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PLANNING FOR INDUSTRIAL AND COMMERCIAL DEVELOPMENT
IN THE VICINITY OF AIRPORTS

A THESIS

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PLANNING FOR INDUSTRIAL AND COMMERCIAL DEVELOPMENT
IN THE VICINITY OF AIRPORTS

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SUMMARY

The purpose of this study is to provide a guide for planning the development of industrial and commercial land uses near an airport and the proper integration of such uses into the airport environment. The study discusses (1) selected industrial and commercial land uses considered appropriate for an airport location, (2) the factors influencing such land uses, and (3) the principal considerations in planning for airport-oriented industrial and commercial development.

To take advantage of the speed and flexibility of air transportation, many industrial and business firms are seeking to locate near an airport -- preferably in a planned "airport industrial park." This development pattern is reflected by (1) the significant growth of general aviation business flying, (2) improvements in airline passenger service, and (3) rapid change in air cargo patterns in the recent past and in the foreseeable future. These trends and their impact upon airport-oriented development are briefly discussed.

An airport location is not suitable or acceptable for all industrial, business and commercial activities. The aviation potential of (1) light manufacturing operations, (2) warehousing and distribution facilities, (3) research and development operations, (4) office developments and (5) commercial establishments is, therefore, discussed. Consideration is given to the general characteristics of these land uses, their business aviation and air cargo potential, and their compatibility with airport operations. The conditions necessary for such land uses to

locate near an airport and other factors which affect the suitability of a particular industrial and commercial activity for an airport location are also discussed.

Land use in the vicinity of an airport is influenced by (1) the aeronautical function of the airport, (2) aircraft operations, (3) regional and community characteristics, and (4) governmental regulations. This study considers each of these factors in terms of its impact on airport-oriented industrial and commercial development.

The study finally outlines the procedures and considerations involved in planning for airport-oriented industrial and commercial development. The basic elements in this planning process include (1) an evaluation of the airport's and community's potential for airport-oriented industrial and commercial development, (2) site evaluation, (3) physical planning of the proposed site, and (4) plan implementation.

The thesis concludes that the development of land in the vicinity of airports for appropriate industrial and commercial activities offers two major advantages: (1) it protects the airport against the encroachment of incompatible land uses and (2) permits the maximum economic potential of the airport to be realized. The "airport industrial park" concept is an important step toward attaining these objectives, but has, to date, been largely limited to isolated tracts of excess airport land. The findings of this study suggest that this approach through proper planning be expanded to encompass the development of all property on or immediately adjacent to the airport for its appropriate non-aviation use. Thus, the term, "airport development district", is introduced.

CHAPTER I

INTRODUCTION

Aviation has, since World War II, emerged as a competitive mode of transportation, rivaling both motor transport and rail service for the movement of people and goods. To take advantage of the speed and flexibility of air travel, many industrial and business firms are now seeking to locate near an airport -- preferably in a planned "airport industrial park." There are, at present, approximately 100 planned developments of this type in the United States and Canada.¹

The demand for an airport location and the evolution of the "airport industrial park" have significant planning implications. This thesis will attempt to place these implications in their proper perspective with regard to airport development.

Aviation Trends and Their Impact on Airport-Oriented Development

The growing dependence of industry and business upon air travel as a means of doing business is reflected by (1) the significant growth of general aviation business flying, (2) improvements in airline passenger service, and (3) rapid change in air cargo patterns in the recent past and in the foreseeable future.

General Aviation Business Flying

General aviation flying includes all civil flying except that by air carriers. Currently, 97 per cent of all civil aircraft are in the general aviation category.² Of the variety of purposes for which general

aviation aircraft are used, business flying is by far the most important, particularly with regard to industrial and commercial development.

Business flying has, since World War II, grown at a faster pace than general aviation as a whole. For example, the estimated number of miles flown for business purposes in 1946 represented only 14 per cent of the total general aviation mileage. By 1963, this figure had grown to 48 per cent. The number of business aircraft increased from 18,570 in 1954 to 21,127 in 1964.³

During recent years, a distinct change has also occurred in the types of aircraft used for business flying. There has been a marked shift from small capacity aircraft to larger, faster and more versatile models. These improvements in capacity, speed and range have led to more intensive use of business aircraft. For example, the total hours flown in business use increased between 1954 and 1964 by 52 per cent as compared to an increase of only 14 per cent in the number of business aircraft.⁴

A recent study concerning aircraft ownership provides some insight into the nature of aircraft-owning firms. The study revealed that the typical aircraft is owned by a small company reporting average annual business receipts between \$50,000 and \$500,000 and employing less than 20 people. Only 10 per cent of the aircraft-owning firms have business receipts over \$10 million, and only 7 per cent employ more than 500 workers. The study also revealed that only a small proportion of the potential corporate market has been realized. Only 1.1 per cent of over one million active corporations now own business aircraft.⁵

General aviation business flying represents the use of aircraft as a transportation vehicle in the conduct of a business. It is used to transport executives, sales personnel, technicians and components from plant to plant and to customer locations. Business flying offers speed and low costs, enables coverage of greater marketing territories, increases person-to-person contact and places the aircraft user in a better competitive position. As aircraft become more important to business operations, firms will seek to locate near a suitable airport.

