D. Luce TITLE Manager, Airspace and Procedures Branch

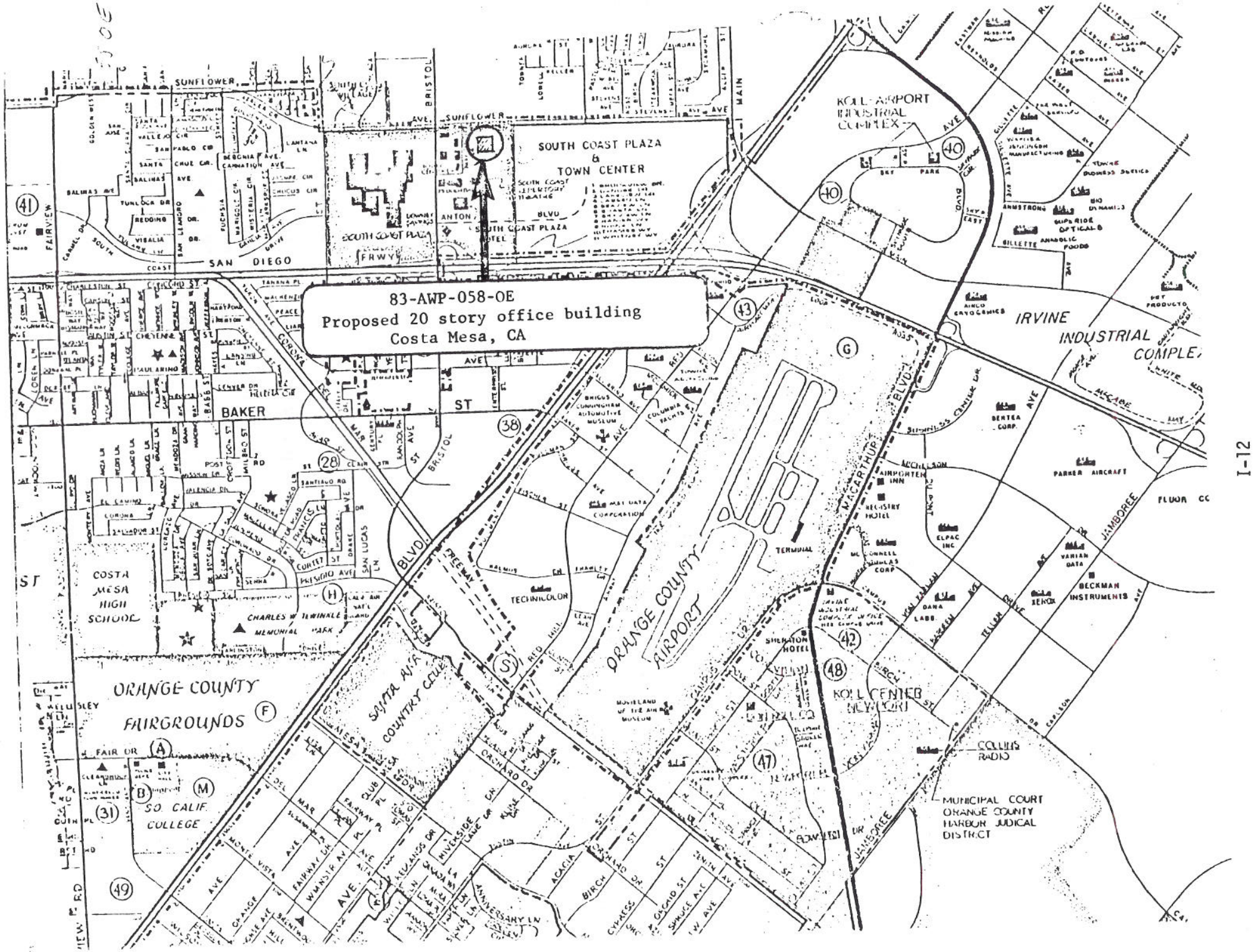
ISSUED IN Hawthorne, CA ON APR 2 0 1983

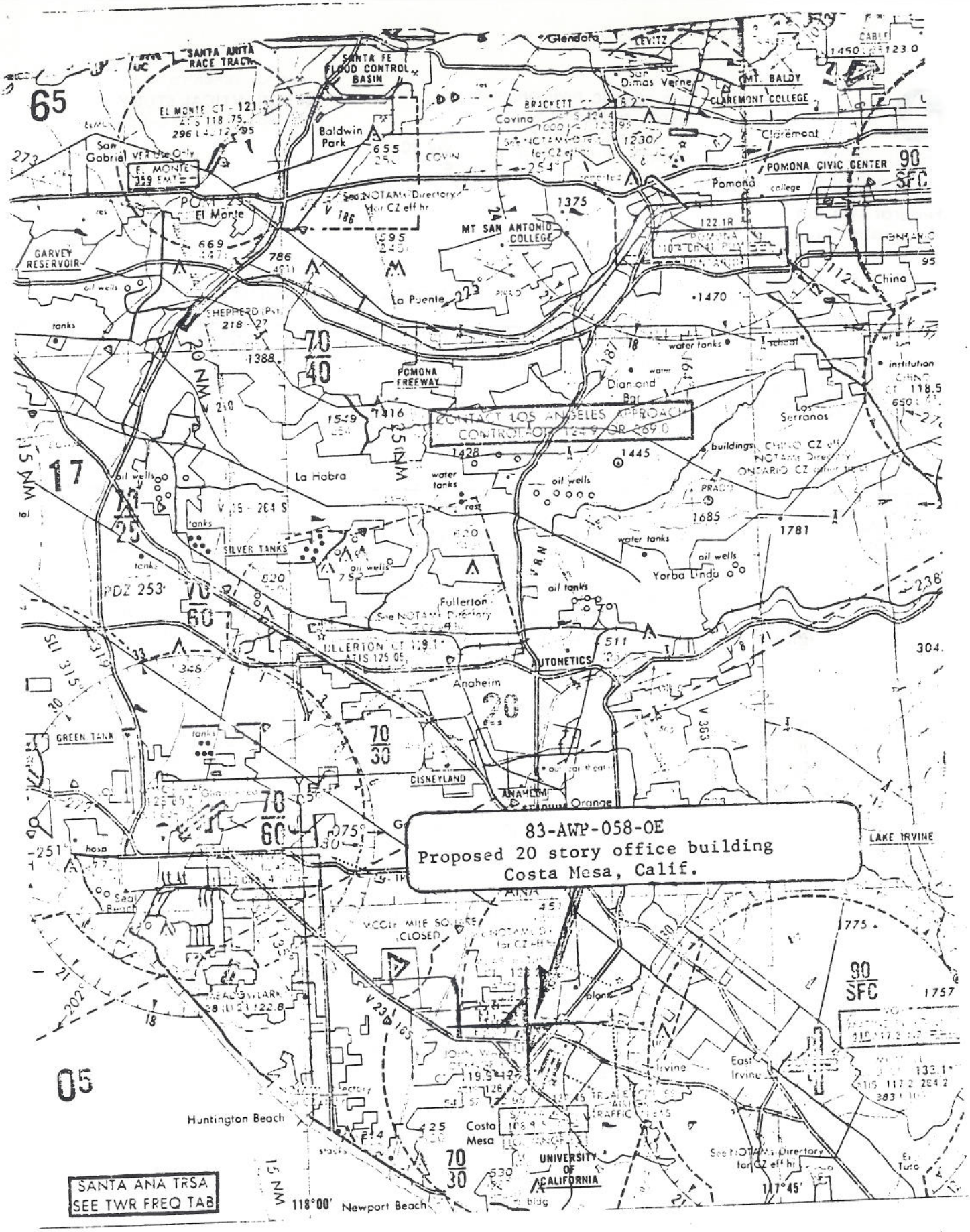
FAA Form 7460-8 (4-71) **AIRPORT MANAGERS - PLEASE POST** GPO 910-227
FAA AC 72-7130

LOC/DME or LOC/VOR Runway 19R
LOC BC Runway 1L
VOR Runway 1L
VOR Runway 19R ( Leota Fix)

77.23(a)(5) by 121' - the horizontal surface of 77.25(a)(2) for John Wayne Airport.

See enclosed charts.


83-AWP-058-OE
Proposed 20 story office building
Costa Mesa, CA
SUNFLOWER
SOUTH COAST PLAZA
& TOWN CENTER
KOLL AIRPORT INDUSTRIAL COMPLEX
IRVINE INDUSTRIAL COMPLEX
SAN DIEGO FRWY
BAKER ST
COSTA MESA HIGH SCHOOL
ORANGE COUNTY FAIRGROUNDS
SANTA ANA COUNTRY CLUB
ORANGE COUNTY AIRPORT
MACARTHUR BLVD
JAMBOREE
TECHNICOLOR
SHERATON HOTEL
KOLL CENTER NEWPORT
COLLINS RADIO
MUNICIPAL COURT ORANGE COUNTY HARBOR JUDICAL DISTRICT
SO CALIF. COLLEGE
I-12




83-AWP-058-OE
Proposed 20 story office building
Costa Mesa, Calif.

U.S. Department of Transportation

**Federal Aviation Administration**

AIR TRAFFIC DIVISION, FAA
15000 Aviation Blvd.
Hawthorne, Ca. 90260
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IN REPLY REFER TO
AERONAUTICAL STUDY
NO. 81-AWE-776-OE

# DETERMINATION OF HAZARD TO AIR NAVIGATION

| | | | |
|---|---|---|---|
| SPONSOR | Fred J. Wild OBO Asian Holdings, Inc.<br>8701 Delgany Avenue<br>Playa Del Rey, California 90291 | CONSTRUCTION LOCATION<br>PLACE NAME<br>Oakland, California<br>LATITUDE: 37°48'04"<br>LONGITUDE: 122°16'17" | |
| CONSTRUCTION PROPOSED | DESCRIPTION: Sixty-eight story office building | HEIGHT (IN FEET)<br>ABOVE GROUND: 1,100'<br>ABOVE MSL: 1,138' | |

An aeronautical study of the proposed construction described above has been completed under the provisions of Part 77 of the Federal Aviation Regulations. Based on the study it is found that the construction would have a substantial adverse effect on the safe and efficient utilization of the navigable airspace by aircraft or on the operation of air navigation facilities. Therefore, pursuant to the authority delegated to me, it is hereby determined that the construction would be a hazard to air navigation.

This determination is subject to review if a petition is filed by the sponsor on or before August 1, 1982. In the event a petition for review is filed it should be submitted in triplicate to the Chief, Airspace Regulations/Obstructions Branch, AAT-230, Federal Aviation Administration, Washington, D.C. 20591, and contain a full statement of the basis upon which it is made.

This determination becomes final on August 11, 1982 unless a petition for review is timely filed, in which case the determination will not become final pending disposition of the petition. Interested parties will be notified of the grant of any review.

An account of the study findings, aeronautical objections, if any, registered with the FAA during the study, and the basis for the FAA's decision in this matter will be found below and/or on the following page(s).

If the structure is subject to the licensing authority of the FCC, a copy of this determination will be sent to that Agency.

This determination, issued in accordance with FAR Part 77, concerns the effect of this proposal on the safe and efficient use of the navigable airspace by aircraft and does not relieve the sponsor of any compliance responsibilities relating to any law, ordinance, or regulation of any Federal, State, or local government body.

SIGNED Jerry D. Luce TITLE Chief, Airspace and Procedures Branch

JERRY D. LUCE

ISSUED IN Hawthorne, California I-14 ON July 2, 1982

Background

On November 5, 1981, a Notice of Proposed Construction or Alteration, FAA Form 7460-1, was filed by Fred J. Wild as agent for Asian Holdings, Inc. for a sixty-eight story, 1,100 foot AGL office building in Oakland, California. The proposed site is bounded by Broadway, Eleventh Street, Webster Street, and Ninth Street, and is 9,600 feet east of the end of Runway 25 at Naval Air Station (NAS) Alameda and approximately 32,650 feet from the Airport Reference Point (ARP) of Metropolitan Oakland International Airport.

Study

The initial study conducted by the FAA determined that the proposed building exceeds the standards of Federal Aviation Regulations (FAR) Part 77 as follows:

Paragraph 77.23(a)(1) - a height of 500 feet above ground level at the site of the object - by 600 feet.

Paragraph 77.23(a)(2) - a height that is 200 feet above ground level... within 3 nautical miles of the established reference point of an airport... - by 900 feet with respect to NAS Alameda.

Paragraph 77.23(a)(3) - a height within a terminal obstacle clearance area which would result in a vertical distance...less than the required obstacle clearance - by 444 feet.

Paragraph 77.23(a)(5) - the surface of...any imaginary surface established under Paragraph 77.25 or 77.28 - by 841 feet, as applied in paragraph 77.28(a)(2) to the conical surface for NAS Alameda.

With regards to instrument flight procedures as governed by United States Standard for Terminal Instrument Procedures (TERPS), the proposed structure would have the following effects:

The slope for the precision radar approach to Runway 25 at NAS Alameda would be raised from 3.5° to 6.87°. The circling approach minimum descent altitude would be raised from 700 feet for category C and 820 feet for categories D and E aircraft to 1440 feet.

The Standard Instrument Approach Procedures for Metropolitan Oakland International Airport would need revision either by raising approach minimum descent altitudes and visibilities, or by revising missed approach procedures.

Finally, consideration would have to be given to the possible interference to radar and navigational signals by the proposed structure.

The sponsor for the proponent was notified of the above findings by an Acknowledgement of Notice of Proposed Construction or Alteration, dated March 16, 1982. The preliminary finding of the FAA was that further aeronautical study would be necessary to determine whether the building, as proposed, would be a hazard to air navigation. The sponsor requested that additional study be conducted.

An Aeronautical Study of Proposed Construction or Alteration was initiated on April 1, 1982. Copies were sent to all persons of known or potential interest in the proposed building. Comments were invited to be received by the FAA on or before May 14, 1982, in order to be considered in the final determination. A synopsis of the comments follows:

Mr. George H. Carver, Associate Director, Air Transport Association of America, requested that an in-depth analysis be made of the possible electromagnetic interference to the Oakland VOR and ASR which could be caused by the proposed building. His concern was that there could be a substantial derogation of navigation and radar signal which would adversely affect air navigation.

Mr. Phillip L. Brown, Chief Pilot, Bridgeford Flying Service, stated his opinion that the proximity of the proposed building to the VFR downwind leg to Runway 27R at Oakland Airport, and to the straight-in radar approach to NAS Alameda, would constitute a hazard. He also expressed concern over the possible alteration of the missed approach procedures at Oakland and the resultant increases in climb gradient if moved clockwise, or crossing of the Runway 29 departure route if moved counter-clockwise. An increase in climb rate would require increased power settings which would result in greater noise pollution.

Mr. Chris Brittle, Metropolitan Transportation Commission, Regional Airport Planning Committee, Association of Bay Area Governments, brought to the FAA's attention that radar departure procedures at Metropolitan Oakland Airport would be seriously affected. The normally used outbound radial is 313°, which passes in close proximity to the proposed building. He went on to say, "Should it no longer be possible to conduct simultaneous instruments from the North and South Fields, there would be a tremendous adverse effect on the capacity of the Oakland International Airport."

Mr. Elmer E. McTaggart, Field Representative, State of California Department of Transportation, objected to the erection of the proposed structure based upon the penetrations of the Metropolitan Oakland Airport missed approach airspace, and its potential impact on the IFR flight operations at the airport.

N. D. Campbell, Captain, U.S.N., Commanding Officer, NAS Alameda, had commented during the initial study phase that the Navy would consider the proposed building a hazard based on the need to raise the precision approach radar glidepath for Runway 25 from 3.5° to more than 6°, and on the increase in circling approach minimums for category C, D, and E aircraft.

A resume of the above comments was sent to the sponsor for review prior to a meeting held May 26, 1982, with the proponent, the sponsor, representatives from NAS Alameda, the FAA, and others. The purpose of the meeting was for NAS Alameda and the proponent to present arguments for their respective case and to attempt to resolve any conflict. Both the Navy and the operators of Metropolitan Oakland Airport feel that any structure which would have an adverse impact on air navigation at either airport would be a hazard to air navigation. The sponsor, on the other hand, offered mitigating arguments and possible solutions to the problems outlined above. The proponent did not offer to revise the size or shape of the proposed building.

CONCLUSION

For over seven months, the FAA has been studying the possible impact the proposed 1,100 foot AGL building would have on air traffic and air navigation in its vicinity. The study has included aeronautical safety and operations, and electromagnetic inteference to navaids. The results of the study follow:

The building would have a substantial adverse effect on the operation of NAS Alameda. By applying the standards of TERPS to the obstruction, the glide path of the precision approach radar for Runway 25 would be raised from 3.5° to 6.87°. The descent rate for turbojet fighter aircraft would increase to approximately 2,000 feet per minute within 2,000 feet of the ground and two miles of the runway. This is considered a hazardous maneuver and would not be allowed by the Navy, thereby prohibiting the use of one of two runways during reduced ceilings and visibility which occur about 15% of the time. The sponsor has suggested that a waiver to the TERPS requirements be requested by the Navy; however, there is no assurance that one could or would be granted. Because Alameda is only one of two deep-water ports on the Pacific Coast of the United States capable of berthing aircraft carriers, it is vitally important in the interest of national defense and security that nothing is allowed to interfere with the operation of the air station.

The building would have a substantial adverse effect on the operation of Metropolitan Oakland International Airport. The airport is operated as though it were two separate airports. The South Field is Runway 11/29 which has a precision instrument landing system (ILS) and is controlled by the South Tower. The North Field consists of Runway 9L/27R with an ILS, Runway 9R/27L served by a VOR approach, and Runway 15/33 classed as a visual runway only. Prior to August 3, 1981, the North Field was controlled by the North Tower, now combined temporarily with the South Tower. The South Field is used primarily by transport type turbojet aircraft (air carrier operations), while the North Field is mainly for general aviation use including light single-engine through corporate/business turbojet aircraft.

The FAA, with the concurrence of the airport operator and NAS Alameda, has designed flight procedures which allow for the simultaneous use of the North and South Fields without interference or restriction. The proposed building would cause the instrument departure and missed approach procedure for the North Field to be altered to avoid the building. As in the case of the approach to NAS Alameda, the sponsor has suggested that the FAA use its waiver authority to mandate an increased angle of climb, in this instance, for instrument departures and missed approaches. The angles proposed by the sponsor would require a climb gradient of at least 220 feet per nautical mile for the missed approach and 280 feet per nautical mile for departures. Again, there is no assurance that such a waiver would be granted if the building were built. Secondly, there are many training type aircraft based at Oakland which could not meet these climb requirements and for which alternative procedures would have to be designed. The alternatives are either to raise the approach and instrument departure weather minimums or to relocate the routes flown

in a southwesterly direction. Either alternative would significantly reduce airport utility - the first by reducing the number of hours during which instrument flight operations could be conducted (by an estimated 5 to 8%); the second by preventing simultaneous instrument operations to and from the North and South Fields.

Finally, an increase in climb angle would require an increased power setting and a resultant increase in fuel consumption by the aircraft. All the above possibilities have the same effect - an increase in operating expense and a decrease in utility for the operators of both the airport and aircraft.

The FAA's study using a computer model showed the impact on the Oakland radar and navaids to be minimal. While the actual effect would not be known precisely until the building is built, it is believed that there would be no adverse effect.

The final area studied was the effect the proposed building would have on VFR flight. Generally speaking, a structure of less than 500 feet AGL would not be considered as having an adverse effect on enroute aircraft; nor would a building of 1,000 feet or less if properly and conspicuously lighted. A building of over 1,000 feet is considered an adverse effect; the degree, however, is left to the study. In the case of this building, it is the opinion of the FAA that it would have a substantial adverse effect on VFR air navigation for the following reasons. Being less than one mile from a prominent visual flyway (the Nimitz Freeway, State Route 17), a pilot following the route during periods of reduced ceiling and visibility might not be afforded enough time to see, identify, and avoid the building. During VFR conditions, aircraft arriving NAS Alameda would pass abeam the building about one-half mile laterally and would be only 300 - 500 feet above it.

Based upon the preceding conclusions, the FAA has determined that the proposed 1,100 foot building would constitute a hazard to air navigation.

## APPENDIX J

## SELECTED SECTIONS OF AERONAUTICS LAW

Public Utilities Code

These sections reflect the provisions of the Public Utilities Code related to land use around airports, as amended by Chapter 681, Statutes of 1982.