Commercial Passenger Service

Commercial passenger operations provide an invaluable service to the business community. Today, approximately seven out of ten passengers are businessmen.⁶ Many find that the convenience, speed and long-range capability of modern airline services allow them to perform functions that would otherwise be impossible.

With the development of faster and larger aircraft and the introduction of short-range subsonic jets, ground travel time to and from the airport will become a critical factor. As improved communications and management techniques eliminate the need for a downtown location, many firms will demand office space readily accessible to the passenger terminal. This effort to reduce total door-to-door travel time is even today providing the incentive for the development of large office complexes near air carrier airports.

Air Cargo

Air cargo is the most dynamic segment of the air transportation industry. It is growing about twice as fast as passenger travel⁷ and has more than doubled in the past five years. In 1965, the airlines

moved 1.7 billion ton miles of air freight representing a one-year increase of 25 per cent for domestic freight and 46 per cent for international freight.⁸

To date, air cargo operations have been confined to (1) shipments where speed is a vital factor -- as in perishable goods and emergencies, (2) shipments of commodities which have a high value per unit weight, (3) relatively long-haul shipments and (4) shipments to destinations not accessible to other transportation.⁹

Despite its rapid growth in recent years the potential air freight market is largely undeveloped. Pending technological advances will likely provide a significant breakthrough for air cargo in the near future. The development of aircraft designed solely for air freight such as the Douglas 63F, the Lockheed C-5A, the Boeing 747 and the Douglas DC-10, and the introduction of improved handling procedures such as containerization will undoubtedly revolutionize the aviation industry. With the subsequent reduction of air freight costs to a level comparable with ground transportation and with the tremendous capacity of new aircraft, the airlines will almost certainly bid for larger and heavier items now reserved for rail and truck shipment.

The growing prospect of a faster, cheaper mode of transportation in the near future has profound implications for airport-oriented development. The entire pattern of wholesale distribution may be drastically altered. The elimination of warehousing facilities in many locations may be possible with no loss in shipping time and at less expense to the industry. The patterns of branch plant location now practiced by many firms may also be affected.

The Airport Development District

The "airport industrial park" concept is an important step toward better airport planning. This concept has, to date, however, been largely limited to the development of isolated tracts of land for use by airport-oriented industries. The results of this study suggest that this approach be expanded to encompass the development of all property on or immediately adjacent to the airport proper for its appropriate non-aviation use. Thus the term, "airport development district," is introduced.

The "airport development district" concept combines the attributes of a planned development with the exclusive value of an airport location. It has the following distinguishing features:

1. Long-range comprehensive planning, compatibility of land uses and planned environmental factors such as architectural and site design, landscaping and performance standards.
2. Integration of non-aviation development into the airport environment with taxiway and terminal area access provided where required.
3. Horizontal rather than vertical development of structures.

The Huntsville-Madison County Airport near Huntsville, Alabama, is a notable example of an "airport development district." When the property for this jet facility was purchased in 1964, 1200 acres surrounding the airport was also acquired specifically for non-aviation purposes. Upon completion of the airport master plan, a development plan for this area was formulated and adopted by the Huntsville-Madison County Airport Authority. Land was allocated not only for industrial use but also for

a full complement of commercial and office facilities. The quality of development achieved at this project, to date, attests to the validity of this planning approach.¹⁰

Purpose

This thesis was prepared as a guide for planning the development of appropriate industrial and commercial land uses on or near an airport and the proper integration of such uses into the airport environment. Primary emphasis was placed upon those industrial, business and commercial activities to which the availability of air transportation is a major locational factor but which are not essential to the operation of the airport.

Method

Information for this study was obtained from a variety of sources. First, a review and analysis of the existing literature pertinent to the subject was made. Particular attention was given to publications prepared by consultants in the field of airport planning, which included some recent surveys of airports offering sites for non-aviation use. Extensive use was also made of various Federal Aviation Agency publications. To supplement this published information, the author contacted by mail or interviewed approximately forty airport managers, planners and other persons involved in airport development. The comments of these individuals are incorporated where applicable throughout this thesis. Field inspections of the Huntsville-Madison County Airport and the airports in the Atlanta metropolitan area were also conducted.

Thesis Organization

The remainder of this study is outlined in the following manner. Chapter II analyzes the characteristics of selected land uses and their requirements and potential for an airport location. Chapter III discusses factors which influence land use in the vicinity of airports and Chapter IV outlines the procedure involved in planning for airport-oriented industrial and commercial development. Chapter V presents conclusions and recommendations.

CHAPTER II

SELECTED LAND USES IN THE VICINITY OF AIRPORTS

An airport location is not suitable or acceptable for all industrial, business, and commercial activities. The purpose of this chapter is to identify appropriate non-aviation activities and to evaluate their potential for an airport location. For this discussion, land uses are classified as follows:

1. Light Manufacturing
2. Warehousing and Distribution
3. Research and Development
4. Offices
5. Commercial Development

The aviation potential of any industrial or commercial activity is determined by two major factors: (1) the characteristics of the land use itself and (2) the characteristics of the airport. This chapter is concerned primarily with those locational characteristics of selected land uses that suggest the desirability of an airport location. The planner must, however, be constantly aware of the unique relationship between an airport and adjacent land uses. The impact of airport operations, and particularly noise, vibration, air pollution and crash hazard, upon surrounding development must be evaluated throughout the planning process. To facilitate such an evaluation, compatibility and other airport factors are discussed in greater detail in a later section.

Light Manufacturing

Industrial development in the immediate vicinity of air terminal facilities is, in general, restricted to medium-sized, light manufacturing. This general criteria, however, is not universally valid. Larger industries may also warrant an airport location if certain conditions are met. It should be noted that the potential for an airport industrial site varies significantly with the type of industry.

Necessary Conditions for Industrial Development in the Airport Environment

The influence of air transportation can be seen where: (1) substantial travel is done by company personnel to distant points, (2) substantial travel is done by customers or clients who visit the facility, (3) there is a significant movement of goods and services by air, and (4) there is an opportunity to improve a company's competitive advantage through the efficient use of air transportation.¹¹ All manufacturing firms that possess these characteristics, however, are not necessarily suited for an airport location. Such firms must also (1) be compatible with airport operations and surrounding development, and (2) possess the ability to decentralize.

Compatibility. The compatibility of manufacturing operations and an airport can best be measured in terms of scale, operational characteristics and labor requirements.

The physical dimensions of an industrial plant are an important factor in determining its appropriateness for an airport location. In most instances, the amount of property on or near an airport site suitable for industrial development is limited. A large manufacturing plant could conceivably require a substantial proportion of the available

property thus denying other potential occupants a desirable airport location. While perhaps justifiable for a large industry -- for example, an airframe manufacturer -- which requires an airport facility for its successful operation, the use of large amounts of available acreage by one manufacturer is generally undesirable.

The vertical scale of buildings and equipment is also a prime consideration in determining compatibility. Height restrictions in the vicinity of airports normally prohibit multi-story buildings and elevated structures such as grain elevators and blast furnaces. Consequently, only manufacturing operations that are adaptable to horizontal construction are desirable in the immediate proximity of an air terminal facility.

Operational characteristics such as the emission of smoke, glare, noise, electrical disturbances and other effects are particularly undesirable in the airport environment. Industrial wastes produced by certain manufacturing processes (chemical processing or meat packing, for example) may also either greatly overload available waste disposal facilities or require large acreages of valuable land for treatment in the form of sewage lagoons and oxidation ponds. The safety and ease of aircraft operations as well as the overall quality of airport development may be jeopardized if such conditions are allowed to exist. Consequently, those manufacturing operations that do not meet minimum operational standards are not considered appropriate for an airport location.

Certain industrial operations that require a large number of employees (textiles, food processing and similar activities) may be incompatible with airport operations for two reasons. First, the

concentration of a large number of people near an airport, and particularly in or near an approach zone, may constitute a crash hazard.

Second, the movement of employees to and from work may interfere with circulation patterns in the vicinity of the airport. This becomes a major consideration if such plants are located near access points to the terminal area of a large air carrier airport.

Ability to Decentralize

Industries most likely to decentralize and perhaps seek an airport location include (1) plants engaged in the latter stages of production and distribution and (2) maturing young enterprises.¹²

Plants involved in the assembly and distribution of intermediate and finished products tend to decentralize. Branch plants of larger firms as well as small subsidiary industries often fit this criteria. Such plants are no longer tied to raw materials and are adaptable to the production of standard products on an assembly-line basis. Through improved transportation, mechanization, and management techniques, activities of this type are able to seek a location that gives them a competitive advantage in terms of increased marketing territory or reduced labor costs.

Maturing young enterprises also tend to decentralize and may subsequently be attracted to an airport environment. In contrast, new enterprises generally require (a) low-rent loft buildings and (b) a central location near an experienced labor supply, managerial personnel and potential customers.¹³ Such industries can ill afford the relatively high initial cost of a developed airport industrial site. As these small firms become established, however, they frequently become prime

candidates for an airport location.

Aviation Potential of Major Industry Groups

Although certain segments of virtually all industries possess the characteristics outlined above, certain major industry groups demonstrate a greater aviation potential than others both in terms of (1) business flying and (2) air cargo operations. To facilitate a more detailed analysis of specific industries than presented in this discussion, the locational characteristics of industries that have located at airports and/or own aircraft are included as Appendix A.

Business Flying Potential. The relative potential of selected major industry groups for business flying was demonstrated by two recent surveys. The first, prepared by Conway Research, Inc., identified those industries that have located plants on or near an airport. The second, prepared by Cessna Aircraft Corporation, identified business aircraft owners by major industry groups.

The former study revealed that the manufacturing activities found most often at an airport are: metal fabricating, machinery manufacturing, electronics equipment manufacturing, aircraft parts manufacturing, automobile, truck and tractor manufacturing, plastics, printing and apparels manufacturing. The results of this survey are included as Appendix B.¹⁴

The Cessna survey revealed that among manufacturers maintaining their own business aircraft the largest users are manufacturers of fabricated metal products, followed by manufacturers of machinery other than electrical. Following in order were makers of miscellaneous products, electrical machinery, transportation equipment, lumber and wood

products, food and kindred products, paper products, petroleum products, textiles, stone-clay-glass, and primary metals.¹⁵ As supplementary material, a listing by Standard Industrial Classification (SIC) Code of the owners of large business aircraft, and of those industries that purchased Beechcraft aircraft in 1963 are also included as Appendices C and D respectively.