### §21655. Notification to, and investigation by department before acquiring site for state building, etc.: Nonexpenditure of funds after unfavorable department report

Notwithstanding any other provision of law, if the proposed site of any state building or other enclosure is within two miles, measured by air line, of that point on an airport boundary which is nearest the site, the state agency or office which proposes to construct the building or other enclosure shall, before acquiring title to property for the new state building or other enclosure site or for an addition to a present site, notify the Department of Transportation, in writing, of the proposed acquisition. The department shall investigate the proposed site and, within 25 days after receipt of the notice, shall submit to the state agency or office which proposes to construct the building or other enclosure a written report of the investigation and its recommendations concerning acquisition of the site.

If the report of the department does not favor acquisition of the site, no state funds shall be expended for the acquisition of the new state building or other enclosure site, or the expansion of the present site, or for the construction of the state building or other enclosure, provided that the provisions of this section shall not affect title to real property once it is acquired.

### §21656. Permit for structures having height in excess of prescribed maximum: Exception where approval by federal agency required

No person shall erect or add to the height of any structure within the boundaries of this state which will result in a structure that extends more than 500 feet above the ground on which such structure rests until a permit therefor has been issued for such purpose by the department. This section is not applicable to the construction of any structure if the Federal Communications Commission is required to approve the height of the structure or if the height of the structure is required to be approved under the Federal Aviation Act of 1958 (Public Law 85-726;72 Stat 731).

### §21658. Prohibition against public utility construction constituting obstruction to air navigation.

No public utility shall construct any pole, pole line, distribution or transmission tower, or tower line, or substation structure in the vicinity of the exterior boundary of an aircraft landing area of any

airport open to public use, in a location with respect to the airport and at a height so as to constitute an obstruction to air navigation, as an obstruction is defined in accordance with Part 77 of the Federal Aviation Regulations, Federal Aviation Administration, or any corresponding rules or regulations of the Federal Aviation Administration, unless the Federal Aviation Administration has determined that the pole, line, tower, or structure does not constitute a hazard to air navigation. This section shall not apply to existing poles, lines, towers, or structures or to the repair, replacement, or reconstruction thereof if the original height is not materially exceeded and this section shall not apply unless just compensation shall have first been paid to the public utility by the owner of any airport for any property or property rights which would be taken or damaged hereby.

**§21659. Permit for structure or growth constituting hazard to air navigation under federal regulation: Exceptions**

(a) No person shall construct any structure or permit any natural growth to grow at a height so as to constitute a hazard to air navigation, as a hazard to air navigation is defined in accordance with the regulations of the Federal Aviation Administration relating to objects affecting navigable airspace contained in Title 14 of the Code of Federal Regulations, Part 77, unless a permit allowing the construction or growth is issued by the department.

(b) The permit shall not be required if the Federal Aviation Administration has determined that the construction or growth does not constitute a hazard to air navigation or would not create an unsafe condition for air navigation. Subdivision (a) does not apply to a pole, pole line, distribution or transmission tower, or tower line or substation of a public utility.

(c) Section 21658 is applicable to subdivision (b).

**§21661.5. Approval of plan**

No political subdivision, any of its officers or employees, or any person may submit any application for the construction of a new airport to any local, regional, state, or federal agency unless the plan for such construction is first approved by the board of supervisors of the county, or the city council of the city, in which the airport is to be located and unless the plan is submitted to the appropriate commission exercising powers pursuant to Article 3.5 (commencing with Section 21670) of Chapter 4 of Part 1 of Division 9, and acted upon by such commission in accordance with the provisions of such article.

**§21661.6. Submission and approval of plan for expanding publicly owned airport: Conformity to approved plan, and approval of variance.**

(a) Prior to the acquisition of land by any political subdivision for the purpose of expanding or enlarging an existing publicly owned airport, the acquiring entity shall submit a plan of such expansion or enlargement to the board of supervisors of the county, or the city council of the city, in which the property proposed to be acquired is located.

(b) The plan shall show in detail the airport-related uses and other uses proposed for the property to be acquired.

(c) The board of supervisors or the city council, as the case may be, shall, upon notice, conduct a public hearing on such plan, and shall thereafter approve or disapprove the plan.

(d) Upon approval of the plan, the proposed acquisition of property may begin.

(e) The use of property so acquired shall thereafter conform to the approved plan, and any variance from such plan, or changes proposed therein, shall first be approved by the appropriate board of supervisors or city council after a public hearing on the subject of the variance or plan change.

(f) The requirements of this section are in addition to any other requirements of law relating to construction or expansion of airports.

**§21662. Approval of airport sites and issuance of airport permits**

The department shall have the authority to issue airport site approval permits, amended airport site approval permits, airport permits, and amended airport permits. No charge shall be made for the issuance of any permit.

Education Code

These sections reflect the provisions of the Education Code related to proposed school sites near airports, as amended by Chapter 681, Statutes of 1982.

**§39005. Investigation of site near airport**

To promote the safety of pupils, comprehensive community planning, and greater educational usefulness of school sites, the governing board of each school district, including districts governed by a city board of education if the proposed site is within two miles, measured by air line, of that point on an airport boundary which is nearest the site and excluding them if the property is not so located, before acquiring title to property for a new school site or for an addition to a present site, shall give the Department of Education notice in writing of the proposed acquisition and shall submit any information required by the Department of Education.

Immediately after receiving notice of the proposed acquisition of property which is within two miles, measured by air line, of that point on an airport boundary which is nearest the site, the Department of Education shall notify the Department of Transportation, in writing, of the proposed acquisition. The Department of Transportation shall make an investigation and report to the Department of Education within 25 days after receipt of the notice. If the Department of Transportation is no longer in operation, the Department of Education shall, in lieu of

notifying the Department of Transportation, notify the Civil Aeronautics Board or any other appropriate agency, in writing, of the proposed acquisition for the purpose of obtaining from the board or other agency any information or assistance that it may desire to give.

The Department of Education shall investigate the proposed site and, within 30 days after receipt of the notice, shall submit to the governing board a written report and its recommendations concerning acquisition of the site. The governing board shall not acquire title to the property until the report of the Department of Education has been received. If the report does not favor the acquisition of the property for a school site or an addition to a present school site, the governing board shall not acquire title to the property until 30 days after the department's report is received and until the department's report has been read at a public hearing duly called after 10 days' notice published once in a newspaper of general circulation within the school district or, if there is no such newspaper, in a newspaper of general circulation within the county in which the property is located.

**§39006. Notice and public hearing**

Notwithstanding Section 39005, immediately after receiving notice of a proposed acquisition of property which is within two miles, measured by air line, of that point on an airport boundary which is nearest the site, the Department of Education shall notify the Department of Transportation, in writing, of the proposed acquisition. The Department of Transportation shall make an investigation and report to the Department of Education within 25 days after receipt of the notice. As part of the investigation, the Department of Transportation shall give notice thereof to the owner and operator of the airport who shall be granted the opportunity to comment upon the proposed school site.

Notwithstanding Section 39005, if the report of the Department of Education required by that section does not favor the acquisition of the property for a school site, or an addition to a present school site, the governing body shall not acquire title to the property until 30 days after the department's report is received and until the department's report has been read at a public hearing duly called after 10 days' notice by publication in a newspaper of general circulation within the school district or, if there is no such newspaper, in a newspaper of general circulation within the county in which the property is located.

**§39007. Proposed site within two miles of airport runway**

If, with respect to a proposed site located within two miles of an operative airport runway, the report of the Department of Education submitted to a school district governing board under Section 39005 or 39006 does not favor the acquisition of the site on the sole or partial basis of the unfavorable recommendation of the Department of Transportation, no state agency or officer shall grant, apportion, or allow to the school district for expenditure, in connection with that site, any state funds otherwise made available under any state law whatever for school site acquisition or school building construction, or for expansion of existing sites and buildings, and no funds of the

school district or of the county in which the district lies shall be expended for those purposes, except that the provisions of this section shall not apply to sites acquired prior to January 1, 1966, nor to any additions or extensions to those sites.

If the recommendation of the Department of Transportation is unfavorable, the recommendations shall not be overruled without the express approval of the Department of Education and the State Allocation Board.

The following sections reflect the provisions of the Education Code related to proposed school sites near airports, as amended by Chapter 470, Statutes of 1981.

**§81036. Investigation of site near airport**

To promote the safety of students, comprehensive community planning, and greater educational usefulness of community college sites, the governing board of each community college district, if the proposed site is within two miles, measured by air line, of that point on an airport boundary which is nearest the site and excluding them if the property is not so located, before acquiring title to property for a new community college site or for an addition to a present site, shall give the board of governors notice in writing of the proposed acquisition and shall submit any information required by the board of governors.

Immediately after receiving notice of the proposed acquisition of property which is within two miles, measured by air line, of that point on an airport boundary which is nearest the site, the board of governors shall notify the Division of Aeronautics of the Department of Transportation, in writing, of the proposed acquisition. The Division of Aeronautics shall make an investigation and report to the board of governors within 25 days after receipt of the notice. If the Division of Aeronautics is no longer in operation, the board of governors shall, in lieu of notifying the Division of Aeronautics, notify the Federal Aviation Administration or any other appropriate agency, in writing of the proposed acquisition for the purpose of obtaining from the authority or other agency such information or assistance as it may desire to give.

The board of governors shall investigate the proposed site and within 30 days after receipt of the notice shall submit to the governing board a written report and its recommendations concerning acquisition of the site. The governing board shall not acquire title to the property until the report of the board of governors has been received. If the report does not favor the acquisition of the property for a community college site or an addition to a present community college site, the governing board shall not acquire title to the property until 30 days after the department's report is received and until the board of governors' report has been read at a public hearing duly called after 10 days' notice published once in a newspaper of general circulation within the community college district, or if there is no such newspaper, then in a newspaper of general circulation within the county in which the property is located.

## §81038. Effect of disfavor of acquisition of site near airport

If, with respect to a proposed site located within two miles of an operative airport runway, the report of the board of governors submitted to a community college district governing board under Section 81036 does not favor the acquisition of the site on the sole or partial basis of the unfavorable recommendation of the Division of Aeronautics of the Department of Transportation, no state agency or officer shall grant, apportion, or allow to such community college district for expenditure in connection with that site, any state funds otherwise made available under any state law whatever for community college site acquisition or college building construction, or for expansion of existing sites and buildings, and no funds of the community college district or the county in which the district lies shall be expended for such purposes; provided that the provisions of this section shall not be applicable to sites acquired prior to January 1, 1966 nor to any additions or extensions to such sites.

If the recommendation of the Division of Aeronautics is unfavorable, such recommendation shall not be overruled without the express approval of the board of governors and the State Allocation Board.

## APPENDIX K

## GENERAL AVIATION AIRCRAFT TAKEOFF AND ACCELERATED STOP DISTANCES

How to Use the Airplane Charts

Takeoff Performance. This column shows various takeoff (TO), accelerate-stop (A/S), and BFL distances as appropriate for two sets of conditions: (1) sea level, standard day, (SL, ISA), and (2) 5,000-foot elevation, hot day (ISA + 20°C).

Takeoff for single engine airplanes is based on the maximum-effort technique. For all other airplanes, takeoff, accelerate-stop, and BFL distances assume a "normal" takeoff procedure and therefore do not necessarily represent the best runway performance possible.

Climb Gradient. Feet (up) per nautical mile (out). For FAR Part 23 aircraft these data generally are based on a clean, max-rate climb. The formula used is (ROC x 60) divided by the climb speed. Climb Speed may be all-engine best-rate-of-climb (All Eng.), engine-out best-rate-of-climb (Eng. Out) or both as noted in column heading. For Part 25 and SFAR 41 airplanes, gradient comes from the aircraft flight manual (AFM) charts.

Business and Commercial Aviation Mission Specifications. B/CA computes paper missions for each aircraft. All missions for all airplane classes are flown with a total payload of four passengers (800 pounds). The pilot is not considered part of the payload in cabin class twins and turbine powered airplanes. However, the pilot is considered part of the payload in all other aircraft.

Turbine powered airplanes carry NBAA IFR reserve fuel. In the case of turboprops, the alternate is 100 nm. In the case of turbojets and turbofans, the alternate is 200 nm. Therefore, care must be taken in comparing missions between turboprop, and turbojet and turbofan classes. Reserve fuel for all piston aircraft is 45 minutes at 65-percent power.

Cabin class twin missions are computed for 300 and 600 nm. All other piston aircraft missions are computed at 200 and 500 nm. Turboprop aircraft missions are computed at 300, 600 and 1,000 nm. Turbojet and turbofan aircraft missions are computed at 200, 600, and 1,500 nm. Where an aircraft cannot cover the mission distance with the 800-pound payload, a reduction in payload or a reduction in mission length is shown. Data shown is the AFM runway requirement: the takeoff distance for piston singles, the accelerate-stop for piston twins and most turboprops, or the BFL for footnoted turboprops and all turbojet and turbofan aircraft.

Notes. Deviations from the conditions stated above are shown in this column.
NA --Information applicable but not available.
NP --Attempted mission not possible under given conditions.
- --Information not applicable.
BFL--Balanced field length.
AFM--Aircraft flight manual.
Source: Business and Commercial Aviation, April 1982 (35).

SINGLE ENGINE PISTON AIRPLANES

Normally Aspirated

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) | B/CA MISSIONS 200 nm Runway Length | B/CA MISSIONS 500 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Cessna Skylane CE-182R | 1,518 2,705 | 641 | 1,195 | 1,357 | |
| Cessna Cutlass RG CE-172RG | 1,775 3,155 | 571 | 1,775* | 1,775** | *Payload reduced 20 lbs. **Payload reduced 143 lbs. |
| Piper Dakota PA-28-236 | 1,216 2,600 | 793 | 1,000 | 1,200 | |
| Cessna Skywagon CE-A185F | 1,430 2,545 | 725 | 956 | 1,108 | |
| Mooney 201 M-20J | 1,518 2,623 | 694 | 1,500 | 1,518* | *Payload reduced 47 lbs. |
| Piper Arrow IV PA-28RT-201 | 1,600 2,250 | 554 | 1,575 | 1,600* | *Payload reduced 96 lbs. |
| Cessna Skylane RG CE-R182 | 1,570 2,808 | 777 | 1,235 | 1,570 | |
| Beech Sierra BE-C24R | 1,812 3,308 | 660 | 1,812* | 1,812** | *Payload reduced 35 lbs. **Payload reduced 169 lbs. |
| Cessna Stationair 6 CE-U206G | 1,780 3,295 | 642 | 1,155 | 1,444 | |
| Cessna Stationair 8 CE-207A | 1,970 3,538 | 565 | 1,420 | 1,620 | |
| Piper Saratoga PA-32-301 | 1,800 3,700 | 667 | 1,500 | 1,600 | |
| Cessna Centurion CE-210N | 2,033 3,810 | 594 | 1,495 | 1,663 | |

| | | | | | |
|---|---|---|---|---|---|
| Piper<br>Saratoga SP<br>PA-32R-301 | 2,100<br>4,200 | 666 | 1,300 | 1,400 | |
| Beech<br>Bonanza<br>BE-V35B | 1,769<br>3,500 | 729 | 1,570 | 1,740 | |
| Beech<br>Bonanza<br>BE-F33A | 1,769<br>3,500 | 729 | 1,530 | 1,769* | *Payload reduced 14 lbs. |
| Beech<br>Bonanza<br>BE-A36 | 2,046<br>3,800 | 644 | 1,950 | 2,070 | |

Turbocharged

| MANUFACTURER<br>MODEL | TAKEOFF PERFORMANCE<br>SL ISA<br>5,000 + 20°C | CLIMB GRADIENT<br>(ft/nm) | B/CA MISSIONS<br>200 nm<br>Runway Length | <br>500 nm<br>Runway Length | NOTES |
|---|---|---|---|---|---|
| Cessna<br>Turbo Skylane<br>CE-T182 | 1,475<br>2,205 | 673 | 1,170 | 1,390 | |
| Piper<br>Turbo Arrow IV<br>PA-28RT-201T | 1,620<br>2,600 | 588 | 1,550 | 1,600* | *Payload reduced 51 lbs. |
| Mooney<br>Turbo 231<br>M-20K | 2,100<br>3,100 | 682 | 2,095 | 2,100* | *Payload reduced 87 lbs. |
| Cessna<br>Turbo Skylane RG<br>CE-TR182 | 1,570<br>2,373 | 693 | 1,460 | 1,570* | *Payload reduced 3 lbs. |
| Cessna Turbo<br>Stationair 6<br>CE-TU206G | 1,643<br>2,428 | 673 | 1,237 | 1,440 | |
| Cessna Turbo<br>Stationair 8<br>CE-T207A | 1,863<br>2,758 | 617 | 1,472 | 1,652 | |
| Piper<br>Turbo Saratoga<br>PA-32-301T | 1,600<br>2,500 | 717 | 1,200 | 1,300 | |
| Cessna Turbo<br>Centurion<br>CE-T210N | 2,165<br>3,250 | 564 | 1,467 | 1,625 | |
| Piper Turbo<br>Saratoga SP<br>PA-32R-301T | 1,800<br>2,800 | 730 | 1,200 | 1,300 | |

| | | | | |
|---|---|---|---|---|
| Beech Bonanza BE-B36TC | 2,141<br>NA | 629 | NA | NA |

Pressurized

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) | B/CA MISSIONS 200 nm Runway Length | B/CA MISSIONS 500 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Cessna Press Centurion CE-P210N | 2,165<br>3,250 | 573 | 1,786 | 1,911 | |

MULTIENGINE PISTON AIRPLANES

Normally Aspirated

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE TO SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA MISSIONS 200 nm Runway Length | B/CA MISSIONS 500 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Piper Seminole PA-44-180 | 2,200<br>4,200<br>2,600<br>4,400 | 893<br>145 | 2,300 | 2,600 | |
| Beech Duchess BE-76 | 1,800<br>3,600<br>2,500<br>3,700 | 861<br>164 | 2,400 | 2,500 | |
| Beech Baron BE-B55 | 2,154<br>3,500<br>3,300<br>4,500 | 943<br>241 | 3,100 | 3,300 | |
| Beech Baron BE-E55 | 2,100<br>3,300<br>3,200<br>4,300 | 989<br>233 | 3,000 | 3,100 | |
| Piper Areostar PA-600A | 2,000<br>3,400<br>3,100<br>4,500 | 885<br>202 | 3,000 | 3,100 | |
| Beech Baron BE-58 | 2,100<br>3,300<br>3,200<br>4,300 | 958<br>234 | 3,000 | 3,150 | |

Turbocharged

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE TO SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA MISSIONS 200 nm Runway Length | 500 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Piper Turbo Seminole PA-44-180T | 1,850<br>2,425<br>2,760<br>3,700 | 860<br>120 | 2,550 | 2,750 | |
| Piper Seneca III PA-34-220T | 1,750<br>2,600<br>3,850<br>5,000 | 903<br>155 | 2,100 | 2,200 | |
| Cessna Crusader CE-T303 | 1,750<br>2,638<br>3,185<br>4,162 | 862<br>135 | 2,769 | 2,900 | |
| Beech Baron BE-58TC | 2,550<br>3,900<br>3,300<br>4,400 | 776<br>142 | 3,100 | 3,300 | |

Pressurized

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE TO SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA MISSIONS 200 nm Runway Length | 500 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Cessna 340A CE-340A | 2,175<br>3,360<br>3,410<br>4,685 | 917<br>189 | 2,805 | 3,390 | |
| Beech Baron BE-58P | 2,550<br>3,900<br>3,300<br>4,400 | 776<br>142 | 3,000 | 3,100 | |
| Piper Aerostar PA-602P | 2,200<br>3,100<br>3,400<br>4,500 | 900<br>154 | 3,020 | 3,200 | |

MULTIENGINE PISTON AIRPLANES/PRESSURIZED (CONT.)

| | | | | |
|---|---|---|---|---|
| Beech<br>Duke<br>BE-B60 | 2,626<br>3,750<br>3,500<br>4,300 | 865<br>166 | 3,200 | 3,350 |