The business flying potential of a specific industry is affected by three major factors: (1) relationship to a parent industry, (2) market size and (3) labor force characteristics.

The use of aircraft by parent firms for travel to and from branch or field facilities represents a major proportion of current business flying.¹⁶ Branch plants and small subsidiary firms, even those serving relatively small market areas may, consequently, make extensive use of airport facilities capable of handling large business aircraft.

Manufacturing firms serving regional and national markets are more apt to utilize business aircraft than those firms serving a local market. While business flying offers little advantage to a local firm, its speed and convenience can greatly increase market territory and potential contacts for those companies competing in a large market area.

Labor force characteristics are the third major factor influencing business flying potential. Industries with a large number of high-salaried, professional and technical employees in addition to executive and managerial personnel may find business flying particularly attractive to their operations. Through the use of business aircraft, critical personnel can reach a required destination more quickly and with less travel time involved.

Air Cargo Potential. Air cargo is typically used for (1) manufacturing and distribution operations seeking broader markets, (2) rapid movement of delicate and perishable products not easily crated or transported, (3) emergency shipments of foods, drugs, and machine repair parts for vital assembly line operations, and (4) special customer services for fashion goods as well as a full range of miscellaneous products.¹⁷

A recent study prepared specifically for the Houston Intercontinental Airport indicates that the following categories of industry are the best potential users of the air cargo fleet.¹⁸

1. Petroleum and petrochemical: (a) small oil field tools and equipment; (b) heavy oil field equipment (valves, etc.); (c) well logging instruments; (d) plastics (bulk); (e) chemicals (samples); (f) rubber and miscellaneous plastic products; and (g) transcontinental pipeline replacement parts. (These products are particularly applicable to Houston's airport because of its proximity to a major source of petroleum raw materials.)

2. Garments and fabrics: (a) cotton samples and (b) high fashion.

3. Electronics: (a) tubes and component parts; (b) instruments; (c) specialty manufacturers and (d) controls.

4. Pharmaceuticals and supplies: (a) patent medicines; (b) prescription formulations; and (c) medical and dental supplies.

5. Mechanical parts and supplies: (a) automotive parts and accessories; (b) bearings; (c) machinery parts; and (d) hardware.

6. Food, produce and flowers: (a) general produce; (b) cut

flowers and plants; and (c) manufactured and processed foods.

7. Other manufacturers: (a) household appliances; (b) farm machinery and tractors; (c) metal fabricating; and (d) electrical equipment.

The air cargo potential of specific industries is affected by (1) the nature of products or raw materials and (2) market characteristics.

To date, air cargo has been largely restricted to relatively few items (light, perishable goods with a high value per pound). While the anticipated introduction of larger cargo aircraft and improved handling procedures will almost certainly provide for greater flexibility, the nature of the products and raw materials will remain the principal determinant of the feasibility of air cargo. Those industries that produce or require light, perishable or high value items will continue to be the prime candidates for air cargo service. As air freight rates decline, however, air cargo facilities will likely be adopted for use by a wider range of less critical products. The use of air cargo for heavy, bulk items such as ore, structural steel, etc. is not feasible in the foreseeable future.

Marketing characteristics are also a major factor influencing an industry's air cargo potential. Air cargo users can generally fit in one of two categories: (1) firms using air transportation for the shipment of manufactured goods to distant markets and (2) firms receiving raw or semi-processed materials by air. Industries falling into the first category normally compete for regional, national and international markets. Through the effective use of air transportation, goods can be

transported quickly from the plant or warehouse to distant points for final distribution to local markets. In the latter case, the use of air cargo service may allow certain raw material-oriented industries to seek a more favorable location near markets or labor supply. For example, industries engaged in the processing of perishable agricultural products could conceivably locate some distance from the area where these products are grown yet receive goods by air within the required time span.

Access Requirements

The success of manufacturing operations at an airport site depends greatly upon the accessibility of (1) taxiways, (2) terminal facilities, and (3) highway, rail and water transportation facilities.

Taxiway access is the unique feature offered to industry by an airport site. All industries desiring an airport location do not, however, require direct taxiway access. For firms utilizing general aviation business aircraft on an infrequent basis, close proximity to the general aviation aircraft parking aprons may be adequate. For those firms making frequent use of company-owned business and cargo aircraft, taxiway access is desirable.

Manufacturing operations making extensive use of air cargo service either require direct access to the freight terminal area, or must be capable of loading cargo aircraft at the plant site. Direct access to the passenger terminal is not necessary and may be undesirable due to increased traffic congestion.

All manufacturing operations must be accessible to adequate highway facilities and the local street system must be capable of accommodating large trucks. Rail service to the industrial site is also highly

desirable and adequate loading and unloading facilities should be provided. Access to waterways is also desirable where practical.

Warehousing and Distribution Facilities

The development of warehousing and distribution facilities near airports is closely associated with the growth of the air cargo industry. Continued improvement of air freight service promises to revolutionize current patterns in warehousing and eventually result in the evolution of the airport as a major distribution center for a wide variety of products.

Large wholesale and retail establishments, as well as many manufacturers, have found it necessary in past years to maintain a number of regional warehouses and distribution facilities to insure prompt delivery of goods and services to customers. The integration of air transportation into such operations, however, makes possible one-day service to virtually any location in the United States from one central warehouse, thus offering the following advantages: (1) the elimination of regional warehousing and distribution centers, (2) minimum inventory costs, (3) broader distribution, and (4) minimum pilferage en route.¹⁹

The efficiency of any air-oriented distribution system depends, in large measure, upon the extent to which ground travel time and handling operations can be minimized. Locating a warehouse near an airport and providing direct access to cargo aircraft or freight terminal facilities is one means of achieving this objective for goods either originating or terminating at the site. For those goods requiring local or regional distribution after arrival at an airport, the immediate availability of ground transportation facilities is highly desirable.

The location of truck terminals, rail spurs, and even docking facilities where possible in close proximity to the air freight terminal provides needed flexibility and contributes to the development of an airport as a self-supporting distribution center.

The "distribution center" concept "changes the idea of moving goods from one airport to another to the concept of providing a complete bridge from a producer in one place to a user in another location."²⁰ Holland's Schiphol Airport recently implemented the "distribution center" concept with heavy emphasis being placed on non-passenger services. Airport space was assigned for assembly, processing and handling of goods in a centralized location accessible to all modes of transportation. The result was an integrated transportation network that included air, highway, and rail service.²¹

The idea of an all-cargo airport serving as a distribution center for an economic region is relatively new and has not been implemented to date in the United States. This function is now performed by air carrier airports providing both passenger and cargo service. The efficient handling of air cargo at such airports is often prohibited by congestion around the terminal area. Under these circumstances, distribution facilities only interfere with other traffic and are, in general, undesirable. However, with the development of all-cargo airports and the effective separation of cargo and passenger facilities, warehouses, truck terminals and rail yards in close proximity to the air freight terminal become appropriate forms of non-aviation development.

Research and Development

Research and development operations have excellent potential for an airport location. These activities are highly dependent upon creative and well-paid employees who require the mobility offered by air transportation. For purposes of discussion the (1) general characteristics, (2) locational requirements, and (3) aviation requirements of research and development operations are considered.

General Characteristics

Research and development activities are customarily divided into three categories: basic research, applied research and development. Basic research is the search for new scientific knowledge with no commercial objective or practical application in mind. Applied research involves scientific investigation and experimentation for a practical or commercial purpose. Development is the transforming of a scientific discovery into a workable prototype or process.²²

A survey of planned research and development districts indicated four basic types of research and development laboratories:²³ (1) research laboratories of manufacturing firms, (2) contract research laboratories, (3) United States Government laboratories, and (4) university research laboratories. Each of these activities has significant potential for an airport site provided other locational requirements can be met.

Locational Requirements

The location of research and development operations is most influenced by:²⁴

1. A university with a graduate program in science and engineering.

2. A scientific complex of the United States Government.

3. The availability of supporting facilities. The required facilities in order of their importance are (a) computers, (b) a university library, and (c) instrument repair shops, machine shops and glassblowing shops.

4. Community amenities. Research scientists and engineers have high incomes and are well educated. Such people have a wide choice in where they live and work, and most prefer communities which provide intellectual stimulation through cultural activities and offer a pleasant environment.

Aviation Requirements

Air transport services are important to the efficient operation of research and development laboratories. Professional and managerial personnel travel frequently and consequently find airline passenger service and general aviation business flying desirable. General aviation aircraft are also used to transport lightweight products critical to research operations.

Access to the taxiway and runway system is desirable for those research laboratories to make extensive use of general aviation business aircraft. For others which utilize business aircraft less frequently, a site in proximity of the general aviation parking areas may be sufficient.

It is important that excellent airline transportation be available to professional and managerial personnel involved in research and development operations. Especially important is non-stop jet service to New York City, Washington, D. C., and the nation's industrial

centers.²⁵ Consequently, a site with good access to a major air carrier terminal may be desirable. Quick and direct access to large airports can also be provided from smaller satellite airports via general aviation aircraft.

The compatibility of airport operations and research and development activities should be carefully considered for two reasons. First, the testing of electrical and other types of equipment may interfere with radio communications and navigation aids. Second, noise and vibration caused by aircraft, especially at large airports, may interfere with delicate measuring devices used in many research and development operations.

Offices

The required mobility of businessmen, managerial personnel and professionals suggests a definite attractiveness of an airport for office facilities. The feasibility of an airport location for office development depends upon the extent to which (1) conditions favorable to office decentralization are present, (2) locational requirements can be met at an airport site and (3) aviation needs can be provided.