Cabin Class, Turbocharged

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE TO SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA MISSIONS 300 nm Runway Length | 600 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Piper<br>Navajo<br>PA-31-310 | 2,300<br>3,300<br>3,350<br>4,200 | 732<br>152 | 3,150 | 3,250 | |
| Cessna<br>Businessliner<br>CE-402C | 2,205<br>3,310<br>3,740<br>5,145 | 806<br>175 | 2,930 | 3,278 | |
| Piper<br>Navajo C/R<br>PA-31-325 | 2,600<br>3,300<br>3,100<br>3,300 | 697<br>151 | 2,800 | 3,000 | |
| Piper<br>Chieftain<br>PA-31-350 | 2,700<br>3,700<br>3,700<br>4,700 | 584<br>187 | 3,350 | 3,450 | |

Cabin Class, Pressurized

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE TO SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA MISSIONS 300 nm Runway Length | 600 nm Runway Length | NOTES |
|---|---|---|---|---|---|
| Cessna<br>Chancellor<br>CE-414A | 2,595<br>3,780<br>4,255<br>5,800 | 844<br>161 | 3,936 | 4,255* | *Payload reduced 58 lbs. |
| Cessna<br>Golden Eagle<br>CE-421C | 2,335<br>3,740<br>3,630<br>5,000 | 1,049<br>189 | 3,085 | 3,426 | |

TURBOPROP AIRPLANES

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA IFR MISSIONS 300 nm Runway Length | 600 nm Runway Length | 1,000 nm Runway Length | NOTES |
|---|---|---|---|---|---|---|
| Piper<br>Cheyenne I<br>PA-31T-500T1 | 2,850<br>4,100<br>3,550<br>4,500 | 833<br>232 | 3,100 | 3,250 | 3,550* | *Payload reduced 15 lbs. |
| Cessna<br>Corsair<br>CE-425 | 2,345<br>3,310<br>3,780<br>4,970 | 1,058<br>235 | 3,116 | 3,322 | 3,780* | *Payload reduced 115 lbs. |
| Beech<br>King Air<br>BE-C90-1 | 2,261<br>3,750<br>3,498<br>4,500 | 1,047<br>302 | 3,000 | 3,125 | 3,400 | |
| Piaggio<br>P.166-DL3<br>P.166-DS3 | 1,640<br>3,540<br>3,200<br>5,100 | 1,096<br>411 | 3,000 | 3,200* | NP | *Payload reduced 161 lbs. |
| Piper<br>Cheyenne II<br>PA-31T-620 | 1,980<br>2,750<br>3,300<br>4,450 | 1,290<br>336 | 2,800 | 3,000 | 3,250 | |
| Gulfstream Am.<br>Commander 840<br>AE-840 | 1,833<br>3,600<br>3,699<br>4,800 | 1,246<br>523 | 3,370 | 3,500 | 3,650 | |
| Piper<br>Cheyenne II XL<br>PA-31T2XL | 2,940<br>4,250<br>4,186<br>6,100 | 875<br>231 | 3,500 | 3,700 | 3,900 | |
| Mitsubishi<br>Solitaire<br>MU-2B-40 | 1,800<br>2,600<br>2,750<br>3,650 | 928<br>190 | 2,600 | 2,675 | 2,750 | |
| Beech<br>King Air<br>BE-F90 | 2,856<br>4,650<br>4,483<br>6,150 | 1,231<br>310 | 3,400 | 3,600 | 4,100 | |

TURBOPROP AIRPLANES (CONT.)

| MANUFACTURER MODEL | TAKEOFF PERFORMANCE SL ISA 5,000 + 20°C A/S SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA IFR MISSIONS 300 nm Runway Length | 600 nm Runway Length | 1,000 nm Runway Length | NOTES |
|---|---|---|---|---|---|---|
| Gulfstream Am. Commander 900 AE-900 | 1,937<br>3,100<br>4,000<br>5,500 | 1,226<br>482 | 3,630 | 3,750 | 3,900 | |
| Cessna Conquest CE-441 | 2,465<br>3,720<br>3,665<br>4,995 | 1,218<br>358 | 3,267 | 3,330 | 3,414 | |
| Gulfstream Am. Commander 980 AE-980 | 1,854<br>2,900<br>3,692<br>5,000 | 1,272<br>595 | 3,400 | 3,500 | 3,675 | |
| Beech King Air BE-B100 | 2,951<br>5,200<br>3,923<br>5,600 | 958<br>240 | 3,200 | 3,400 | 3,600 | |
| Gulfstream Am. Commander 1000 AE-1000 | 2,131<br>3,300<br>3,939<br>5,350 | 1,227<br>442 | 3,450 | 3,550 | 3,700 | |
| Piper Cheyenne III PA-42 | 3,230<br>4,400<br>3,985<br>4,950 | 1,485<br>287 | 3,100 | 3,500 | 3,650 | |
| Mitsubishi Marquise MU-2B-60 | 2,700<br>3,850<br>3,400<br>4,200 | 835<br>162 | 2,900 | 3,050 | 3,200 | |
| LearAvia Lear Fan LF-2100 | 2,500<br>3,300<br>3,250<br>4,440 | 1,218<br>520 | 1,700 | 1,825 | 2,000 | |
| Beech King Air BE-B200 | 3,300<br>4,800<br>3,364<br>4,600 | 1,157<br>367 | 3,000 | 3,100 | 3,200 | |
| Swearingen Merlin IIIC/23 SA 227-TT/23 | 2,400<br>3,475<br>3,750<br>5,100 | 1,352*<br>352* | 2,100 | 2,200 | 2,280 | *AFM gradient. |

| | | | | | | |
|---|---|---|---|---|---|---|
| Swearingen Merlin IIIC/41 SA 227-TT/41 | 2,900<br>4,100<br>4,700<br>6,200 | 1,191*<br>274* | 2,175 | 2,240 | 2,350 | *AFM gradient. |
| Swearingen Merlin IVC/41 SA 227-AT/41 | 3,200<br>4,900<br>3,990<br>5,400 | 1,018*<br>310* | 2,800 | 2,950 | 3,250 | *AFM gradient. |
| British Aerospace Jetstream 31 BA-3103 | NA<br>NA<br>4,150**<br>6,600** | 985<br>246 | 2,900 | 3,150 | 3,400* | *1,500 nm.<br>**BFL.<br>All data preliminary. |
| Lockheed Convertible Her. L-100-30C | 6,000<br>8,400*<br>6,000<br>8,400** | 603<br>350 | 3,840 | 3,892 | 3,961 | *B/CA est.<br>**BFL 2nd seg. ltd at 141,800. |

TURBOJET/TURBOFAN AIRPLANES

| MANUFACTURER MODEL | AIRPORT PERFORMANCE SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA IFR MISSIONS 300 nm Runway Length | 600 nm Runway Length | 1,500 nm Runway Length | NOTES |
|---|---|---|---|---|---|---|
| Cessna Jet Citation I CE-500 | 2,930<br>5,700 | 2,719*<br>421 | 2,286 | 2,590 | 2,930** | *fpm climb rate.<br>**Mission reduced to 950 nm. |
| Mitsubishi Diamond I MU-300 | 4,050<br>6,700 | 3,100*<br>280 | 3,300 | 3,575 | 4,050** | *fpm climb rate.<br>**Mission reduced to 1,144 nm. |
| Gates Learjet LR-25D | 3,937<br>6,850 | 6,830*<br>426 | 2,750 | 3,175 | 3,937** | *fpm climb rate.<br>**Mission reduced to 1,060 nm. |
| Cessna Jet Citation II CE-550 | 2,990<br>5,630 | 3,373*<br>461 | 2,085 | 2,315 | 2,990** | *fpm climb rate.<br>**Mission reduced to 1,378 nm. |
| Gates Learjet LR-28 | 3,000<br>4,700 | 6,925*<br>523 | 2,475 | 2,650 | 2,750** | *fpm climb rate.<br>**Mission reduced to 759 nm. |
| Gates Learjet LR-29 | 3,000<br>4,700 | 6,925*<br>523 | 2,475 | 2,650 | 3,000** | *fpm climb rate.<br>**Mission reduced to 973 nm. |

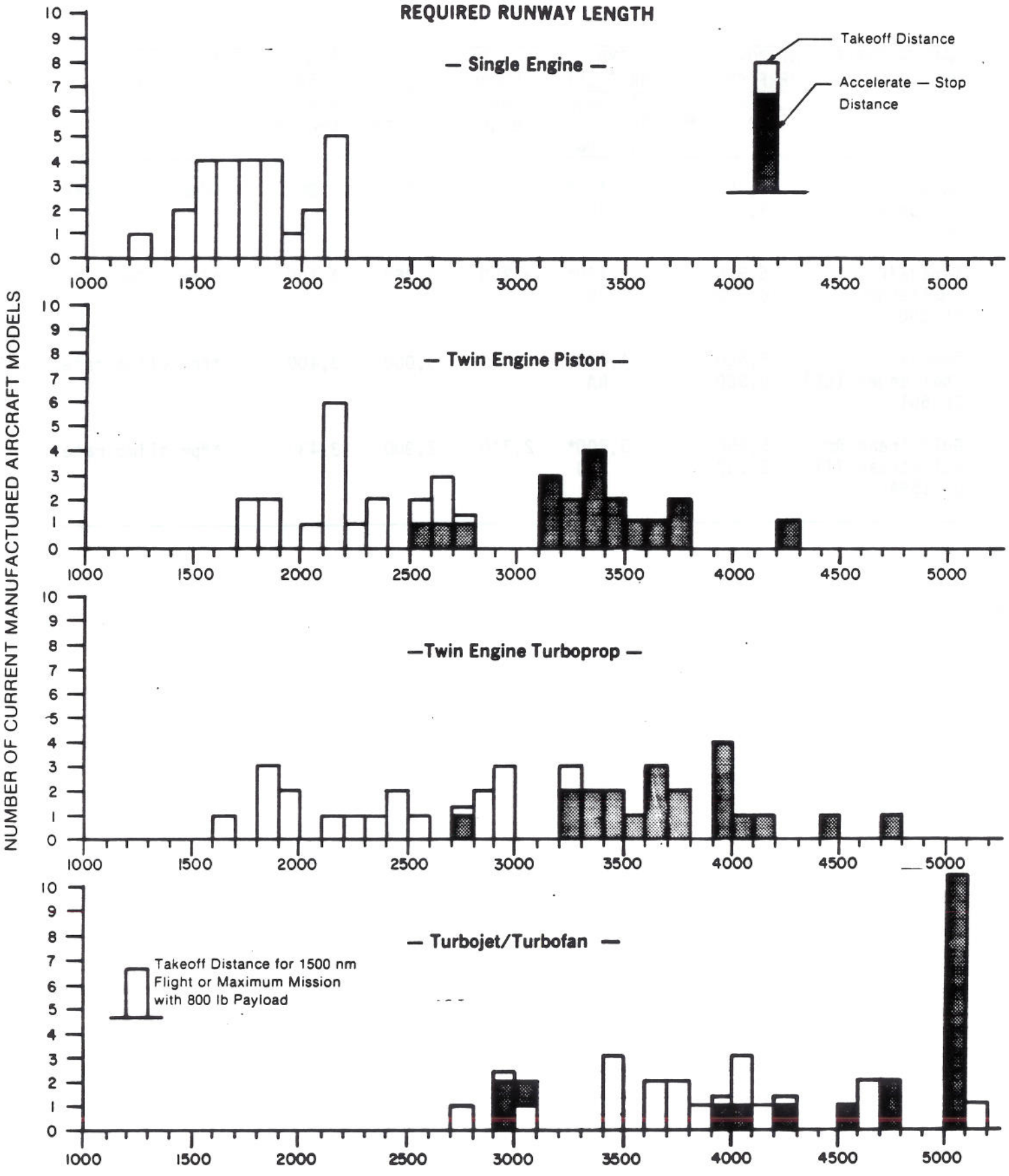
TURBOJET/TURBOFAN AIRPLANES (CONT.)

| MANUFACTURER MODEL | AIRPORT PERFORMANCE SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA IFR MISSIONS 300 nm Runway Length | 600 nm Runway Length | 1,500 nm Runway Length | NOTES |
|---|---|---|---|---|---|---|
| Gates Learjet LR-25G | 4,950<br>NA | 5,720*<br>1,970* | 3,300 | 3,750 | 4,950** | *fpm climb rate.<br>**Mission reduced to 1,387 nm. |
| Gates Learjet LR-35A | 4,224<br>8,100 | 4,760*<br>328 | 2,650 | 2,800 | 3,600 | *fpm climb rate. |
| Gates Learjet LR-36A | 4,972<br>10,100 | 4,340*<br>249 | 2,650 | 2,800 | 3,600 | *fpm climb rate |
| Israel Aircraft Westwind 1 IA-1124 | 4,950<br>7,200 | 3,200*<br>392 | 2,700 | 2,850 | 3,700 | *fpm climb rate. |
| Dassault Falcon 100 AD MY-10 | 4,500<br>7,600 | 4,600*<br>158 | 2,850 | 2,975 | 4,000 | *fpm climb rate. |
| Israel Aircraft Westwind 2 IA-1124A | 5,150<br>7,750 | 3,500*<br>392 | 2,650 | 2,950 | 3,750 | *fpm climb rate. |
| Gates Learjet LR-55 | 5,480<br>8,300 | 4,380*<br>274 | 3,350 | 3,600 | 4,600 | *fpm climb rate. |
| Cessna Jet Citation III CE-650 | 4,700<br>9,400 | 4,340*<br>1,285* | 2,955 | 3,157 | 3,814 | *fpm climb rate. |
| British Aerospace HS 125 Srs 700 | 5,800<br>6,850 | 3,000*<br>415 | 3,000 | 3,125 | 4,200 | *fpm climb rate. |
| Dassault Falcon 20 AD MY-20F | 4,950<br>9,100 | 3,330*<br>213 | 3,200 | 3,600 | 4,600 | *fpm climb rate. |
| Dassault Falcon 200 DA-20 | 5,250<br>7,535 | 3,120*<br>195 | 3,000 | 3,200 | 4,000 | *fpm climb rate. |

TURBOJET/TURBOFAN AIRPLANES (CONT.)

| MANUFACTURER MODEL | AIRPORT PERFORMANCE SL ISA 5,000 + 20°C | CLIMB GRADIENT (ft/nm) All Eng. Eng. Out | B/CA IFR MISSIONS 300 nm Runway Length | 500 nm Runway Length | 1,500 nm Runway Length | NOTES |
|---|---|---|---|---|---|---|
| Dassault Falcon 50 AD MY-50 | 4,700<br>8,800 | 3,430*<br>353 | 2,910 | 2,950 | 2,980 | *fpm climb rate. |
| Canadair Challenger CL-600 | 6,510<br>10,500 | 3,400*<br>367 | 3,250 | 3,350 | 4,100 | *fpm climb rate. |
| Canadair Challenger (GE) CL-601 | 5,600<br>8,500 | 4,400*<br>NA | 3,000 | 3,000 | 3,400 | *fpm climb rate. |
| Gulfstream Am. Gulfstream III G-1159A | 5,850<br>8,100 | 3,800*<br>320 | 2,740 | 2,900 | 3,430 | *fpm climb rate. |

**Figure K-1**


REQUIRED RUNWAY LENGTH
— Single Engine —
Takeoff Distance
Accelerate — Stop Distance
— Twin Engine Piston —
—Twin Engine Turboprop —
— Turbojet/Turbofan —
Takeoff Distance for 1500 nm Flight or Maximum Mission with 800 lb Payload
NUMBER OF CURRENT MANUFACTURED AIRCRAFT MODELS
0 1 2 3 4 5 6 7 8 9 10
1000 1500 2000 2500 3000 3500 4000 4500 5000
RUNWAY LENGTH (FT.)
Sea Level/Standard Day Conditions

## APPENDIX L

## MODEL AIRPORT ENVIRONS REVIEW ORDINANCE

SECTION 1. TITLE AND PURPOSE. The provisions of Section 1 through 15, inclusive, shall be known as the Airport Environs Review Ordinance. The purpose of these provisions is to promote land uses compatible with the [airport] 1/ within the airport's designated environs.

SECTION 2. DETERMINATION OF AIRPORT ENVIRONS. For purposes of this ordinance, the Airport Environs is that geographic area affected by the airport and defined on the basis of factors including but not limited to aircraft noise, airport flight paths, airport safety zones, local circulation patterns, and area development plans. The airport environs is subdivided into two zones of impact:

a. Zone A - Moderate to High Impact. Within Zone A, a project is subject to review as described in this ordinance and shall be evaluated for consistency with the land use guidelines in the [plan].

b. Zone B - Limited Impact. In Zone B, an avigation easement and a notification to property purchasers is required.

The boundaries of the Airport Environs and its subzones, as adopted by [jurisdiction], shall be reviewed at least every five years, and maps portraying the Airport Environs shall be on file and open to public inspection in offices of the [City, County and Airport].

SECTION 3. APPLICATION OF AIRPORT ENVIRONS REVIEW ORDINANCE.

a. New Buildings and Structures. All new buildings or structures intended for human use or habitation which lie wholly or in part within the airport environs shall be subject to the provisions of this ordinance. Such uses include but are not limited to:

   (1) Residential structures, such as single and multi-family dwellings;

   (2) Commercial structures, such as retail stores, offices, recreational centers, and hotels;

   (3) Manufacturing and warehousing structures, such as industrial plants and storage and distribution facilities;

   (4) Civic structures, such as hospitals, churches, and schools.

b. Outdoor Activities. All activities which are to occur in unenclosed space involving human use or assembly, which lie wholly or in part within the airport environs shall be subject to the provisions of this ordinance. Such activities include but are not limited to:

1./Appropriate names and titles should be inserted in brackets used throughout the model.

(1) Parks, playgrounds, and playing fields;.

(2) Open storage areas, roofed or unroofed, separate or adjoining another structure;

(3) Drive-in facilities designed or operated to enable the provision of services or purchase or consumption of goods while remaining in a motor vehicle.

SECTION 4. EXEMPTIONS. The provisions of this ordinance shall not be deemed applicable to the following when permitted in the underlying zone:

a. Existing Uses. Uses existing on the effective data of this ordinance shall not be required to change operations to comply with these regulations. However, any use shall not be so changed as to result in a greater degree of nonconformity with respect to these regulations.

b. Temporary Uses. Temporary use including but not limited to: circus, carnival, or other outdoor entertainment events and religious assembly, so long as the period of operation does not exceed five days.

c. Temporary Structures. Temporary buildings and structures auxiliary to residential development and major construction, and temporary uses in new subdivisions and other residential developments which support the sale of dwellings and lots within the same subdivisions or residential development, so long as such uses and associated structures are constructed or erected as incidental to a development, do not involve any significant investment, are solely used for the designated purpose, and remain for a maximum of one year.

d. Agricultural Structures. Bona fide agricultural buildings, structures, improvements, and associated developments, so long as no more than one single family dwelling occurs within that portion of the parcel located within the airport environs.

e. Other uses determined by the [Planning Director] to be minor or incidental and within the intent or objective of these regulations.

SECTION 5. INTERIOR NOISE LEVELS ESTABLISHED.2/ Interior Community Noise Equivalent Levels (CNEL) with windows closed, attributable to exterior sources, shall not exceed the levels described in this Section. For uses not specifically identified, the [Planning Director] shall make a determination of the applicable standard, using this Section as the basis for that decision.

a. Residential Uses:

Single or Multiple Family - 45 CNEL
Mobile Homes - 50 CNEL

2./Values shown are examples only. Local noise insulation regulations may equal or exceed state standards as specified in Section 17922.7 of California Health and Safety Code (see Appendix B for copy).

b. Commercial Uses:

Concert Halls - 30 CNEL
Hotel and Motels (sleeping area only) - 45 CNEL
Theaters - 45 CNEL
Offices - 55 CNEL
Retail/Restaurant - 60 CNEL
Bowling Alleys - 70 CNEL

c. Industrial Uses:

Offices - 60 CNEL
Other - as guided by regulations of the State of California or the U.S. Occupational Safety and Health Administration.

d. Civic Uses:

Schools, Churches, Libraries - 45 CNEL
Hospitals, Convalescent Homes (sleeping area only) - 45 CNEL

SECTION 6. AVIGATION EASEMENT REQUIRED. No permit of any type shall be issued for any development or activity subject to the Airport Environs Review Ordinance until [jurisdiction] is provided with an avigation easement permitting the right of flight in the airspace above the subject property. Such easement shall be supplied in a form prescribed by the [jurisdiction] Counsel and shall be recorded on the title of the subject property.