Conditions Favorable to Office Decentralization

Office facilities appropriate for an airport location generally exhibit the characteristics of all office development that has moved out of the central business district and into suburban office parks or other outlying locations. This decentralization has been prompted by a desire to avoid downtown congestion and to take advantage of relatively inexpensive land suitable for office development. The planned office park has greatly facilitated this shift by providing an efficient and

pleasant working environment protected by high design standards and strict development controls. The integration of planned office developments of this type into an airport environment provides the additional advantage of immediate access to air passenger service and general aviation facilities.

Three factors make the decentralization of office facilities possible: improved communications, data processing and automation, and the separation of office activity.

Improved communications have reduced the need of many office activities for a central location. Business transactions can be easily and quickly conducted through the use of sophisticated telephone and teletype equipment.

Data processing equipment has replaced the unskilled office workers who are dependent on public transportation, and has created more jobs for technical and skilled employees. These office workers earn relatively high salaries and often reside in suburban areas. They are generally more mobile and are, consequently, more easily attracted to an outlying location.²⁶

Some businesses that must remain in a downtown location, but have a large amount of routine activities, may be able to separate their operations. Sales offices, for example, may find an airport site highly desirable although some distance from the central office.

Locational Requirements

The attractiveness of an airport site for office development is influenced by its accessibility to ground transportation facilities, the proximity of prestige residential neighborhoods, the proximity of

commercial services, and adjacent land uses.²⁷

Accessibility to Ground Transportation Facilities. Office facilities near an airport should be accessible to both major thoroughfares and mass transportation, if available.

Office facilities require easy access to the central business district and to residential neighborhoods. Consequently, locations near major streets and highways serving the airport are generally desirable for office development. At large air carrier airports, however, conflicts between traffic generated by the airport and that generated by office facilities in the immediate vicinity may greatly increase congestion thus adversely affecting airport operations. Such conflicts should be avoided, even if office development must be prohibited.

Access to mass transportation lines facilitates the movement of low-income clerical and janitorial workers between the central city and airport-oriented office sites. An office location providing direct access to such facilities is therefore desirable.

Proximity to Prestige Residential Neighborhoods. An airport-oriented office facility normally attracts high-salaried technical, professional and executive personnel. These upper-echelon employees generally prefer prestige neighborhoods which afford good public and private facilities such as schools, libraries, parks and country clubs.²⁸ From the standpoint of convenience, close proximity to such neighborhoods is desirable.

High-quality residential development, however, is highly incompatible with aircraft operations, particularly at large airports. The

convenience of nearby residential areas for office personnel is far outweighed by the adverse effects of noise, vibration and air pollution associated with an airport environment. Consequently, the air transportation advantages must be a more important locational consideration if airport-oriented office facilities are to be successful.

Proximity to Commercial Facilities. Commercial facilities such as motels, restaurants, service stations and retail convenience shops are desirable in proximity to office facilities. Those commercial establishments serving the airport itself generally fulfill this requirement.

Adjacent Land Uses. Quality office development must be protected from the encroachment of industrial and commercial land uses, particularly those uses that may exert a blighting influence. A pleasant working environment is a prerequisite for a successful office park.

Aviation Needs

Business firms desire both air passenger service and general aviation facilities convenient to their executive and sales personnel. A location accessible to both taxiways and to the passenger terminal area is therefore desirable although impractical in many cases. Providing some office sites with access to the terminal area and some with access to taxiways and general aviation facilities may be one possible solution and provide a wider range of choice for the prospective tenant.

Commercial Development

Commercial establishments desire an airport location to capitalize upon the market created by other non-aviation development in the vicinity and by the passengers, employees and visitors that frequent an

air terminal facility. Those commercial uses considered most appropriate for the airport environment include (1) motels, (2) auto rental services, (3) restaurants, (4) banking facilities, and (5) airport parking facilities.

Airport Motels

The airport motel is a relatively new and prosperous development. These motels were originally intended to supplement downtown facilities but have come into their own with the increasing importance of air transportation.²⁹ Many of these motels, such as the 450-room Hilton Inn at the San Francisco International Airport, are quite large. On the average, airport inns vary from 100 to 150 room units.³⁰

Airport motels provide accommodations for air passengers utilizing the terminal facility (at air carrier airports) and for personnel and clients visiting industrial and business firms located nearby. Because of the nature of their market, airport inns enjoy some unique advantages. Seasonality is not a major problem and most enjoy high occupancy rates, sometimes exceeding 100 per cent (resulting from stays of less than a day).³¹

Airport motels also provide somewhat unique accommodations. In addition to normal motel services, facilities that can be used as an office by business executives are usually available. To accommodate the layover passenger, small "roomettes" are often furnished on an hourly basis. Many of the larger inns also provide convention facilities.

The most important locational factor for an airport motel is accessibility. The facility must be accessible -- preferably by foot and auto -- to the terminal area and to the air passengers it serves.

Access to industrial and business developments in the vicinity is also desirable. Taxiway access may offer an additional advantage, if practical. The Bakersfield, California, Auto-Air Skyways House and Restaurant is, for example, accessible to the general aviation parking apron as well as to highway facilities.³²

Auto Rental Services

Auto rental is an important service that should be provided at all air carrier airports. It is desirable, for the convenience of the traveler, that these facilities be located in or near the terminal and not at an off-airport site.

Auto rental requires (1) a rental counter area or areas, and (2) a parking area or areas in close proximity to the terminal building. The airline baggage claim area has proved to be the optimum location for rental counters. Rental car parking should be within 400 feet of the terminal (average renter is unwilling to walk more than 400 feet with baggage).³³

Restaurants

The type of restaurant locating near an airport ranges from the small, quick-order, counter-service type to deluxe, high-quality operations. The quick-order type is normally located within the terminal building for the convenience of passengers and should not be allowed elsewhere on airport property. Restaurants offering medium-priced meals are desirable for airport employees, office personnel and other persons frequenting the area. These facilities require both access to the terminal area and to the surrounding development, if possible. High-quality restaurants not only serve the airport, but often tend to be major traffic generators. Such facilities should be located so that

restaurant traffic does not interfere with the airport's circulation pattern.

Banking Facilities

Banking facilities serving the airport are of two major types: (1) convenience banking for air passengers, and (2) branch banking serving surrounding industrial and business firms, and their employees.

Convenience checking facilities should be located in the terminal building. These small banks are primarily concerned with the cashing of personal checks and the sale of traveler's checks for the convenience of the passenger.

Branch banking facilities should be available to industrial and business firms in the area and to their employees. Desirable services include payroll accounting for businesses, and checking and deposit services for their employees. Drive-in facilities may also be desirable.

Airport Parking Facilities

Airports, particularly large ones, must provide auto parking for (1) passengers, (2) visitors and (3) employees. The necessary parking facilities may be owned by the airport or privately depending on the arrangement best suited for the airport in question. In either case, parking facilities should reflect the airport's parking needs and should be included as part of the airport master plan.

Parking for passengers and visitors should be located as near as possible to the terminal building, preferably within 1000 feet so that walking distances may be kept to a minimum.³⁴ Separate parking areas should be provided for airport employees.

Conclusion

The land uses discussed in this chapter include those which are considered most desirable in an airport environment and are most likely to seek an airport location. This is not to say that other types of industrial, commercial and even residential uses would not be suitable under certain circumstances. In fact, virtually any type of land use may be desirable if properly planned and properly controlled. However, the potential of any land use for an airport location should be determined by two overriding factors: (1) the continued and efficient operation of the airport itself including anticipated expansion needs and (2) the ultimate effect of airport operations on the specific land use.

The continued and efficient use of the airport facilities should be the airport planner's primary concern. Consequently, the development of industries and commercial operations that in any way interfere with the operations of the airport should be avoided.

Land uses, particularly residential, that may be adversely affected by airport operations should be avoided when formulating a plan for non-aviation development. One primary reason for the development of an airport site for compatible industrial and commercial uses is to reduce the impact of noise, vibration, air pollution and crash hazard on surrounding areas. The development of the airport area for residential use, in general, defeats this purpose and is not recommended.

In the final analysis, the desirability of any land use for an airport location will be determined by the characteristics of the land use itself and their relationship to factors which influence a specific airport and its surrounding development. Chapter III discusses some of these factors and their general implications.

CHAPTER III

FACTORS INFLUENCING INDUSTRIAL AND COMMERCIAL DEVELOPMENT IN THE VICINITY OF AIRPORTS

The purpose of this chapter is to identify the factors that influence airport-oriented industrial and commercial development and to evaluate their effect upon the type and quality of development. Consideration is given to (1) an airport's aeronautical function, (2) the effect of aircraft operations, (3) regional and community characteristics, and (4) governmental regulations.

Aeronautical Function of the Airport

Airports are classified by aeronautical function as (1) air carrier airports or (2) general aviation airports.

Air Carrier Airports

Air carrier airports provide service for regularly scheduled flights by trunk, international and territorial carriers, local carriers, all cargo carriers and helicopter carriers.³⁵ Industrial and commercial development in the vicinity of an air carrier airport is influenced by (1) the quality of passenger service, (2) the quality of air cargo service, (3) the general aviation capability of the airport, and (4) the relative size of the airport.

Quality of Passenger Service. The quality of passenger service as reflected by the frequency of schedules, directness of routes and overall efficiency and convenience to the air traveler is a major

locational factor for certain types of non-aviation development. Airport-oriented office development requires direct non-stop service to many cities. Airports such as Atlanta Municipal, for example, which serve as passenger transfer points and provide direct connections to distant points, afford business and professional personnel located in the area a capability not found at airports of lesser importance. The attraction of an air carrier airport for research and development activities as well as light manufacturing concerns is also greatly enhanced if good passenger service is available.

Quality of Air Cargo Operations. The quality of air cargo operations is reflected by the frequency of schedules, the capacity of available cargo aircraft, the efficiency of cargo handling procedures, and the availability of ground transport facilities. Warehousing and distribution facilities such as truck terminals and rail yards have little incentive to locate near an airport if air cargo service is not available. Manufacturing firms utilizing air freight must also locate at an airport served by a cargo carrier.

General Aviation Capability. Manufacturing concerns, research and development operations and office facilities that require a general aviation capability as well as scheduled passenger and cargo service may find that a multi-purpose airport best meets their requirements. Although multi-purpose use of many large metropolitan airports cannot be justified because of increased air traffic congestion, many smaller terminals can accommodate both air carrier and general aviation aircraft.