SECTION 7. NOTICE TO PURCHASERS REQUIRED. No permit of any type shall be issued for any development or activity subject to the Airport Environs Review Ordinance until the [Planning Director] approves the form, content, and method of notice by which purchasers of property within the Airport Environs will be informed that the area is subject to aircraft overflight. Said notice shall include but not be limited to a map showing the Airport Environs, noise contours forecast for the year 2000, and current and anticipated aircraft flight paths.

SECTION 8. DEVELOPMENT REVIEW REQUIRED. No permit of any type shall be issued for any development or activity within Zone A of the Airport Environs until such development or activity has been reviewed and approved in accordance with the provisions of the minor development review described in Section 9 or the development plan review described in Section 10. Minor development review shall be required in the case of construction or alteration of a single-family dwelling within the Airport Environs when being constructed or altered by the owner(s) and which involves no more than one dwelling owned by the applicant within the parcel, tract, or subdivision. The specific intent of the minor development review is to allow for expeditious review of plans for construction and remodeling of individual single-family homes by their owners. All other uses subject to the provisions of this ordinance shall prepare and submit a development plan in accordance with Section 10.

SECTION 9. CONTENT OF MINOR DEVELOPMENT REVIEW APPLICATIONS. An application for a minor development review shall be submitted by the property owner to the [Planning Director] and shall include:

a. Descriptive information on the development proposed and the sound attenuation techniques to be incorporated in construction;

b. Evidence of consultation with the [Department of Public Works] indicating that information on construction techniques and practices commonly used to reduce interior noise levels were provided the applicant;

c. A statement of assurance signed by the property owner indicating that insulation required to reduce interior noise levels to 45 CNEL 2/ in all habitable rooms will be incorporated in the construction or remodeling; and

d. Such other information as may be required by the [Planning Director] to determine the adequacy of the sound attenuation measures proposed.

SECTION 10. CONTENT OF DEVELOPMENT PLAN. The required development plan shall include technical substantiation, maps, plans, drawings, and such other information as is necessary to show:

a. CNEL Contours. Community Noise Equivalent Level (CNEL) contours, as provided in the most current airport master plan, shall be superimposed on a topographic map of the development site to show both present and future aircraft-generated sound levels projected for the property. All maps should be drawn at a scale designated by the [Planning Director].

b. Location of Structures. The placement of all existing and proposed buildings and structures shall be shown located on the site/contour map.

c. Specification of Uses. Identification of the uses to occur within each structure or activity area shall be designated on the site/contour map.

d. Noise Mitigation Measures. Noise attenuation measures to be applied in the development shall be identified, together with an analysis of the noise insulation effectiveness of the proposed construction showing that the prescribed interior noise level requirements are met. Said analysis shall be prepared by or under the supervision of a person experienced in the field of acoustical engineering who shall be identified. If interior allowable noise levels are met by requiring that windows be unopenable or closed, the design for the structure must also specify the means that will be employed to provide ventilation, and cooling if necessary, to provide a habitable interior environment.

2./Values shown are examples only. Local noise insulation regulations may equal or exceed state standards as specified in Section 17922.7 of California Health and Safety Code (see Appendix B for copy).

e. Narrative Description. A narrative shall be provided describing the location of the site, its total acreage, existing character and use; the concept of the proposed development or use, including, as appropriate, proposed residential density, number of employees, and/or estimated number of people who will be engaged in transactions at the site over a 24-hour period, such as but not limited to retail store customers; and the relation of the proposed plan to the General Plan.

SECTION 11. DEVELOPMENT PLAN REVIEW CRITERIA. The development plan described in Section 10 shall be reviewed and evaluated by the [Planning Director] for conformance with the following criteria:

a. Permitted Uses. All elements of the proposed development are consistent with the land use compatibility standards for the [airport] environs and with the requirements of this ordinance.

b. Siting. Buildings and structures are located, when reasonable and feasible, at the greatest distance from the noise source, taking maximum advantage of existing topographical features to minimize noise impact.

c. Design Consideration Regarding Noise. The amount of passive outdoor recreational space where individuals would be subject to high levels of noise is minimized; construction materials utilized are such that sound attenuation yields an interior average sound level as described in Section 5.

SECTION 12. DECISION AND NOTICE.

a. Minor Development Review. Minor development review applications shall be reviewed by the [Planning Director], who shall either find that the proposed use is consistent with the intent of this ordinance and approve the application, or shall return the development review application specifying those changes and modifications required for approval. Notice of the decision of the [Planning Director] shall be filed in the office of the [Department of Planning] and a copy of said notice shall be mailed to the applicant within 30 days of receipt of a complete application for minor development review.

b. Development Plan Review. Development plans shall be reviewed by the [Planning Director], who shall submit his recommendation to the [Planning Commission] for action. The [Planning Commission] shall either find that the proposed use is consistent with the intent of this ordinance and approve the Development Plan, or shall return the Development Plan specifying those changes and modifications required for approval. Notice of the decision of the [Planning Commission] shall be filed in the office of the [Department of Planning] and a copy of said notice shall be mailed to the applicant within 60 days of receipt of a complete application for development plan review.

SECTION 13. APPEAL. A decision of the [Planning Director], pursuant to Section 12a, may be appealed to the [Planning Commission] and shall be filed in accordance with [Administrative Appeal Procedures] established by the [Planning Commission].

SECTION 14. CERTIFICATE OF COMPLIANCE REQUIRED. A Certificate of Compliance shall be required for any use or activity subject to a development plan review to confirm that construction is in conformance with the approved development plan. Subsequent to the completion of the development but prior to occupancy of any structure, a Certificate of Compliance shall be issued by the [Department of Public Works] when field inspection indicates that construction is in accordance with the approved design.

SECTION 15. FIELD TESTING OF INTERIOR SOUND LEVELS. Field testing may be required by the [Department of Public Works] as a condition for a Certificate of Compliance, pursuant to the provisions of Section 14, or by an individual with vested interest in the structure(s). Where a complaint as to noncompliance with this ordinance requires a field test to resolve the complaint, the complainant shall post a bond or adequate funds in escrow for the cost of said testing. Such costs shall be chargeable to the complainant when such field tests show that compliance with these regulations is in fact present. If such tests show noncompliance, then such testing costs shall be borne by the owner or builder. Actions shall then be taken by the owner or builder to comply with the sound attenuation provisions of this ordinance. Interior noise measurements shall be taken under conditions of typical maximum exterior noise levels.

Source: derived from draft ordinance presented in reference 42.

## APPENDIX M

## MODEL ZONING ORDINANCE TO LIMIT HEIGHT OF OBJECTS AROUND AN AIRPORT

The model zoning ordinance may be used as a guide for developing airport zoning ordinances to limit the height of objects that may interfere with the operation of a civil airport or heliport. The blank spaces should be filled in with appropriate data as noted.

It is not necessary that all material set forth in the model ordinance be used for all airport zoning ordinances. For example, if the airport to be zoned is a utility airport with no precision or nonprecision instrument runways existing or planned, those definitions and paragraphs referring to precision or nonprecision instrument runways or larger than utility runways may be omitted. However, if the airport changes to a larger than utility airport or receives instrument approach procedures, the ordinance should be amended to provide for the changes.

Section III should only include the airport zones applicable to the airport being zoned. An approach zone is applied to each end of each runway based upon the type of approach available or planned for that runway end. The most precise type of approach, existing or planned, for either end of the runway determines the primary surface width. Heliports do not have horizontal or conical zones. Other zones to accommodate the areas covered in FAR Part 77.23(a)(2) and (3) may be added.

An example of use of the ordinance is included in this appendix.

Source: Reference 46.

Model Ordinance

This Ordinance is adopted pursuant to the authority conferred by _____ 1/. It is hereby found that an obstruction has the potential for endangering the lives and property of users of [airport], and property or occupants of land in its vicinity; that an obstruction may affect existing and future instrument approach minimums of [airport]; and that an obstruction may reduce the size of areas available for the landing, takeoff, and maneuvering of aircraft, thus tending to destroy or impair the utility of [airport] and the public investment therein. Accordingly, it is declared:

(1) that the creation or establishment of an obstruction has the potential of being a public nuisance and may injure the region served by [airport];

(2) that is is necessary in the interest of the public health, public safety, and general welfare ____ 2/ that the creation or establishment of obstructions that are a hazard to air navigation be prevented; and

(3) that the prevention of these obstructions should be accomplished, to the extent legally possible, by the exercise of the police power without compensation.

It is further declared that the prevention of the creation or establishment of hazards to air navigation, the elimination, removal, alteration or mitigation of hazards to air navigation, and the marking and lighting of obstructions are public purposes for which a political subdivision may raise and expend public funds and acquire land or interests in land.

1/ This citation should be made to conform to the usual method of citing your state laws.

2/ If other terms are commonly used by the courts of your state in defining the limits of police power, such as "convenience" or "prosperity," they should be added here.

IT IS HEREBY ORDAINED BY _____ 3/ as follows:

SECTION I: SHORT TITLE

This Ordinance shall be known and may be cited as [airport] Height Limitation and Zoning Ordinance.

SECTION II: DEFINITIONS

As used in this Ordinance, unless the context otherwise requires:

1. AIRPORT - [name of airport].

2. AIRPORT ELEVATION - The highest point of an airport's usable landing area measured in feet from sea level.

3. APPROACH SURFACE - A surface longitudinally centered on the extended runway centerline, extending outward and upward from the end of the primary surface and at the same slope as the approach zone height limitation slope set forth in Section IV of this Ordinance. In plan the perimeter of the approach surface coincides with the perimeter of the approach zone.

4. APPROACH, TRANSITIONAL, HORIZONTAL, AND CONICAL ZONES - These zones are set forth in Section III of this Ordinance.

5. BOARD OF ADJUSTMENT - A Board consisting of _____ 4/ members appointed by the _____ 4/ as provided in _____ 4/.

6. CONICAL SURFACE - A surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

7. HAZARD TO AIR NAVIGATION - An obstruction determined to have a substantial adverse effect on the safe and efficient utilization of the navigable airspace.

8. HEIGHT - For the purpose of determining the height limits in all zones set forth in this Ordinance and shown on the zoning map, the datum shall be mean sea level elevation unless otherwise specified.

3/ A form of enacting clause commonly used by the political subdivision in adopting ordinances should be followed.

4/ Insert the number of members appointed to the Board of Adjustment, the appointing body, and the enabling legislation authorizing same.

9. HELIPORT PRIMARY SURFACE - The area of the primary surface coincides in size and shape with the designated takeoff and landing area of a heliport. This surface is a horizontal plane at the elevation of the established heliport elevation.

10. HORIZONTAL SURFACE - A horizontal plane 150 feet above the established airport elevation, the perimeter of which in plan coincides with the perimeter of the horizontal zone.

11. LARGER THAN UTILITY RUNWAY - A runway that is constructed for and intended to be used by propeller driven aircraft of greater than 12,500 pounds maximum gross weight and by jet powered aircraft.

12. NONCONFORMING USE - Any pre-existing structure, object of natural growth, or use of land that is inconsistent with the provisions of this Ordinance or an amendment thereto.

13. NONPRECISION INSTRUMENT RUNWAY - A runway having an existing instrument approach procedure utilizing air navigation facilities with only horizontal guidance, or area type navigation equipment, for which a straight-in nonprecision instrument approach procedure has been approved or planned.

14. OBSTRUCTION - Any structure, growth, or other object, including a mobile object, which exceeds a limiting height set forth in Section IV of this Ordinance.

15. PERSON - An individual, firm, partnership, corporation, company, association, joint stock association, or governmental entity; includes a trustee, a receiver, an assignee, or a similar representative of any of them.

16. PRECISION INSTRUMENT RUNWAY - A runway having an existing instrument approach procedure utilizing an Instrument Landing System (ILS) or a Precision Approach Radar (PAR). It also means a runway for which a precision approach system is planned and is so indicated on an approved airport layout plan or any other planning document.

17. PRIMARY SURFACE - A surface longitudinally centered on a runway. When the runway has a specially prepared hard surface, the primary surface extends 200 feet beyond each end of that runway; for military runways or when the runway has no specially prepared hard surface, or planned hard surface, the primary surface ends at each end of that runway. The width of the primary surface is set forth in Section III of this Ordinance. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline.

18. RUNWAY - A defined area on an airport prepared for landing and takeoff of aircraft along its length.

19. STRUCTURE - An object, including a mobile object, constructed or installed by man, including but without limitation, buildings, towers, cranes, smokestacks, earth formation, and overhead transmission lines.

20. TRANSITIONAL SURFACES - These surfaces extend outward at 90 degree angles to the runway centerline and the runway centerline extended at a slope of seven (7) feet horizontally for each foot vertically from the sides of the primary and approach surfaces to where they intersect the horizontal and conical surfaces. Transitional surfaces for those portions of the precision approach surfaces, which project through and beyond the limits of the conical surface, extend a distance of 5,000 feet measured horizontally from the edge of the approach surface and at 90 degree angles to the extended runway centerline.

21. TREE - Any object of natural growth.

22. UTILITY RUNWAY - A runway that is constructed for and intended to be used by propeller driven aircraft of 12,500 pounds maximum gross weight and less.

23. VISUAL RUNWAY - A runway intended solely for the operation of aircraft using visual approach procedures.

## SECTION III: AIRPORT ZONES

In order to carry out the provisions of this Ordinance, there are hereby created and established certain zones which include all of the land lying beneath the approach surfaces, transitional surfaces, horizontal surfaces, and conical surfaces as they apply to [airport]. Such zones are shown on [airport] zoning map consisting of _____ sheets, prepared by _____, and dated _____ 19 _____, which is attached to this Ordinance and made a part hereof. An area located in more than one (1) of the following zones is considered to be only in the zone with the more restrictive height limitation. The various zones are hereby established and defined as follows:

1. Utility Runway Visual Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is _____ 5/ feet wide. The approach zone expands outward uniformly to a width of 1,250 feet at a horizontal distance of 5,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

2. Utility Runway Nonprecision Instrument Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is 500 feet wide. The approach zone expands outward uniformly to a width of 2,000 feet at a horizontal distance 5,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

3. Runway Larger Than Utility Visual Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is _____ 5/ feet at a horizontal distance of 5,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

5/ Insert dimension as set forth in FAR Part 77. Where more than one dimension is applicable, insert dimension identified to the appropriate runway involved.

4. Runway Larger Than Utility With A Visibility Minimum Greater Than 3/4 Mile Nonprecision Instrument Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is _____ 5/ feet wide. The approach zone expands outward uniformly to a width of 3,500 feet at a horizontal distance of 10,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

5. Runway Larger Than Utility With A Visibility Minimum As Low As 3/4 Mile Nonprecision Instrument Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is 1,000 feet wide. The approach zone expands outward uniformly to a width of 4,000 feet at a horizontal distance of 10,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

6. Precision Instrument Runway Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is 1,000 feet wide. The approach zone expands outward uniformly to a width of 16,000 feet at a horizontal distance of 50,000 feet from the primary surface. Its centerline is the continuation of the centerline of the runway.

7. Heliport Approach Zone - The inner edge of this approach zone coincides with the width of the primary surface and is _____ 6/ feet wide. The approach zone expands outward uniformly to a width of 500 feet at a horizontal distance of 4,000 feet from the primary surface.

8. Transitional Zones - The transitional zones are the areas beneath the transitional surfaces.

9. Heliport Transitional Zones - These zones extend outward from the sides of the primary surface and the heliport approach zones a horizontal distance of 250 feet from the primary surface centerline and the heliport approach zone centerline.

10. Horizontal Zone - The horizontal zone is established by swinging arcs of _____ 7/ feet radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs by drawing lines tangent to those arcs. The horizontal zone does not include the approach and transitional zones.

5/ Insert dimension as set forth in FAR Part 77. Where more than one dimension is applicable, insert dimension identified to the appropriate runway involved.

6/ The size of the heliport primary surface must be based on present and future heliport operations.

7/ The radius of arc is:
a) 5,000 feet for all runways designated utility or visual,
b) 10,000 feet for all others.
The radius of the arcs for each end of the runway shall be the same. The radius used shall be the longest determined for either end.

11. Conical Zone - The conical zone is established as the area that commences at the periphery of the horizontal zone and extends outward therefrom a horizontal distance of 4,000 feet.

## SECTION IV: AIRPORT ZONE HEIGHT LIMITATIONS

Except as otherwise provided in this Ordinance, no structure shall be erected, altered, or maintained, and no tree shall be allowed to grow in any zone created by this Ordinance to a height in excess of the applicable height limit herein established for such zone. Such applicable height limitations are hereby established for each of the zones in question as follows:

1. Utility Runway Visual Approach Zone - Slopes twenty (20) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 5,000 feet along the extended runway centerline.

2. Utility Runway Nonprecision Instrument Approach Zone - Slopes twenty (20) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 5,000 feet along the extended runway centerline.

3. Runway Larger Than Utility Visual Approach Zone - Slopes twenty (20) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 5,000 feet along the extended runway centerline.

4. Runway Larger Than Utility With A Visibility Minimum Greater Than 3/4 Mile Nonprecision Instrument Approach Zone - Slopes thirty-four (34) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 10,000 feet along the extended runway centerline.

5. Runway Larger Than Utility With A Visibility Minimum As Low As 3/4 Mile Nonprecision Instrument Approach Zone - Slopes thirty-four (34) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 10,000 feet along the extended runway centerline.

6. Precision Instrument Runway Approach Zone - Slopes fifty (50) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a horizontal distance of 10,000 feet along the extended runway centerline; thence slopes upward forty (40) feet horizontally for each foot vertically to an additional horizontal distance of 40,000 feet along the extended runway centerline.

7. Heliport Approach Zone - Slopes eight (8) feet outward for each foot upward beginning at the end of and at the same elevation as the primary surface and extending to a distance of 4,000 feet along the heliport approach zone centerline.

8. Transitional Zones - Slope seven (7) feet outward for each foot upward beginning at the sides of and at the same elevation as the primary surface and the approach surface, and extending to a height of 150 feet above the airport elevation which is _____ feet above mean sea level. In addition to the foregoing, there are established height limits sloping seven (7) feet outward for each foot upward beginning at the sides of and at the same elevation as the approach surface, and extending to where they intersect the conical surface. Where the precision instrument runway approach zone projects beyond the conical zone, there are established height limits sloping seven (7) feet outward for each foot upward beginning at the sides of and at the same elevation as the approach surface, and extending a horizontal distance of 5,000 feet measured at 90 degree angles to the extended runway centerline.

9. Heliport Transitional Zones - Slope two (2) feet outward for each foot upward beginning at the sides of and at the same elevation as the primary surface and the heliport approach zones and extending a distance of 250 feet measured horizontally from and at 90 degree angles to the primary surface centerline and heliport approach zones centerline.

10. Horizontal Zone - Established at 150 feet above the airport elevation or at a height of _____ feet above mean sea level.

11. Conical Zone - Slopes twenty (20) feet outward for each foot upward beginning at the periphery of the horizontal zone and at 150 feet above the airport elevation and extending to a height of 350 feet above the airport elevation.

12. Excepted Height Limitations - Nothing in this Ordinance shall be construed as prohibiting the construction or maintenance of any structure, or growth of any tree to a height up to _____ 8/ feet above the surface of the land.

8/ The adoption of height limits should be reasonable and based on land use considerations in the vicinity of the airport and the nature of the area to be zoned. The adoption of height limits should not be so low as to constitute a taking of private property without due process of law.

## SECTION V: USE RESTRICTIONS

Notwithstanding any other provisions of this Ordinance, no use may be made of land or water within any zone established by this Ordinance in such a manner as to create electrical interference with navigational signals or radio communication between the airport and aircraft, make it difficult for pilots to distinguish between airport lights and other lights, result in glare in the eyes of pilots using the airport, impair visibility in the vicinity of the airport, create bird strike hazards, or otherwise in any way endanger or interfere with the landing, takeoff, or maneuvering of aircraft intending to use the airport.

## SECTION VI: NONCONFORMING USES

1. Regulations Not Retroactive - The regulations prescribed by this Ordinance shall not be construed to require the removal, lowering, or other change or alteration of any structure or tree not conforming to the regulations as of the effective date of this Ordinance, or otherwise interfere with the continuance of nonconforming use. Nothing contained herein shall require any change in the construction, alteration or intended use of any structure, the construction or alteration of which was begun prior to the effective date of this Ordinance, and is diligently prosecuted.

2. Marking and Lighting - Notwithstanding the preceding provision of this Section, the owner of any existing nonconforming structure or tree is hereby required to permit the installation, operation, and maintenance thereon of such markers and lights as shall be deemed necessary by the _____ 9/ to indicate to the operators of aircraft in the vicinity of the airport the presence of such airport obstruction. Such markers and lights shall be installed, operated, and maintained at the expense of the _____ 10/.

## SECTION VII: PERMITS

1. Future Uses - Except as specifically provided in a, b, and c hereunder, no material change shall be made in the use of land, no structure shall be erected or otherwise established, and no tree shall be planted in any zone hereby created unless a permit therefor shall have been applied for and granted. Each application for a permit shall indicate the purpose for which the permit is desired, with sufficient particularity to permit it to be determined whether the resulting use, structure, or tree would conform to the regulations herein prescribed. If such determination is in the affirmative, the permit shall be granted. No permit for a use inconsistent with the provisions of this Ordinance shall be granted unless a variance has been approved in accordance with Section VII, 4.

9/ Insert the title of the appropriate official who has been charged with the responsibility for determining the necessity for marking and lighting.

10/ Insert the name of the appropriate political body or subdivision.

a. In the area lying within the limits of the horizontal zone and conical zone, no permit shall be required for any tree or structure less than thirty-five feet of vertical height above the ground, except when, because of terrain, land contour, or topographic features, such tree or structure would extend above the height limits prescribed for such zones.

b. In areas lying within the limits of the approach zones, but at a horizontal distance of not less than 4,200 feet from each end of the runway, no permit shall be required for any tree of structure less than thirty-five feet of vertical height above the ground, except when such tree or structure would extend above the height limit prescribed for such approach zones.

c. In the areas lying within the limits of the transition zones beyond the perimeter of the horizontal zone, no permit shall be required for any tree or structure less than thirty-five feet of vertical height above the ground, except when such tree or structure, because of terrain, land contour, or topographic features, would extend above the height limit prescribed for such transition zones.

Nothing contained in any of the foregoing exceptions shall be construed as permitting or intending to permit any construction, or alteration of any structure, or growth of any tree in excess of any of the height limits established by this Ordinance except as set forth in Section IV, 12.

2. Existing Uses - No permit shall be granted that would allow the establishment or creation of an obstruction or permit a nonconforming use, structure, or tree to become a greater hazard to air navigation than it was on the effective date of this Ordinance or any amendments thereto or than it is when the application for a permit is made. Except as indicated, all applications for such a permit shall be granted.

3. Nonconforming Uses Abandoned or Destroyed - Whenever the _____ 11/ determines that a nonconforming tree or structure has been abandoned or more than 80 percent torn down, physically deteriorated, or decayed, no permit shall be granted that would allow such structure or tree to exceed the applicable height or otherwise deviate from the zoning regulations.

11/ Insert here the title of the appropriate official charged with making this determination.

4. Variances - Any person desiring to erect or increase the height of any structure, or permit the growth of any tree, or use property, not in accordance with the regulations prescribed in this Ordinance, may apply to the Board of Adjustment for a variance from such regulations. The application for variance shall be accompanied by a determination from the Federal Aviation Administration as to the effect of the proposal on the operation of air navigation facilities and the safe, efficient use of navigable airspace. Such variances shall be allowed where it is duly found that a literal application or enforcement of the regulations will result in unnecessary hardship and relief granted, will not be contrary to the public interest, will not create a hazard to air navigation, will do substantial justice, and will be in accordance with the spirit of this Ordinance. Additionally, no application for variance to the requirements of this Ordinance may be considered by the Board of Adjustment unless a copy of the application has been furnished to the _____ 12/ for advice as to the aeronautical effects of the variance. If the _____ 12/ does not respond to the application within fifteen (15) days after receipt, the Board of Adjustment may act on its own to grant or deny said application.

5. Obstruction Marking and Lighting - Any permit or variance granted may, if such action is deemed advisable to effectuate the purpose of this Ordinance and be reasonable in the circumstances, be so conditioned as to require the owner of the structure or tree in question to install, operate, and maintain, at the owner's expense, such markings and lights as may be necessary. If deemed proper by the Board of Adjustment, this condition may be modified to require the owner to permit the _____ 10/ at its own expense, to install, operate, and maintain the necessary markings and lights.

## SECTION VIII: ENFORCEMENT

It shall be the duty of the _____ 13/ to administer and enforce the regulations prescribed herein. Applications for permits and variances shall be made to the _____ 13/ upon a form published for that purpose. Applications required by this Ordinance to be submitted to the _____ 13/ shall be promptly considered and granted or denied. Application for action by the Board of Adjustment shall be forthwith transmitted by the ____ 13/.

10/ Insert the name of the appropriate political body or subdivision.

12/ Insert here the official or body responsible for operation and maintenance of the airport to be zoned.

13/ Insert here the title of the appropriate official.

## SECTION IX: BOARD OF ADJUSTMENT

1. There is hereby created a Board of Adjustment to have and exercise the following powers: (1) to hear and decide appeals from any order, requirement, decision, or determination made by the _____ 13/ in the enforcement of this Ordinance; (2) to hear and decide special exceptions to the terms of this Ordinance upon which such Board of Adjustment under such regulations may be required to pass; and (3) to hear and decide specific variances.

2. The Board of Adjustment shall consist of _____ members appointed by the _____ 11/ and each shall serve for a term of _____ years until a successor is duly appointed and qualified. Of the members first appointed, one shall be appointed for a term of _____ year, _____ for a term of _____ years, and _____ for a term of _____ years. Members shall be removable by the appointing authority for cause, upon written charges, after a public hearing.

3. The Board of Adjustment shall adopt rules for its governance and in harmony with the provisions of this Ordinance. Meetings of the Board of Adjustment shall be held at the call of the Chairperson and at such other times as the Board of Adjustment may determine. The Chairperson or, in the absence of the Chairperson, the Acting Chairperson may administer oaths and compel the attendance of witnesses. All hearings of the Board of Adjustment shall be public. The Board of Adjustment shall keep minutes of its proceedings showing the vote of each member upon each question; or if absent or failing to vote, indicating such fact, and shall keep records of its examinations and other official actions, all of which shall immediately be filed in the office of _____ 13/ and on due cause shown.

4. The Board of Adjustment shall make written findings of facts and conclusions of law giving the facts upon which it acted and its legal conclusions from such facts in reversing, affirming, or modifying any order, requirement, decision, or determination which comes before it under the provisions of this Ordinance.

11/ Insert here the title of the appropriate official charged with making this determination.

13/ Insert here the title of the appropriate official.

5. The concurring vote of a majority of the members of the Board of Adjustment shall be sufficient to reverse any order, requirement, decision, or determination of the _____ 13/ or decide in favor of the applicant on any matter upon which it is required to pass under this Ordinance, or to effect variation to this Ordinance.

## SECTION X: APPEALS

1. Any person aggrieved, or any taxpayer affected, by any decision of the _____ 13/ made in the administration of the Ordinance may appeal to the Board of Adjustment.

2. All appeals hereunder must be taken within a reasonable time as provided by the rules of the Board of Adjustment, by filing with the _____ 13/ a notice of appeal specifying the grounds thereof. The _____ 13/ shall forthwith transmit to the Board of Adjustment all the papers constituting the record upon which the action appealed from was taken.

3. An appeal shall stay all proceedings in furtherance of the action appealed from unless the _____ 13/ certifies to the Board of Adjustment, after the notice of appeal has been filed with it, that by reason of the facts stated in the certificate a stay would in the opinion of _____ 13/ cause imminent peril to life or property. In such case, proceedings shall not be stayed except by the order of the Board of Adjustment on notice to the _____ 13/ and on due cause shown.

4. The Board of Adjustment shall fix a reasonable time for hearing appeals, give public notice and due notice to the parties in interest, and decide the same within a reasonable time. Upon the hearing, any party may appear in person or by agent or by attorney.

5. The Board of Adjustment may, in conformity with the provisions of this Ordinance, reverse or affirm, in whole or in part, or modify the order, requirement, decision, or determination appealed from and may make such order, requirement, decision, or determination as may be appropriate under the circumstances.

## SECTION XI: JUDICIAL-REVIEW

Any person aggrieved, or any taxpaper affected, by any decision of the Board of Adjustment, may appeal to the Court of _____ as provided in Section _____ of Chapter _____ of the Public Laws of _____ 14/.

13/Insert here the title of the appropriate official.

14/Insert the jurisdiction. Consideration should be given to the desirability of setting forth this procedure here, or as an alternative, attaching to all copies of this Ordinance, a copy of excerpts from the statute cited.

## SECTION XII: PENALTIES

Each violation of this Ordinance or of any regulation, order, or ruling promulgated hereunder shall constitute a misdemeanor and shall be punishable by a fine of not more than _____ dollars or imprisonment for not more than _____ days or both; and each day a violation continues to exist shall constitute a separate offense.

## SECTION XIII: CONFLICTING REGULATIONS

Where there exists a conflict between any of the regulations or limitations prescribed in this Ordinance and any other regulations applicable to the same area, whether the conflict be with respect to the height of structures or trees, and the use of land, or any other matter, the more stringent limitation or requirement shall govern and prevail.

## SECTION XIV: SEVERABILITY

If any of the provisions of this Ordinance or the application thereof to any person or circumstances are held invalid, such invalidity shall not affect other provisions or applications of the Ordinance which can be given effect without the invalid provision or application, and to this end, the provisions of this Ordinance are declared to be severable.

## SECTION XV: EFFECTIVE DATE

WHEREAS, the immediate operation of the provisions of this Ordinance is necessary for the preservation of the public health, public safety, and general welfare, an EMERGENCY is hereby declared to exist, and this Ordinance shall be in full force and effect from and after its passage by the _____ and publication and posting as required by law. Adopted by the _____ this _____ day of _____, 19 _____.

## EXAMPLE USE OF MODEL ORDINANCE

PROPOSED NUT TREE AIRPORT HAZARD ZONING ORDINANCE
County of Solano

An Ordinance regulating and restricting the height of structures and of objects of natural growth, and otherwise regulating the use of property and of air space in the vicinity of the Nut Tree Airport by creating airport approach zones, horizontal zones, conical zones, and transition zones; establishing the boundaries thereof; providing for changes in the restrictions and boundaries of such zones; defining certain terms used herein; referring to the zoning map which is incorporated in and made a part of this Ordinance; providing for enforcement of this Ordinance and prescribing penalties.

The Board of Supervisors of the County of Solano do ordain as follows:

SECTION 1: Pursuant to the authority conferred by the Government Code of the State of California, and in conformance with the standards of the Federal Aviation Administration, this Ordinance is adopted for the purpose of promoting and safeguarding the health, safety, and general welfare of the inhabitants of the County of Solano by preventing the creation, establishment or maintenance of airport hazards, thereby protecting the lives and property of the users of the Nut Tree Airport and of the occupants of the land in the vicinity of the airport, and preventing the destruction and impaired use of the Nut Tree Airport and the public investment therein.

SECTION 2: The creation or establishment of an airport hazard is a public nuisance and an injury to the area served by the Nut Tree Airport. It is necessary, in the interest of the public health and safety and the general welfare, that the creation or establishment of airport hazards be prevented. To the maximum extent legally possible, prevention of such hazards should be accomplished by the exercise of the police power without compensation. It is further declared that both the prevention of airport hazards and the elimination, removal, alteration, mitigation, or marking and lighting of existing airport hazards are public purposes for which the County of Solano expends public funds.

SECTION 3: SHORT TITLE: This Ordinance shall be known as the Nut Tree Airport Hazard Zoning Ordinance of the County of Solano.

SECTION 4: DEFINITIONS: As used in this Ordinance, unless the context requires otherwise:

a. "Airport" means the Nut Tree Airport.

b. "Airport Elevation" means the highest point (measured in feet above mean sea level) of the airport's usable landing area.

c. "Airport Hazard" means any structure or tree, or use of land in the vicinity of the airport, which obstructs the runway safety areas, clear zones, or approach surfaces as defined in FAR Part 77; any

airport the presence of such hazards. Such markers and lights shall be installed, operated, and maintained at the expense of the County of Solano.

SECTION 9: ADMINISTERING AGENCY: The County of Solano Planning Director is hereby designated as the administrator charged with the duty of administering and enforcing the provisions of this Ordinance. He so shall act as necessary to administer the Ordinance and enforce its provisions, including prosecuting violations through injunctive or other processes.

SECTION 10: FUTURE ACTIONS: No material change shall be made in the use of land (and water) and no structure or tree shall be erected, replaced, substantially altered or repaired, rebuilt, planted or replanted, allowed to grow higher, or otherwise established in any zone created by this Ordinance, unless a permit therefore shall first be applied for and granted. Requests for permits shall be filed with the County Planning Commission at least ninety (90) days prior to the intended action.

a. A permit shall not be required for a tree or structure less than 35 feet of vertical height above the ground in the horizontal and conical zones or any approach or transitional zone beyond a horizontal distance of 4,200 feet from each end of the runway EXCEPT when because of terrain, land contour, or topographic feature, such tree or structure would extend above the height limit prescribed for the respective zone. No permit shall be required for maintenance, repairs, or replacement of parts of existing structures where such action will not enlarge or increase the height of the existing structure.

b. Each application for a permit shall clearly indicate the purpose for which the permit is requested in sufficient detail to enable a determination whether the resulting use, structure, or tree would conform to the provisions of this Ordinance, or would create a hazard. Permits shall be granted except when nonconformance will result or when a hazard would be created.

c. Existing Uses: No permit shall be granted which would allow the creation or establishment of an airport hazard or permit a nonconforming use, structure, or tree to become a greater hazard to air navigation than it was on the effective date of this Ordinance or any amendments thereto, or than it was when the application for a permit was made. Except as indicated, the permit shall be granted.

d. Abandonment: Whenever the Planning Director determines that a nonconforming tree or structure has been abandoned, more than 80% torn down, physically deteriorated, or decayed, no permit shall be granted which would allow such a tree or structure to exceed the applicable height limit, or otherwise deviate from the zoning regulations.

e. Variances: Any person desiring to erect or increase the height of any structure, or permit the growth of any tree, or otherwise use his property, in violation of these zoning regulations, may apply to the County Planning Commission for a variance from such regulations. Such variances shall be allowed where it is duly found that a literal application or enforcement of the regulations would result in practical difficulty or unnecessary hardship, and the relief sought would not be contrary to the public interest, but would do substantial justice and be in accordance with the spirit of this Ordinance; provided that any variance be allowed subject to any reasonable conditions determined necessary and imposed by the County Planning Commission to effectuate the purposes of this Ordinance.

SECTION 11: APPEALS: Any person aggrieved, or any taxpayer affected, by a decision of the County Planning Commission may appeal to the Board of Supervisors.

a. Any such appeal must be filed with the Board of Supervisors within a reasonable time as provided by the rules of the Board of Supervisors, specifying the grounds for appeal.

b. An appeal shall stay all proceedings in furtherance of the action appealed unless the Planning Director certified to the Board of Supervisors that such a stay would, in his opinion, cause imminent peril to life or property. In such event, proceedings shall not be stayed except by order of the Board of Supervisors on notice to the Planning Director, and on due cause shown.

c. The Board of Supervisors shall fix a reasonable time for hearing appeals, give public notice and due notice to all involved parties, and decide upon the appeal within a reasonable time. At the hearing, any person may appear or be represented by an agent or attorney.

d. The Board of Supervisors may, in conformity with the provisions of this Ordinance, affirm, reverse, in whole or in part, the actions and orders of the Planning Director or may modify the order, requirement, decision, or determination as may be appropriate under the circumstances.

e. Judicial Review - Any person aggrieved, or any taxpayer affected by a decision of the Board of Supervisors, may appeal to the local court having jurisdiction.

SECTION 12: VIOLATIONS: Each violation of this Ordinance or any regulations, order, or ruling promulgated hereunder, shall constitute a misdemeanor and shall be punishable by a fine of not more than Five Hundred Dollars ($500) or by imprisonment. Each and every day during any portion of which any violation of this Ordinance is committed, continued, or permitted, shall be considered a separate violation and shall be punishable as herein indicated. It shall be the duty of the District Attorney of the County of Solano to bring and prosecute an action in a court of competent jurisdiction (including injunctive or punitive actions).

SECTION 13: CONFLICTING REGULATIONS: Where there exists a conflict between any of the regulations or limitations prescribed in this Ordinance and any other regulations applicable to the same area, whether the conflict be with respect to the height of structures or trees, the use of land, or any other matter, the more stringent limitation or requirement shall govern and prevail.

SECTION 14: SEVERABILITY: If any provision of this Ordinance or the application thereof to any person in any circumstance is, or shall be held invalid, such invalidity shall not affect the validity of the Ordinance, and to this end, the provisions of this Ordinance are declared to be severable.

SECTION 15: EFFECTIVE DATE: WHEREAS the immediate operation of the provisions of this Ordinance is necessary for the preservation of the public health, public safety, and general welfare, an EMERGENCY is hereby declared to exist, and this Ordinance shall be in full force and effect from and after its adoption on DATE and following publications and posting as required by law.

Adopted by the Board of Supervisors of the County of Solano this (date) _____.

Source: Draft Ordinance Proposed in Reference 42.

## APPENDIX N

## MODEL AVIGATION AND NOISE EASEMENT

WHEREAS, [property owner][1], hereinafter called Grantor, is the owner in fee of that certain parcel of land situated in the [City, County, State] more particularly described and identified in Exhibit A (legal description of property) attached hereto and made a part hereof, hereinafter called "PARCEL" and

WHEREAS, [ ] hereinafter called Grantee, is the [owner and/or operator] of certain properties upon which [airport], described in Exhibit B attached hereto, is located, said properties lying within [City, County, State] and furthermore being in close proximity to said PARCEL; and

WHEREAS, Grantor and Grantee wish to establish provisions so that aircraft using the [airport] shall have the right of flight and the right to cause noise, light, and other effects associated with the operation of aircraft in the airspace over and above said PARCEL.

NOW, THEREFORE, Grantor, for its heirs, executors, administrators, successors and assigns, for and in consideration of the sum of One Dollar ($1.00) and other good and valuable consideration, receipt and sufficiency of which are hereby acknowledged, hereby grants and conveys to Grantee, its successors and assigns forever:

1. A perpetual public-use avigation/noise easement subject to termination as expressly provided herein, and right-of-way for the free and unobstructed passage and flight of aircraft, of any and all kinds now known or hereafter invented, used or designed for navigation or flight in the air, of the class, size and category operationally compatible with [airport]. Said easement shall be in, through, over and across the airspace of said PARCEL in an airspace as described and depicted in Exhibit C (map of areas protected by easement including description of imaginary surfaces and elevations).

2. The rights herein granted shall include the right in such airspace to allow, make and emit such noise, light, vibrations, fumes, exhaust, smoke, air currents, dust, fuel particles, radio, television, and other electromagnetic interferences, and all other effects as may be inherent to the operation of aircraft for navigation or flight in the air.

[1] Insert appropriate names, titles, etc. in brackets used throughout the model.

3. Grantor hereby fully waives, remises and releases any right or cause of action that it may now have or that it may have in the future against Grantee, its successors, and assigns, and covenants not to sue due to such noise, light, vibrations, fumes, exhaust, smoke, air currents, dust, fuel particles, radio, television, and other electromagnetic interferences, and all other effects that may be caused or may have been caused by the operation of aircraft landing at, or taking off from, or operating at or on [airport]. Said release and covenant shall include, but not be limited to claims, known or unknown, for damages for physical or emotional injuries, discomfort, inconvenience, property damage, death, interference with use and enjoyment of property, diminution of property values, nuisance, or inverse condemnation or for injunctive or other extraordinary or equitable relief.

4. It is further agreed that Grantee as [owner and/or operator] of [airport] shall have no duty to avoid or mitigate such damages by, without limitation, setting aside or condemning buffer lands, rerouting air traffic, erecting sound or other barriers, establishing curfews, noise or other regulations, except to the extent, if any, that such actions are validly required by governmental authority. Grantor reserves such use, rights and privileges in said PARCEL as may be exercised and enjoyed without interference with or abridgment of the rights hereby granted.

5. (a) This grant of easement allows the level of aircraft noise impinging on Grantor's PARCEL to be the lesser of:

(1) The annual CNEL reflected on the latest map validated by the [County of ] and filed with the California Department of Transportation, Division of Aeronautics in accordance with §5050 of Title 21 of the California Administrative Code, or
(2) The annual CNEL reflected on any subsequent map validated by the [County of ] and filed with the California Department of Transportation, Division of Aeronautics in accordance with §5050 of Title 21 of the California Administrative Code.

(b) There is hereby created an irrebutable presumption that this grant of easement is overburdened by unreasonable use if the noise which impinges on the burdened property exceeds the easement by an amount equal to or greater than 1.5 dB CNEL, and Grantor may seek injunctive relief from the unreasonable use of the easement.

(c) There is hereby created an irrebutable presumption that this grant of easement is so overburdened by unreasonable use that its purpose is defeated if the noise which impinges on the burdened property exceeds the easement by an amount equal to or greater than 3.0 dB CNEL, and Grantor may seek a court finding that the easement is extinguished.

(d) The provisions of subdivisions (b) or (c) shall not apply under the following circumstances: [specify exceptions, if desired].

6. This grant of avigation/noise easement shall not operate to deprive the Grantor, his successors or assigns, of any rights that it may from time to time have against any individual or private operator for negligent or unlawful operation of aircraft.

7. For and on behalf of itself, its successors and assigns, Grantor hereby covenants with Grantee for the direct benefit of the real property constituting [airport] that neither Grantor nor its successors in interest or assigns shall hereafter construct or permit the construction or growth of any structure, tree or other object that penetrates an approved transitional, horizontal, or control surface as described and depicted in Exhibit C or that constitutes an obstruction to air navigation under FAA Part 77, or that obstructs or interferes with the use of the flight easements and rights of way herein granted or that creates electrical interference with radio communication between any installation upon said airport and aircraft, or as to make it difficult for pilots to distinguish between airport lights and other lights, or as to impair visibility in the vicinity of the airport, or as otherwise to endanger the landing, take-off or maneuvering of aircraft. Grantee reserves the right to mark and light as obstructions to air navigation any such building, structure, tree or other object now upon, or that in the future may be upon Grantor's property, together with the right of ingress to, egress from, and passage over Grantor's property for the above purpose.

8. All promises, covenants, conditions and reservations contained in this document are made and entered into for the benefit of [owner and/or operator] of [airport]. These promises, covenants, conditions and reservations shall run with the PARCEL, described and identified on Exhibit A attached, and bind Grantor's heirs, administrators, executors, successors and assigns to the maximum extent now or hereafter permitted by statute or case law and are intended by the parties to comply with California Civil Code §1468. The real property first hereinabove described as the PARCEL is the servient tenement and said [airport] is the dominant tenement. Grantor for itself and its successors and assigns waives all rights under Civil Code §1542. "Successors and assigns" as used in this paragraph includes without limitation: invitees, licensees, permittees, tenants, lessees, and others who may use easement rights reserved herein or use or be upon said PARCEL, and/or their respective officers, agents, and employees.

9. Grantor agrees to defend at its own cost, hold harmless and indemnify Grantee from any liability for or based upon the exercise of the easement rights granted herein.

10. The avigation/noise easement, covenants and agreements described herein shall continue in effect until [airport] shall be abandoned and shall cease to be used for public airport purposes.

Dated: _____

Signed: _____

_____

(Signatures of Grantor)

Source: Derived from Reference 47 and other examples of easements in current use.

## APPENDIX O

## MODEL NOISE EASEMENT AND RELEASE

[Owner][1] (Grantor), hereby grants to [airport operator] (Grantee) a perpetual easement on the following terms:

1. Description. The easement shall be an easement on, over and upon that certain real property situated on within the [City, County], State of California and the airspace above said real property (PARCEL) which property is described in Exhibit 1 attached hereto, and by this reference incorporated herein, the airspace being formed by a plane parallel to the surface of the real property, and having the same boundaries as those described in Exhibit 1 attached hereto and extending the boundaries of the plane perpendicular to the plane upwards to the limits of the atmosphere of the earth.

2. Benefit. The easement shall be appurtenant to and for the benefit of all of the real property comprising the [airport], hereafter called Airport, a legal description of which is attached hereto designated Exhibit 2 and by this reference incorporated herein, and such other additional property or interest therein as shall be subsequently acquired or designated from time to time by Grantee or its successors as constituting a part of the Airport, and the easement shall be in gross for the benefit of Grantee and all other persons and entities who directly or indirectly use the easement as a result of any type of use of the property and facilities constituting the Airport, including aviation ground and flight operations.

3. Use and Purpose. The easement shall be used for the existence on, over, upon and within the described PARCEL, of all noise, vibration, air currents, natural or artificial illumination and such matter, emissions, activities or other things that may occur or result directly or indirectly from the operations of the Airport, now and in the future, including but in no way limited to ground and flight operations of aircraft at, over, on or about the Airport. The easement shall not be used for the passage and flight of aircraft. However, this easement shall not affect such rights for the passage and flight of aircraft as such rights existed prior to the date of the easement and as are now or may be provided or permitted by law.

All of such uses shall be without any liability of Grantee or of any other person or entity entitled to the benefits of this easement to Grantor, Grantor's heirs, assigns or successors in interest to all or any part of the property or any interest therein or to any other person or entity using or located on or in the area subject to the easement for:

[1]Insert appropriate names, titles, etc. in brackets used throughout the model

- o damage to property or physical or emotional injury to persons, animals or any other living thing,

- o the diminution in value of any personal or real property,

- o discomfort or inconvenience of any type or kind to any person or thing,

- o or interference with television, radio or other types or kinds of electrical reception, transmissions or activities in the easement.

4. Release. Grantor, for itself and on behalf of the Grantor's heirs, assigns or successors in interest to all or any part of the property, or any interest therein and each person or entity using or located on or in the area subject to this easement, hereby releases and discharges Grantee and all persons and entities entitled to the benefits of the easement from all claims, demands, actions and causes of action of all types or kinds, known or unknown, existing or that might be created hereinafter by statute or case decision, arising out of any of the foregoing described injuries or damages resulting from the use of this easement by Grantee and any other person or entity entitled to the benefits of this easement pursuant to Civil Code Section 1542. Grantor further agrees to defend at its own cost, hold harmless and indemnify Grantee from any liability for or based upon the exercise of the easement rights granted herein.

5. (a) This grant of easement allows the level of aircraft noise impinging on Grantor's PARCEL to be the lesser of:

(1) The annual CNEL reflected on the latest map validated by the [County of ] and filed with the California Department of Transportation, Division of Aeronautics in accordance with Section 5050 of Title 21 of the California Administrative Code, or

(2) The annual CNEL reflected on any subsequent map validated by the [County of ] and filed with the California Department of Transportation, Division of Aeronautics in accordance with Section 5050 of Title 21 of the California Administrative Code.

(b) There is hereby created an irrebutable presumption that this grant of easement is overburdened by unreasonable use if the noise which impinges on the burdened property exceeds the easement by an amount equal to or greater than 1.5 dB CNEL, and Grantor may seek injunctive relief from the unreasonable use of the easement.

(c) There is hereby created an irrebutable presumption that this grant of easement is so overburdened by unreasonable use that its purpose is defeated if the noise which impinges on the burdened property exceeds the easement by an amount equal to or greater than 3.0 dB CNEL, and Grantor may seek a court finding that the easement is extinguished.

(d) The provisions of subdivisions (b) or (c) shall not apply under the following circumstances: [specify exceptions, if desired].

6. This easement and release and the uses authorized herein shall run with the property described in Exhibit 1, and bind Grantor's heirs, administrators, executors, successors and assigns to the maximum extent now or hereafter permitted by statute or case law and are intended by the parties to comply with Civil Code Section 1468. The real property first hereinabove described as the PARCEL is the servient tenement and said [airport] is the dominant tenement.

7. This noise easement, covenants and agreements described herein shall continue in effect until [airport] shall be abandoned and shall cease to be used for public airport purposes.

Dated: _____

By: _____

(Signatures of Grantor)

Source: Modified from Harbor Bay Isle Noise Easement and Release for Oakland International Airport, and other examples.

# APPENDIX P

## PROPOSED USE OF CONSERVATION EASEMENTS

### Concept and Application

The use of conservation easements has been proposed as an airport approach protection device. This form of easement involves the purchase of development rights. The airport would obtain the landowner's right to develop the property while leaving the right to use the land for agricultural or other open space activities specified in the easement agreement. The landowner would also retain the rights to keep others off the land, to sell or lease the property, etc. As with other types of easements, conservation easements must be accomplished on a parcel-by-parcel basis. Each easement is recorded in County records with the deed for the respective parcel and is binding on subsequent owners of the land.

Historically, conservation easements were first used for preservation of scenic qualities. More recently, they have become popular as means of preserving agricultural land. The total number of examples nationwide, however, is quite limited and, with few exceptions, their establishment has been voluntary on the part of the landowner. There are no known cases where conservation easements have been purchased for the purpose of airport approach protection.

The best use of conservation easements for airport-related purposes is to preserve existing compatibility within the critical inner portions of runway approaches and within the airport's noise impact boundary. Conservation easements are consequently most suited to agricultural lands and parcels having little or no incompatible development. Where a residence already exists, a "grandfather clause" exemption could be provided or the easement could cover all of the property except the dwelling site.

The advantage of the easements over fee simple acquisition is that they can be much less costly to obtain, especially when the property has no clearly foreseeable development potential. Compared to zoning the purchase of development rights gives greater long-term assurance that the land uses will remain compatible. It also provides compensation to the landowner for the use restrictions that would be involved. Accomplishing the same objective by zoning could constitute a taking of property.

### Limitations

The applicability of conservation easements to approach protection is limited in several ways. The most obvious is that they are useful only as a means of eliminating the potential for future incompatible development, not as a way of mitigating already existing incompatibilities. Another factor is the cost of acquisition and the uncertainties over how to compute it. If the cost is a large percentage of the fee simple value, then the latter option becomes more attractive. Part of the problem in computing the cost is the lack of examples to go by -- many of the conservation easements that have been established, not only have been voluntary on the part of the landowner, but have been donated or sold to a land trust at a reduced or "bargain" price.

The lack of examples is a limitation in other ways as well. As a means of airport approach protection, conservation easements are a relatively untried and an unfamiliar concept. If these easements are to be successfully established as a means of approach protection, then questions posed because of the newness of the concept will need to be addressed. Some of these issues are discussed below.

Determination of Cost

Determining the fair market value of conservation easements is one of the more difficult issues which must be dealt with. In theory, the value of development rights equals the market value of the land minus its value solely for agricultural or other open space use. The market value is based upon the concept of "highest and best use". The property's development potential -- taking into account the proximity of urban areas, the existing zoning, the possibility of rezoning, etc. -- is a major factor in this evaluation. Agricultural value is determined, again in theory, by the income capability of the property.

One means of establishing a fair value for a conservation easement is to conduct an appraisal. Obtaining an appraisal may require some special attention in that not all appraisers are familiar with the concept of development rights acquisition. A more difficult problem is the lack of comparable transactions for conservation easements or even for land sold strictly for its agricultural value. A wide range of "fair" values could result: in one local locality where conservation easements were being acquired, separate appraisals of the market value and agricultural value were obtained and, on some parcels, the latter was appraised higher than the former. Ultimately, County policy decisions and the attitudes of the landowners will predominate in setting the price paid for purchase of development rights.

Other Issues

Although perhaps not generally as prominent as the question of cost, other issues associated with the purchase of development rights are also important. Some thoughts on several of these are presented below.

Defining the Restrictions -- It is essential that the rights to be obtained (in other words, the restrictions to be applied) be carefully and explicitly defined. The restrictions can be stated either by indicating the remaining uses which are acceptable and/or by defining the uses prohibited. The restrictions could be slightly varied depending upon the location of each property with respect to the airport. For property within a clear zone, for example, all structures may be prohibited, whereas farther from the airport, farm structures and perhaps even a dwelling (if the parcel is large) may be acceptable. Also, the wording will need to assure the landowner that he is not surrendering any property rights other than the right of development and that the public will not have a right of access.

Method of Acquisition -- The question here is how hard should the County pursue the purchase of development rights. At one extreme would be the use of eminent domain and at the other would be purely voluntary sales. The former end of the spectrum is likely to result in higher costs, both for the easements themselves and for the acquisition procedures. It is uncertain how receptive landowners would be to selling their development rights voluntarily.

Enforcement -- Some provision will need to be made to inspect the acquired conservation easements to assure that unauthorized development has not taken place. Procedures will also be needed to be certain that unwarranted releasing of owners from the restrictions of the easements does not occur as a result of unawareness or misunderstanding of the easement provisions or for some other reason.

Remaining Use -- Care should be taken in the drafting of development restrictions to make sure that the remaining allowable use of the land is viable and profitable. Periodic reevaluation of the circumstances facing each property may be desirable. If warranted, some adjustments to the easement conditions may be appropriate.

Tax Implications -- The establishment of conservation easements would have tax implications for both the landowner and the County. By restricting the land's use to agricultural and open space use, the property can no longer be valued for its development potential and should therefore be taxed accordingly. This is essentially the same as the concept behind taxing of land placed in agricultural preserve contracts under the Williamson Act. Some loss of tax receipts may be incurred by the County, more in the long range (by which time the property might have been developed) than the near term. Another consideration for landowners may be the effect on their income, capital gains, and inheritance taxes. To some individuals, donating the development rights or selling them at a below-market-value price may have tax advantages.

Acceptability to the FAA -- Since a large share of the approach protection property acquisition cost is expected to be borne by the FAA, the eligibility and priority of conservation easements must be considered. As a true legal property interest, it appears clear that conservation easements are eligible for FAA participation; it is their priority which will require evaluation. Existing zoning and ALUC policies provide a measure of protection which the FAA might perceive as adequate. It is anticipated, however, that the information set forth herein will document the need and the cost-effectiveness of additional control.

Land Trusts -- One last issue concerns the possible role that a land trust might play in the acquisition of development rights around an airport. A land trust is a private, nonprofit, tax exempt corporation set up to acquire and manage lands in the public interest. Land trusts generally can act faster than governments in acquiring land, an advantage that could be valuable if a property comes on the market. Moreover, land trusts can negotiate gifts or bargain price sales of conservation easements, whereas a government must offer full market

value. A trust can serve as a broker, acquiring the easements and then selling them to a public agency, or it can hold and administer them itself. The American Farmland Trust (a nationwide organization with an office in San Francisco) and the Sonoma Land Trust are two trusts which perhaps could be helpful with regard to the airport's approach protection objectives.

Example of Proposed Use at Sonoma County Airport

Conservation easements are proposed to be acquired on all or parts of approach area and noise impact area parcels where the current use, with the exception of a single residence on a large parcel, is airport compatible. There are 11 such parcels north of the airport and 18 generally larger parcels on the south. In total, the Sonoma County plan proposes that conservation easements be obtained on approximately 792 acres.

- Conservation easements would be pursued with owners of all parcels involved. Where voluntary agreements cannot be reached within approximately five years of the initial offers, the urgency of obtaining the easements would be reexamined and, if necessary, the easement acquisition proceed by means of eminent domain.

- The possibility that some property owners may wish to donate conservation easements because of tax advantages should also be pursued.

- The easement agreement should allow any existing residences to remain, provided that no improvements be made which would increase the occupancy.

- Conservation easements should include the overflight and other rights associated with avigation easements.

- Appraisers familiar with both the concept of conservation easements and airport activity should be retained to determine fair values.

- The cost of obtaining conservation easements on any particular parcel will vary according to parcel-specific considerations. In terms of full market value, the conservation easement may be as little as 0% if a donation can be obtained and it may be cost-effective as high as 20%. If the cost is determined to be more than 20%, then consideration should be given to acquiring the property in fee and reselling it with appropriate restrictions.

- The possibility that a nonprofit organization such as the Sonoma Land Trust could play a part in the acquiring, holding, and/or administering of conservation easements in partnership with the airport should be further explored.

Source: Reference 10.

# APPENDIX Q

## EXAMPLE DEPARTURE PATHS AGREEMENT

The voluntary departure path height limitation at the San Carlos Airport is an example of cooperative pre-project planning activities. Recent development activities in the vicinity of the airport, a general aviation facility, included proposals for high-rise buildings from eight to fourteen stories in height. A 100-foot high hotel was to be located 3800 feet from the runway, almost directly on the runway centerline. Under FAR Part 77, with an approach slope of 20:1 to the runway, the proposed hotel building could be as high as 180 feet. However, members of the San Carlos Chamber of Commerce were concerned that even the 100-foot building would pose a safety hazard to the twin engine aircraft commonly flying out of San Carlos when mechanical problems reduce climb performance on departure.

At the request of the Chamber of Commerce, the developer, Redwood Shores, Inc., met with members of the Chamber's Commercial and Industrial Committee and with the Airport staff to discuss their concerns. In addition to the height limits applicable to the property under current FAR Part 77, the developer agreed to limit the height of buildings above the existing ground level within two defined departure paths at the northwesterly end of the San Carlos Airport runway. Within these zones, building heights will be limited to sixty (60) feet above mean sea level which is approximately fifty (50) feet above the airport runway. This voluntary height limit restricts the height of buildings in these designated paths to one-third of the height presently allowed under Federal Aviation Regulations Part 77. The proposed 100-foot hotel has been relocated, outside these two departure paths.

The agreement, with a map illustrating the protected departure paths, has been recorded in the minutes of the San Mateo County ALUC meeting of April 14, 1983. This is the extent of formality to the agreement.

The key point is to recognize that such negotiated settlements are most successfully achieved when the parties involved consult early, before the development plans progress to a level that major design changes are no longer economically feasible.

Source: San Mateo County ALUC, meeting notes, April 14, 1983.

## APPENDIX R

## GLOSSARY

Accelerate - Stop Distance: The distance required for an aircraft to accelerate to the critical engine failure speed (v) -- at which point it is assumed the engine fails -- and then brake to a complete stop. The speed at which engine failure is assumed to occur is selected by the aircraft manufacturer. If an engine fails at a speed greater than v, the pilot has no choice but to continue takeoff.

Accident Potential Zones (APZs): Designated areas of higher likelihood of accidents; accident potential zones for military airports are developed by reviewing the accident history of the airport, usually as part of an AICUZ study.

Acoustical Study: For the purposes of this report, a study performed by a person qualified in acoustical analyses, identifying construction materials and techniques required to achieve a specified noise level reduction in homes and offices as specified by the ALUC plan.

Aeronautical Study: A study performed pursuant to paragraph 77.31 ff of Part 77 "Objects Affecting Navigable Airspace" concerning the effect of proposed construction or alteration on the use of air navigation facilities or navigable airspace by aircraft. The conclusion of such a study is normally a determination as to whether the specific proposal studied would be a hazard to air navigation.

Air Carrier: Commercial aircraft operating pursuant to a federal certificate of public convenience and necessity, issued by the Civil Aeronautics Board.

Air Installation Compatible Use Zone (AICUZ): Department of Defense programs established by Department of Defense Instruction 4165.57 "Air Installation Compatible Use Zones", November 8, 1977.

Airport: An area of land or water used or intended to be used for the landing and takeoff of aircraft, and includes its buildings and facilities, if any.

Airport Classification:

- Basic Utility--Stage I. This type of airport accommodates about 75 percent of the propeller aircraft under 12,500 pounds. It is primarily intended to serve low activity locations such as small population communities and remote recreational areas. Such an airport provides "air access" to the national air transportation system. Usually, Stage I is only the first step toward development of a Stage II Basic Utility airport.

- o Basic Utility--Stage II. This type of airport accommodates about 95 percent of propellar aircraft under 12,500 pounds. It is primarily intended to serve locations which have a medium size population with diversity of usage and potential for increased aviation activities.

- o General Utility. This type of airport accommodates substantially all propeller aircraft of less than 12,500 pounds. It is primarily intended to serve either communities located on the fringe of a metropolitan area or a relatively larger population community remote from a metropolitan area. In either case, there should be a substantial usage or potential usage by aircraft having a gross weight of over 8,000 pounds.

- o Basic Transport Airport. The basic transport airport accommodates turbojet-powered airplanes up to 60,000 pounds gross weight. This type of airport is planned for use by "business jets," "corporate jets," and "executive jets."

- o General Transport Airport. A general transport airport accommodates transport category airplanes up to 175,000 pounds gross weight used in general aviation.

Airport Control Tower: A facility that through the use of air/ground communications, visual signalling, and other devices, provides air traffic control services to airborne aircraft in the vicinity of the airport and to aircraft operating on the airport/airfield movement area.

Airport Elevation/Field Elevation: The highest point of an airport's usable landing area measured in feet above mean sea level.

Airport Hazard: Any structure or object of natural growth located on or in the vicinity of a public-use airport, or any use of land near such airport, that obstructs the airspace required for the flight of aircraft in landing or taking off at such airport or is otherwise hazardous to such landing or taking off of aircraft.

Airport Land Use Commission (ALUC): A State-authorized body existing in each county having the responsibility to develop plans for achieving land use compatibility between airports and their environs.

Airport Layout Plan: Depicts existing and proposed airport facilities and land uses, their locations, and the pertinent clearance and dimensional information required to show conformance with the applicable standards. It shows the airport location, clear zones, approach areas, and other environmental features that may influence airport usage and expansion capabilities, and includes the following elements:

- airport layout
- location map
- vicinity map
- basic data table
- wind information

Airport Master Plan: A plan to provide guidelines for future development of an airport which will satisfy aviation demand and be compatible with the environment, community development, other modes of transportation, and other airports. See Chapter VII.

Airport Noise Control and Land Use Compatibility (ANCLUC) Study: A study tailored to the needs of the community and the airport, and designed to produce a variety of recommendations with regard to airport operations procedures, land use planning, and public involvement, which if implemented would limit the impacts of airport and aircraft noise on the airport environs.

Airport Proprietor (California): Owner of airport or other party having authority to control airport operations. Also the holder of an airport permit issued by the Department of Transportation (Caltrans), Division of Aeronautics pursuant to Article 3, Chapter 4, Part 1, Division 9, Public Utilities Code.

Air Traffic: Aircraft operating in the air or on an airport surface, exclusive of loading ramps and parking areas.

Altitude: The height of a point, measured in feet Above Ground Level (AGL) or from Mean Sea Level (MSL).

Ambient Noise Level: Background noise level, the normal or existing level of environmental noise at a given location.

Area Navigation (RNAV): A type of instrument approach using radio navigation where there is no VOR station. Location and course information is developed by on-board equipment in the aircraft by comparing the signals of two nearby VORs.

Blast Fence: A structure built behind the takeoff location of aircraft to protect these areas from high velocity jet exhaust gases by deflecting these gases upward.

Business Jet: Generally, twin engine turbojet/turbofan aircraft, a high percentage of which are owned by private companies who use the aircraft for business purposes.

Clear Zone: Defined in Federal Aviation Regulations, Part 152.9(b): an area at ground level, extending beyond the runway primary surface and underlying the approach surface; these zones, which include all of the area out to a point where the approach surface reaches 50 feet above ground level, are presented in detail on the Airport Layout Plan for each airport. The federal government requires that the airport owner have an "adequate property interest" in the clear-zone area in order that the requirements of FAR Part 77 can be met and the area protected from future encroachments. Adequate property interest may be in the form of ownership in fee simple (the most preferred) or lease (provided it is long term) or any other demonstration of legal ability to prevent future obstructions in the runway clear zone.

Climb Gradient: The rate of climb of an aircraft, express in feet per nautical mile.

Community Noise Equivalent Level (CNEL): Average daily noise level, averaged for each of the 24 hours, and weighted more heavily during evening and nighttime hours to account for the lower tolerance of persons to noise during those hours.

Commuter Air Carrier: An air carrier which performs at least five round trips per week between two or more points and publishes flight schedules of its operating times and destinations. These airlines are exempt from some of the requlations covering large carriers. Commuter airlines must be certified by the FAA and must comply with the flight and safety regulations appropriate to the size and aircraft operated. Commuters may operate aircraft seating up to 60 passengers. If the carrier elects to apply for a certificate of public convenience and necessity from the Civil Aeronautics Board, larger aircraft may be operated.

Consistency: An action, program, or project is consistent with the general plan if it, considering all its aspects, will further the objectives and policies of the general plan and not obstruct their attainment.

Control Tower: An FAA facility providing air traffic control service.

dBA: A-weighted sound level, in decibels, as measured on a sound level meter equipped with weighting networks that represent the way the human ear hears certain sounds. Overall readings can be taken with weighting networks which are called A-scale or B-scale or C-scale settings on the meter. These scales do not represent the true sound pressure level because some of the sound has sound has been filtered out. The A-scale setting filters out as much as 20 to 40 dB of the sound below 100 Hz, while the B-scale setting filters out as much as 5 to 20 dB of the sound below 100 Hz. The C-scale setting retains almost all the sound signal over the full frequency range. However, the B-scale and C-scale settings are rarely used.

Decibel, dB: A unit for describing the intensity or level of sound, equal to 20 times the logarithm to the base 10 of the ratio of the pressure of the sound measured to a standard reference pressure.

Decision Height: The height, specified in feet above MSL, above the highest runway elevation in the touchdown zone at which a missed approach shall be initiated if the required visual reference has not been established. The decision height applies only where an electronic glide slope provides the reference for descent, as in ILS or PAR.

Displaced Threshold: A runway threshold that is located at a point other than the designated beginning of the runway.

Distance Measuring Equipment (DME): Shows the pilot the air distance between the aircraft and a particular VOR station. DME has been installed at nearly all VOR stations. Since it is the air distance that is measured (in nautical miles), the receiving equipment in an aircraft flying at 35,000 ft directly over the DME station would read 5.8 nmi. An en route

air navigation aid which best suited the tactical needs of the military was developed by the Navy in the early 1950s. This aid is known as TACAN, which stands for tactical air navigation, or VORTAC, VOR-DMET. The aid combines azimuth and distance measuring into one unit instead of two and is operated in the ultra-high-frequency range.

Emergency Catchment Area: An area in which a pilot is obliged to find a suitable area for an emergency landing or controlled crash should the remaining engine power, following a failure, be insufficient to maintain level flight.

Federal Aviation Administration (FAA): A federal agency charged with regulating air commerce to promote its safety and development, encouraging and developing civil aviation, air traffic control, and air navigation and promoting the development of a national system of airports.

Federal Aviation Regulations (FAR): Regulations issued by the FAA to regulate air commerce; issued as separate "Parts", e.g., Part 77.

FAR Part 36: Establishes noise standards for the civil aviation fleet.

FAR Part 77: Establishes standards for determining obstructions in navigable airspace, sets forth requirements for notice of proposed construction or alteration and provides for aeronautical studies of obstructions to air navigation.

Flaps: Surfaces that can be extended downward at various angles from the trailing edge of an aircraft wing to modify the shape of the wing and the lift that it produces (e.g., 15° of flap, 20° of flap, etc.).

Frequency: The number of cycles per second (CPS) of a sound.

General Aviation: All types of aviation other than that performed by air carriers and the military.

Glide Slope: The angle of descent, measured in degrees, of an aircraft approaching a runway in preparation for landing.

Ground Controlled Approach (GCA): A radar approach system operated from the ground by air traffic control personnel transmitting instructions to the pilot by radio. The approach may be conducted with surveillance radar (ASR) only or with both surveillance and precision approach radar (PAR).

Heliport: An area of land or water used or intended to be used for the landing and takeoff of helicopters, and includes its buildings and facilities, if any.

Hertz (Hz): The designated unit for measuring the frequency of sound, also termed cycles per second (CPS).

Imaginary Surfaces: Surfaces established in relation to the end of each runway or designated takeoff and landing area (for heliports), as defined in paragraphs 77.25, 77.28, and 77.29 of FAR Part 77 "Objects Affecting the Navigable Airspace." Such surfaces include imaginary approach, horizontal, conical, transitional, primary and other surfaces.

Instrument Approach Procedure: A series of predetermined manuevers for the orderly transfer of an aircraft under instrument flight conditions to a landing, or to a point where a landing may be made visually.

Instrument Flight Rules (IFR): Rules governing the procedures for conducting flight under instrument meteorological conditions.

IFR Aircraft/IFR Flight: An aircraft conducting flight in accordance with instrument flight rules.

IFR Conditions: Weather conditions below the minimum for flight under visual flight rules (VFR).

Instrument Landing System (ILS): A precision instrument approach system. An ILS consists of two radio transmitters located on the airport; one radio beam is called the localizer and the other the glide slope. The localizer indicates to pilots whether they are left or right of the correct alignment for approach to the runway. The glide slope indicates the correct angle of descent to the runway (glide slopes vary from 2 to 3°). In order to further help pilots on their ILS approach, two low-power fan markers called ILS markers are usually installed so that they may know just how far along the approach to the runway they have progressed. The first is called the outer marker (LOM) and is located about 4 to 5 nmi from the end of the runway; and the other, the middle marker (MM) is located about 3,000 ft from the end of the runway. For category II operations (when visibility is quite poor), an additional marker called the inner marker (IM) is located 1,000 ft from the end of the runway. This inner marker is placed so as to alert pilots that they must have visual reference with the ground at that point, and if not abandon the approach. When the plane passes over a marker, a light goes on in the cockpit and a high-pitched tone sounds.

Instrument Meteorological Conditions (IMC): Conditions expressed in terms of visibility, distance from cloud, and ceiling less than the minima specified for visual flight rules.

Instrument Procedure: Any one of the following procedures defined in the U.S. Terminal Instrument Procedures (TERPS) manual:

- precision approach (straight-in or simultaneous)
- nonprecision approach (straight-in)
- circling
- departure procedure

Instrument Runway: A runway specially marked and lighted and served by instruments for landing under IFR conditions.

Intensity: The intensity of a particular sound, determined by measuring its pressure relative to a base or reference sound pressure, and expressed in decibels, dB.

Intermittent Noise: Noise that is not constantly present, but occurs periodically throughout the day.

Knots: Nautical miles per hour, the most common way to measure aircraft speed.

Ldn: Average day-night sound level.

Localizer: Part of an Instrument Landing System. The localizer equipment provides horizontal guidance information to landing aircraft.

Microwave Landing System (MLS): An instrument approach and landing system operating in the microwave spectrum which provides lateral and vertical guidance to aircraft having compatible avionics equipment.

Minimum Descent Altitude (MDA): The lowest altitude to which descent shall be authorized in procedures not using a glide slope. Aircraft are not authorized to descend below the MDA until the runway environment is in sight, and the aircraft is in a position to descend for a normal landing. The MDA is expressed in feet above MSL and is determined by adding the required obstacle clearance to the MSL height of the controlling obstacle.

Military: Refers to U.S. Army, Navy, Air Force, Marines, Coast Guard, Air National Guard.

Minimums: A set of conditions specified for operation of aircraft during IFR approach and departure under adverse weather conditions.

Nautical Mile: One nautical mile (nmi) is equivalent to 6076 feet.

Navigational Aid (Navaid): Any visual or electronic device (airborne or on the surface) which provides point-to-point guidance.

Noise: Defined subjectively as unwanted sound. The measurement of noise involves understanding three characteristics of sound: intensity, frequency, and duration.

Noise Abatement Procedures: Changes in runway usage, flight approach and departure routes and procedures, and vehicle movement, such as ground maneuvers or other air traffic procedures, which shift aviation impacts away from noise sensitive areas (e.g., runway use programs and preferred arrivals and depatures).

Noise Complaint: A recorded complaint concerning airport noise made by an individual and kept on file at the airport.

Noise Contours: Lines drawn about a noise source indicating constant energy levels of noise exposure. CNEL and Ldn are the measures used to describe community exposure to noise.

Noise Control Plans: Documentation by the airport proprietor of actions to be taken by the proprietor, alone, or in cooperation with FAA, airport users, and affected units of local government, with appropriate input from affected citizens, to reduce the impact of aviation noise.

Noise Exposure Level: The integrated value, over a given period of time, of a number of different events of equal or different noise levels and durations. The integration may include weighting factors during certain time periods for which people are more annoyed by noise. The single event noise exposure level (SENEL) is an integrated average noise level of one incident. The community noise equivalent level (CNEL) is the integrated average noise level over a 24-hour period with weighting factors for the number of events during evening (7 p.m. to 10 p.m.) and night (10 p.m. - 7 a.m.) time periods. See SENEL, CNEL and Chapter III for more detail.

Noise Impact Area: The area in square statute miles enclosed by the noise impact boundary less that area of land usage within the boundary that is considered to be compatible with the actual noise environment.

Noise Impact Boundary: An imaginary line around an airport joining all points for which the annual CNEL is equal to the criterion value.

Noise Insulation: Also called sound insulation, the materials and construction techniques applied to a structure to achieve outside to inside noise reduction.

Noise Level Reduction (NLR): The numerical difference, in decibels, between the average noise levels in two areas.

Nonconforming Use: Any pre-existing structure, tree, or use of land, which is inconsistent with the provisions of the ALUC, local land use or airport master plans.

Nonprecision Approach: An instrument approach that provides guidance to the runway but no vertical guidance (glide slope) to control the descent to the airport. VOR, RNAV, and NDB (non-directional beacon) approaches are nonprecision approaches.

Nonprecision Instrument Runway: A runway having instrument approach equipment that provides horizontal course guidance or area type navigation to touchdown.

Obstruction: Any object of natural growth, terrain, or permanent or temporary construction or alteration, including equipment or materials used therein the height of which exceeds the obstruction standards of subpart C of FAR Part 77 "Objects Affecting Navigable Airspace."

Operation: An aircraft takeoff or landing.

Obstacle Identification Surface (OIS): In TERPS, an imaginary plane used to determine the adequacy of obstacle clearances for instrument departure procedures. Objects which penetrate the OIS are obstacles and shall be considered in the departure procedure by specifying a flight path which will safely avoid the obstacle(s) or by specifying a climb gradient that will produce the required obstacle clearance.

Overflight Zone: The area where aircraft are maneuvering to enter or leave the traffic pattern, defined by the FAR Part 77 horizontal surface.

Overlay Zoning: Establishes development standards in areas of special concern (e.g., fault zones, airport vicinity, flood plains, and hillsides) over and above the standards applicable to basic zones (e.g., commercial, residential, and industrial).

Planning Boundary: The area designated by the ALUC surrounding each airport pursuant to Section 21675(c) of the Public Utilities Code in which the ALUC plan applies.

Precision Approach: An instrument approach providing vertical guidance to control descent to the airport. Included in this category are ILS and GCA approaches.

Precision Approach Runway: A runway having an existing approach procedure utilizing an Instrument Landing System (ILS) that provides horizontal and vertical course guidance to touchdown.

Precision Approach Radar (PAR): Radar displaying range, azimuth, and elevation (in relation to a glide slope) normally encompassing an area from 10 miles out from a runway to a position on the runway intercepted by the glide slope.

Proprietary Use Restrictions: Action by an airport proprietor which establishes limits on the use of the airport in terms of the number, type, class, manner, or time of aircraft operations at the airport.

Public Use Airport: Publicly or privately owned airport that offers the use of its facilities to the public without prior notice or special invitation or clearance, and that has been issued a California Airport Permit by the Division of Aeronautics of the California Department of Transportation.

Referral Area: The area surrounding each airport within which any proposed project is to be referred to the ALUC for review.

Retrofit: The refitting of existing "noisy" jet aircraft engines with quieter replacement engines.

Rotorcraft: Helicopter.

Runway: A defined area on a land airport, prepared for the landing and takeoff of aircraft. Runways are normally numbered in relation to their magnetic direction.

Safety Zone(s): The areas(s) in the vicinity of an airport in which land use restrictions are established to protect the safety of the public.

Single Event Noise Exposure Level (SENEL) or Sound Exposure Level (SEL): The A-weighted sound level of a single noise event, such as an aircraft overflight, measured over the time interval between the initial and final times for which the noise level exceeds a threshold level and normalized to a reference duration of 1 second. SENEL and SEL values are identical: SENEL is used in California, SEL is adopted by the EPA and the FAA.

The SENEL (SEL) expresses the level of a continuous 1-second signal that contains the same amount of energy as the entire noise event. This value is not equal to the maximum A-level occurring during the noise event. Aircraft noise events last more than 1 second. SENEL/SEL values will be higher than the maximum A-level for the same events.

Sound Level Meter: An instrument that provides a direct reading of the sound pressure level at a particular location. It consists of a microphone and electronic amplifier together with a meter having a scale graded in dB. Using electrical filters, it is possible to directly measure the A-weighted sound pressure level with such an instrument. The meter is normally set to read with a "slow response" which provides a running average measure of the sound with an effective integration time comparable to that of the human ear.

Sound Pressure: A measure of the change in pressure at a point in a sound field from the static value (i.e., atmospheric pressure) caused by the presence of the sound field. For most complex sources of sound, the sound pressure contains energy over a broad frequency range audible to humans.

Sound Pressure Level (SPL): The measurement of sound pressure, the units being the decibel or dB. The range in sound pressures from the minimum audible sound waves to those existing in the vicinity of a modern jet airplane is greater than a factor of one million. The sound magnitudes are therefore more conveniently expressed on a reduced scale: a logarithmic scale is used in which equal additions correspond to equal multiples of sound pressure; the reference pressure corresponds approximately to the minimum audible sound pressure. The logarithmic scale is a convenient scale to use since the ear responds to sound waves in a similar manner.

Sound Transmission Loss (TL): The reduction in sound magnitude upon passing through a medium or object such as a wall or partition.

Sound Transmission Class (STC): A single number rating of the sound transmission loss (TL) of a wall or structure which attempts to account for the variation in TL with the frequency of the sound.

Structure: An object, including a mobile object, constructed or installed by man, including but without limitation, buildings, towers cranes, smokestacks, earth formation, and overhead transmission lines.

Terminal Area: A general term used to described airspace in which approach control service or airport traffic control is provided.

TERPS: U.S. Terminal Instrument Procedures, an FAA manual that establishes instrument flight procedures.

Threshold: The beginning of that portion of a runway usable for landing.

Touch and Go: A practice maneuver consisting of a landing and a takeoff performed in one continuous movement. A touch and go is defined as two operations: a landing and a takeoff.

Traffic Pattern: Projection on the ground of the aerial path associated with an aircraft on the crosswind, downwind, base, and final approach legs of the approach/departure process:

- o Crosswind Leg. A flight path at right angles to the landing runway off its upwind end.
- o Downwind Leg. A flight path parallel to the landing runway in the direction opposite to landing. The downwind leg normally extends between the crosswind leg and the base leg.
- o Base Leg. A flight path at right angles to the landing runway off its approach end. The base leg normally extends from the downwind leg to the intersection of the extended runway centerline.
- o Final Approach. A flight path in the direction of landing along the extended runway centerline. The final approach normally extends from the base leg to the runway. An aircraft making a straight-in approach VFR is also considered to be on final approach.

Visual Approach: An approach where an aircraft on a IFR flight plan or operating in VFR conditions under the control of an air traffic control facility and having an air traffic control authorization may proceed to the airport of its destination in VFR conditions.

VASI: Visual Approach Slope Indicator, a visual method of defining the glidepath to the runway. VASI lights project red and white beams from the approach end of the runway. Various combinations of colors (dependent on system in use) indicate "high", "low", or "on glidepath."

Visual Flight Rules (VFR): Flight rules that identify conditions when weather is adequate for aircraft to maintain safe separation by visual means. Under VFR conditions safe separation between aircraft is responsibility of the pilot.

Visual Meteorological Conditions (VMC): Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling equal to or better than specified minima.

VOR: Very-high frequency omnirange. A VOR station sends out radio signals in all directions. Each signal can be considered as a course or a route (referred to as a radial) that can be followed by an aircraft. In terms of 1° intervals, there are therefore 360 courses or routes that are radiated from a VOR station; from 0° pointing toward magnetic north increasing to 360° in a clockwise direction. The VOR transmitter station broadcasts on a frequency just above that of FM radio stations. VOR stations establish the network of airways and jet routes and are also essential to area navigation. The range of a VOR station varies but is usually less than 200 nmi.

Wind Shear: A condition typified by rapid changes in wind velocity and duration with altitude.

## APPENDIX S

## REFERENCES


1. Schultz, T.J., "Synthesis of Social Surveys on Noise Annoyance," The Journal of the Acoustical Society of America, pp. 377-405, August, 1978.

2. Environmental Protection Agency, "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety," Rep. 550/9-74-004, March, 1973.

3. Eldred, K.M., "Community Noise," U.S. Environmental Protection Agency Report NTID 300.3, December, 1971.

4. Federal Aviation Administration, Federal Aviation Regulations, Part 36, "Noise Standards: Aircraft Type and Airworthiness Certification," (Consolidated reprint incorporates changes 1 through 10), June, 1974.

5. Williams, Platzek and Mocine Planning Team, San Francisco International Airport - San Mateo County Environs Area Joint Land Use Study, Final Technical Report," March, 1980.

6. San Mateo County Airport Land Use Commission, "Airport Land Use Plan," adopted August 26, 1976.

7. Office of Noise Control, California Department of Health Services, "Guidelines for the Preparation and Content of Noise Elements of the General Plan," February, 1976.

8. Department of Housing and Urban Development, "Aircraft Noise Impact: Planning Guidelines for Local Agencies," prepared by Wilsey & Ham, and Bolt, Beranek & Newman, 1972.

9. Federal Interagency Committee on Urban Noise, "Guidelines for Considering Noise in Land Use Planning and Control," June, 1980.

10. Hodges and Shutt, Aviation Planning Services, "Approach Protection Study, Sonoma County Airport," prepared for the County of Sonoma, March, 1983.

11. The Parry Company, "San Mateo County Environs Joint Land Use Study - Technical Memo II-B.2 Noise Exposure Analysis," January, 1979.

12. Santa Clara County Airport Land Use Commission, "Land Use Plan for Area Surrounding Santa Clara County Airports," August, 1973, as amended.

13. Paul S. Veneklasen and Associates, "Noise Insulation Problems in Buildings," prepared for the Santa Clara County Airport Land Use Subcommittee, Airport Land Use Commission, January, 1973.

14. Charles M. Salter, Associates, Inc., "Aircraft Noise Study," prepared for Santa Clara County ALUC, May, 1981.

15. San Jose Municipal Airport Staff, presentation at ABAG/MTC Regional Airport Planning Committee, July, 1983.

16. Robert E. Monroe, "Airports as a Threat to Public Safety - A Look at the Record of General Aviation Aircraft Collisions with Buildings and Residences during 1964-1979," prepared by the Aircraft Owners and Pilots Association, March, 1982.

17. National Transportation Safety Board, "Annual Review of Aircraft Accident Data - U.S. Air Carrier Operations 1979," NTSB - ARC - 81, November, 1981.

18. National Transportation Safety Board, "Annual Review of Aircraft Accident Data - U.S. Air Carrier Operations," annual reports from 1974 through 1979.

19. National Transportation Safety Board, "Annual Review of Aircraft Accident Data - U.S. General Aviation," annual reports from 1974 to 1979.

20. National Transportation Safety Board, "Annual Review of Aircraft Accident Data-U.S. General Aviation Calendar Year 1979," NTSB - ARG - 81 - 1, November, 1981.

21. National Transportation Safety Board, "Special Study Review of Rotorcraft Accidents, 1977 - 1979," NTSB - AAS - 817, August, 1981.

22. James L. McElroy, "Aircraft Accidents in the Vicinity of Airports," prepared by Air Safety Publications for the Assembly Committee on Natural Resources and Conservation, January, 1973.

23. Naval Facilities Engineering Command, unpublished study, "Aircraft Accident Statistics 1968-1981," May, 1982.

24. Federal Aviation Administration, "Federal Aviation Regulations, Part 77, Objects Affecting Navigable Airspace," published January, 1975.

25. Sacramento Airport Land Use Commission, "Comprehensive Land Use Plan for Executive Airport," March, 1982.

26. Maurice A. Garbell, "Airport Safety for Santa Clara County," performed for the Santa Clara County Airport Land Use Commission, May, 1973.

27. Wadell Engineering Corporation, "General Aviation Reliever Airport Site Feasibility Study," prepared for the City of Fremont and City of San Jose, October, 1982.

28. Alameda County Airport Land Use Commission, "Airport Land Use Policy Plan," August, 1977.

29. National Transportation Safety Board, Various Aircraft Accident Reports, Undated.

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30. Department of the Navy, "Instruction OPNAVINST 11010.36," May, 1979.

31. Oregon Department of Transportation, Aeronautics Division, "Airport Compatibility Planning - Recommended Guidelines and Procedures for Airport Land Use Planning and Zoning," 1978.

32. Monterey Peninsula Airport District, "Airport Noise Control Land Use Compatibility Study - Monterey Peninsula Airport," prepared by Peat, Marwick and Mitchell, August, 1980.

33. Federal Aviation Administration, "United States Standard for Terminal Instrument Procedures (TERPS)," Third Edition, July, 1976.

34. Federal Aviation Administration, "Procedures for Handling Airspace Matters-7400.2B," February, 1974.

35. Business and Commercial Aviation, "1982 Planning and Purchasing Handbook," April, 1982.

36. International Civil Aviation Organization, "International Standards and Recommended Practices - AERODROMES - Annex 14," June, 1976.

37. Federal Aviation Administration, "Obstruction Marking and Lighting," AC70/7460-1F, September, 1978.

38. Federal Aviation Administration, "Federal Aviation Regulations Part 152, Federal Aid Program," December, 1974.

39. Daniel, Mann, Johnson, and Mendenhall, "Buchanan Field Airport Master Plan Study," prepared for Contra Costa County, February, 1977.

40. Noise Abatement Officer, San Francisco International Airport.

41. California Office of Planning and Research, "General Plan Guidelines," December, 1982.

42. Wadell Engineering Corporation, "Nut Tree Airport Master Plan and Environs Compatibility Study," November, 1982.

43. California Office of Planning and Research, "Bridging the Gap: Using Findings in Local Land Use Decisions," December, 1982.

44. Proceedings of the Monterey Conference on Planning for Rotorcraft and Commuter Air Transportation: "Heliport Noise," by Charles M. Cox, Bell Helicopter Textron, NASA Contract NAS2-10815, February, 1983.

45. The Parry Company, "Recommended Building Requirements and Their Incremental Costs for Residences in Areas with High Noise Levels," December, 1982.

46. Federal Aviation Administration, "Advisory Circular 150/5190-4," August, 1977.

47. National Institute of Municipal Law Officers, "NIMLO Model Avigation and Hazard Easement," August, 1964.

# APPENDIX T

## LIST OF FAA FEDERAL AVIATION REGULATIONS AND SELECTED ADVISORY CIRCULARS

**Subject:**
**ADVISORY CIRCULAR CHECKLIST**

**Date: 3/15/83**
**Initiated by: AMS-110**

**AC No: AC 00-2WW**

1. **Purpose.** This circular transmits the revised checklist of current FAA advisory circulars (AC's) as of March 15, 1983.

2. **Cancellation.** AC 00-VV, Advisory Circular Checklist, dated April 15, 1982 is canceled.

3. **Explanation of AC system.** The FAA issues advisory circulars to inform the aviation public in a systematic way of nonregulatory material of interest. Unless incorporated into a regulation by reference, the contents of an advisory circular are not binding on the public. Advisory circulars are issued in a numbered-subject system corresponding to the subject areas of the Federal Aviation Regulations (FAR's) (Title 14, Code of Federal Regulations, Chapter I, Federal Aviation Administration). An AC is issued to provide guidance and information in its designated subject area or to show a method acceptable to the Administrator for complying with a related Federal Aviation Regulation. This checklist is issued as necessary to list all current advisory circulars.

4. **The Circular Numbering System.**

a. **General.** The advisory circular numbers relate to the FAR subchapter titles and correspond to the Parts, and when appropriate, to the specific sections of the Federal Aviation Regulations.

b. **General and specific subject numbers.** The subject numbers and related subject areas are as follows:

| *General Subject Number* [1] | *Specific Subject Number* [2] | *Subject* |
|---|---|---|
| 00 | | GENERAL |
| | 1 | Definitions and Abbreviations |
| 10 | | PROCEDURAL RULES |
| | 11 | General Rule-Making Procedures |
| | 13 | Investigation and Enforcement Procedures |
| 20 | | AIRCRAFT |
| | 21 | Certification Procedures for Products and Parts |
| | 23 | Airworthiness Standards: Normal, Utility, and Acrobatic Category Airplanes |
| | 25 | Airworthiness Standards: Transport Category Airplanes |
| | 27 | Airworthiness Standards: Normal Category Rotorcraft |
| | 29 | Airworthiness Standards: Transport Category Rotorcraft |
| | 31 | Airworthiness Standards: Manned Free Balloons |
| | 33 | Airworthiness Standards: Aircraft Engines |
| | 35 | Airworthiness Standards: Propellers |
| | 36 | Noise Standards: Aircraft Type and Airworthiness Certification |
| | 37 | Revoked |
| | 39 | Airworthiness Directives |
| | 43 | Maintenance, Preventive Maintenance, Rebuilding and Alteration |
| | 45 | Identification and Registration Marking |
| | 47 | Aircraft Registration |
| | 49 | Recording of Aircraft Titles and Security Documents |
| 60 | | AIRMEN |
| | 61 | Certification: Pilots and Flight Instructors |
| | 63 | Certification: Flight Crewmembers Other Than Pilots |
| | 65 | Certification: Airmen Other Than Flight Crewmembers |
| | 67 | Medical Standards and Certification |
| 70 | | AIRSPACE |
| | 71 | Designation of Federal Airways, Area Low Routes, Controlled Airspace, and Reporting Points |
| | 73 | Special Use Airspace |
| | 75 | Establishment of Jet Routes and Area High Routes |
| | 77 | Objects Affecting Navigable Airspace |
| 90 | | AIR TRAFFIC AND GENERAL OPERATING RULES |
| | 91 | General Operating and Flight Rules |
| | 93 | Special Air Traffic Rules and Airport Traffic Patterns |
| | 95 | IFR Altitudes |
| | 97 | Standard Instrument Approach Procedures |
| | 99 | Security Control of Air Traffic |
| | 101 | Moored Balloons, Kites, Unmanned Rockets and Unmanned Free Balloons |
| | 103 | Revoked |
| | 105 | Parachute Jumping |

[1] Based on FAR Subchapter Titles.
[2] Based on FAR Part Titles, Excluding the 210 Series.

[1] Based on FAR Subchapter Titles
[2] Based on FAR Part Titles, Excluding the 210 Series.

| General Subject Number [1] | Specific Subject Number [2] | Subject |
|---|---|---|
| | 107 | Airport Security |
| | 108 | Airplane Operators Security |
| | 109 | Indirect Air Carrier Security |
| 120 | | AIR CARRIERS, AIR TRAVEL CLUBS, AND OPERATORS FOR COMPENSATION OR HIRE: CERTIFICATION AND OPERATIONS |
| | 121 | Certification and Operations: Domestic, Flag, and Supplemental Air Carriers and Commercial Operators of Large Aircraft |
| | 123 | Certification and Operations: Air Travel Clubs Using Large Airplanes |
| | 125 | Certification and Operations: Airplanes Having a Seating Capacity of 20 or More Passengers or a Maximum Payload Capacity of 6,000 Pounds or More |
| | 127 | Certification and Operations of Scheduled Air Carriers with Helicopters |
| | 129 | Operations of Foreign Air Carriers |
| | 133 | Rotorcraft External-Load Operations |
| | 135 | Air Taxi Operators and Commercial Operators |
| | 137 | Agricultural Aircraft Operations |
| | 139 | Certification and Operations: Land Airports Serving CAB-Certificated Air Carriers |
| 140 | | SCHOOLS AND OTHER CERTIFICATED AGENCIES |
| | 141 | Pilot Schools |
| | 143 | Ground Instructors |
| | 145 | Repair Stations |
| | 147 | Aviation Maintenance Technician Schools |
| | 149 | Parachute Lofts |
| 150 | | AIRPORT NOISE COMPATIBILITY PLANNING |
| | 151 | Federal Aid to Airports |
| | 152 | Airport Aid Program |
| | 153 | Acquisition of U.S. Land for Public Airports |
| | 154 | Acquisition of U.S. Land for Public Airports Under the Airport and Airway Development Act of 1970 |
| | 155 | Release of Airport Property from Surplus Property Disposal Restrictions |
| | 157 | Notice of Construction, Alteration, Activation, and Deactivation of Airports |
| | 159 | National Capital Airports |
| | 159/10 | Washington National Airport |
| | 159/20 | Dulles International Airport |
| | 169 | Expenditures of Federal Funds for Nonmilitary Airports or Air Navigational Facilities Thereon |
| 170 | | NAVIGATIONAL FACILITIES |
| | 171 | Non-Federal Navigation Facilities |
| 180 | | ADMINISTRATIVE REGULATIONS |
| | 183 | Representatives of the Administrator |
| | 185 | Testimony by Employees and Production of Records in Legal Proceedings |
| | 187 | Fees |
| | 189 | Use of Federal Aviation Administration Communication System. |
| 190 | | WITHHOLDING SECURITY INFORMATION; WAR RISK INSURANCE; AIRCRAFT LOAN GUARANTEE PROGRAM |
| | 191 | Withholding Security Information from Disclosure Under the Air Transportation Security Act of 1974 |
| 210 | | FLIGHT INFORMATION |
| | 211 | Aeronautical Charts and Flight Information Publications |
| | 212 | Publication Specifications—Charts and Publications |

[1] Based on FAR Subchapter Titles.

[2] Based on FAR Part Titles, Excluding the 210 Series.

Within the General Subject Number Areas, specific selectivity in advisory circular mail lists is available corresponding to the applicable FAR Parts. For example: under the 60 general subject area, separate mail lists for advisory circulars issued in the 61, 63, 65, or 67 series are available. An AC numbered "60" goes to all numbers in the 60 series—61, 63, 65, 67.

c. **Breakdown of subject numbers.** When the volume of circulars in a series warrants a subsubject breakdown, the general number is followed by a slash and a subsubject number. Material in the 150 series, Airports, is issued under the following subsubjects:

*Number and Subject*

150/1900 Defense Readiness Program.
150/4000 Resource Management.
150/5000 Airport Planning.
150/5020 Noise Control and Compatibility Planning for Airports.
150/5100 Federal-aid Airport Program.
150/5150 Surplus Airport Property Conveyance Programs.
150/5190 Airport Compliance Program.
150/5200 Airport Safety—General.
150/5210 Airport Safety Operations (Recommended Training, Standards, Manning).
150/5220 Airport Safety Equipment and Facilities.
150/5230 Airport Ground Safety System.
150/5240 Civil Airports Emergency Preparedness.
150/5300 Design, Construction, and Maintenance—General.
150/5320 Airport Design.
150/5325 Influence of Aircraft Performance on Aircraft Design.
150/5335 Runway, Taxiway, and Apron Characteristics.
150/5340 Airport Visual Aids.
150/5345 Airport Lighting Equipment.
150/5360 Airport Buildings.
150/5370 Airport Construction.
150/5380 Airport Maintenance.
150/5390 Heliports.
150/5900 Planning Grants for Airports.

**d. Individual circular identification numbers.** Each circular has a subject number followed by a dash and a consecutive number identifying the individual circular. This consecutive number is not used again in the same subject series. Revised circulars have a letter A, B, C, etc., after the consecutive number to show complete revisions. Changes to circulars have Chg. 1, Chg. 2, Chg. 3, etc., after the identification number on pages that have been changed. The date on a revised page is changed to the date of the Change transmittal.

**5. The Advisory Circular Checklist.**

**a. General.** Each circular issued is listed numerically within its subject-number breakdown in Appendix I. The identification number (AC 120-1), the change number of the latest change, if any, to the right of the identification number, the title, and the issuance date for each circular are shown. A brief explanation of the contents is given for each listing. For cross-referencing purposes an alphabetical section is added as Appendix II.

**b. Omitted numbers.** In some series, some consecutive numbers are missing. These numbers were assigned to advisory circulars still in preparation which will be issued later or were assigned to advisory circulars that have been canceled.

**6. How to order advisory circulars.**

**a. Free AC's.** If no price is listed after the AC, it is free. Send your order to:

U.S. Department of Transportation
Publications Section, M-442.32
Washington, D.C. 20590

To be added to or deleted from the MAILING LIST to receive free AC's as issued, write to:

U.S. Department of Transportation
Distribution Requirements Section, M-481.1
Washington, D.C. 20590

**Note:** Be sure to identify the subject matter numbers and titles. Also include a self-addressed mailing label. This will expedite the process.

**b. Sale AC's.** If a price is listed after the AC description the AC is sold by the Superintendent of Document, U.S. Government Printing Office. When "(Sub.)" is included with the price, the AC is available on a subscription basis only; supplements or changes to the basic document will be sent to you at no additional charge until the subscription expires. Orders for mailing to foreign countries should include an additional 25 percent of the total price to cover handling. No c.o.d. orders are accepted.

Make check or money order in the amount listed to Superintendent of Documents. Mail it with the exact title and stock number of the AC you are ordering to:

Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402

or to any of the following GPO bookstores located throughout the United States. (For convenience, both the Federal Telecommunications System (FTS) and commercial phone numbers are listed after each address.)

*Main Bookstore, 710 North Capitol St., N.W., Washington, D.C. 20402, FTS 275-2091, Commercial 202-275-2091.

*Commerce Bookstore, 14th & E Sts., N.W., Room 1604, Washington, D.C. 20230, FTS 377-3527, Commercial 202-377-3527.

*H.E.W. Bookstore, Rm. 1528, H.E.W. North Bldg., 330 Independence Ave., S.W., Washington, D.C. 20201, FTS 472-7478, Commercial 202-472-7478.

*Int'l Communication Agency, 1776 Pennsylvania Avenue, N.W., Washington, D.C. 20547, FTS 724-9928, Commercial 202-724-9928.

*Pentagon Bookstore, Main Concourse, South End, Washington, D.C. 20310, FTS 557-1821, Commercial 202-557-1821

*State Bookstore, 2317 North Lobby, 21st & C Streets, N.W., Washington, D.C. 20520, FTS 632-1437, Commercial 202-632-1437.

*Laurel Bookstore, 8660 Cherry Lane, Laurel, MD 20810, No FTS Number, Commercial 301-953-7974.

Atlanta Bookstore, Rm. 100, Federal Bldg., 275 Peachtree Street, N.E., Atlanta, GA 30303, FTS 242-6946, Commercial 404-221-6947.

Birmingham Bookstore, Roebuck Shopping City, 9220 Parkway East-B, Birmingham, AL 35206, FTS 229-1056, Commercial 205-254-1056.

Boston Bookstore, Rm. G-25, JFK Federal Bldg., Sudbury Street, Boston, MA 02203, FTS 223-6071, Commercial 617-223-6071.

Chicago Bookstore, Rm. 1463, 14th Floor, Everett M. Dirksen Bldg., 219 S. Dearborn Street, Chicago, IL 60604, FTS 353-5133, Commercial 312-353-5133.

Cleveland Bookstore, 1st Floor, Fed. Off. Bldg., 1240 E. 9th Street, Cleveland, OH 44199, FTS 293-4922, Commercial 216-522-4922.

Columbus Bookstore, Rm. 207, Federal Bldg., 200 North High Street, Columbus, OH 43215, FTS 943-6056, Commercial 614-469-6956.

Dallas Bookstore, Room 1C50, 1100 Commerce Street, Dallas, TX 75242, FTS 729-0076, Commercial 214-767-0076.

Denver Bookstore, Rm. 117, Federal Bldg., 1961 Stout Street, Denver, CO 80294, FTS 327-3964, Commercial 303-837-3964.

Detroit Bookstore, Patrick V. McNamara Fed. Bldg., Suite 160, 477 Michigan Avenue, Detroit, MI 48226, FTS 226-7816, Commercial 313-226-7816.

Houston Bookstore, 45 College Center, 9319 Gulf Freeway, Houston, TX 77017, FTS 527-5453, Commercial 713-226-5453.

Jacksonville Bookstore, 400 West Bay Street, Rm. 158, P.O. Box 35089, Jacksonville, FL 32202, FTS 946-3801, Commercial 904-791-3801.

Kansas City Bookstore, Rm. 144, Fed. Off. Bldg., 601 East 12th Street, Kansas City, MO 64106, FTS 758-2160, Commercial 816-374-2160.

Los Angeles Bookstore, Arco Plaza, Level "C", 505 South Flower St., Los Angeles, CA 90071, FTS 798-5841, Commercial 213-688-5841.

Milwaukee Bookstore, Rm. 190, Federal Bldg., 519 E. Wisconsin Avenue,, Milwaukee, WI 53202, FTS 362-1300, Commercial 414-291-1305.

New York Bookstore, Rm. 110, 26 Federal Plaza, New York, NY 10007, FTS 264-3825, Commercial 212-264-3825.

Philadelphia Bookstore, Rm. 1214, Fed. Off. Bldg., 600 Arch Street, Philadelphia, PA 19106, FTS 597-0677, Commercial 215-597-0677.

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*Washington Area Bookstores.