The El Paso International Airport offers an excellent example of the advantage of this dual capability. Although this airport is capable

of handling all existing aircraft and accommodates a relatively large volume of air carrier traffic each year (29,659 operations in 1967), general aviation flying represents about 88 per cent of the total aircraft operations. The El Paso Airport and its adjacent industrial tract has been one of the most successful non-aviation development projects to date.³⁶

Airport Size. The relative size of an air terminal facility in terms of the number of passengers and employees is reflected by the extent to which commercialization has occurred in the vicinity. Large airports attract a full complement of motels, restaurants, auto rental establishments, banking facilities, service stations and a variety of other activities. In general, air passenger operations at smaller airports cannot fully support independent commercial activities.

General Aviation Airports

The attraction of general aviation airports for non-aviation development depends upon the airport's capability in terms of the type of aircraft it can accommodate. The Federal Aviation Agency classifies airports for this purpose as (1) Basic Utility (Stages I and II), (2) General Utility, and (3) Larger than General Utility.³⁷

Basic Utility. The Basic Utility type of airport will accommodate approximately 95 per cent of the general aviation fleet, i.e., all except a few types of twin-engine aircraft of over 8,000-lb. gross weight and transport aircraft. For purposes of phase development, the Basic Utility category is subdivided into Stages I and II.

Stage I airports are capable of accommodating about 75 per cent of the general aviation fleet including most single-engine and some

light twin-engine aircraft. This stage meets the requirements for that portion of business flying which utilizes the lighter planes and can be expanded to Stage II, the final stage of the Basic Utility airport!

As implied, the Basic Utility airport has only limited capability. Such airports are normally small and attract very little commercial activity. Their basic importance in terms of non-aviation development is related to business and industrial activities that use light planes for transporting executive and sales personnel. Substantial air cargo operations are beyond the capability of this type of airport.

General Utility. The General Utility airport accommodates all general aviation needs except transport aircraft. Airports of this type are suitable for all business aircraft with the possible exception of large executive jets. The extensive use of air cargo, however, is severely restricted.

Larger than General Utility. General aviation airports of this type can accommodate transport aircraft as well as all business aircraft. The development potential near such airports for industrial and business activities that utilize company-owned cargo aircraft or general aviation business aircraft is virtually unlimited.

Aircraft Operations

Aircraft operations produce noise, vibration and air pollution, and create a crash hazard. These effects may be deleterious to industrial and commercial development if structures are improperly located or have failed to comply with desirable building standards requiring sound proofing, air conditioning and other structural safeguards.

Noise

With the introduction of jet aircraft, noise and its effect on the area surrounding an airport has become a major concern. In fact, much of the current airport planning activity is directed at reducing the impact of aircraft noise on adjacent land uses. Two documents, Land Use Planning Relating to Aircraft Noise, prepared by Bolt, Beranek and Newman, Inc., and The Control and Protection of Land Uses in the Vicinity of Airports by Frank Osgood, an unpublished Master's thesis, Georgia Institute of Technology, provide excellent information concerning the planning procedures currently used to evaluate and reduce the effect of aircraft noise.

The effect of aircraft noise is greatest in the approach zone near the end of the runway and decreases rapidly as distance from the runway increases. Noise intensity is less significant in areas not immediately under the flight path. It should also be noted that the effects of noise on the surrounding area is greatly diminished at airports handling propeller-driven aircraft only.

The industrial, business and commercial establishments that desire an airport location are, in general, least affected by aircraft noise. In those operations where noise may interfere with sleep or conversation such as motels and office buildings, improved construction can, in most cases, reduce the noise intensity to a tolerable level.

Vibration

Vibration caused by large aircraft may have a detrimental effect on certain types of non-aviation development. Research and development operations, for example, that use delicate measuring instruments cannot

adequately function under such conditions.

The effect of vibration is most significant in those areas near the runways and the aircraft aprons, and decreases rapidly as the distance from these facilities increases. Consequently proper location of industrial activity is normally sufficient to eliminate the effect of vibration.

Air Pollution

The significance of air pollution resulting from aircraft exhaust, fuel spillage, odor, smoke, etc. is largely undetermined. A recent information report prepared by the American Society of Planning Officials states:

Although findings with respect to aircraft-generated air pollution are not yet conclusive, some studies indicate that jet aircraft emit substantial amounts of carbon monoxide and oxides of nitrogen during landing and takeoff. Relative to the total amounts of these pollutants in the air, such quantities may not be significant but in the vicinity of such heavily-used airports as O'Hare, Kennedy and Washington National, they may cause some concern.³⁸

Crash Hazard

Crash hazard at both large and small airports has been largely overrated in the past. Statistics show that the number of non-occupant deaths in aircraft accidents has been almost negligible when compared with non-occupant deaths associated with other forms of transportation. For example, between 1950 and 1963, aircraft accidents accounted for only 66 non-occupant fatalities as compared to 138,591 non-occupant fatalities attributed to ground vehicles during this same period.³⁹

As the above figures indicate, the actual probability of injury or property damage from falling aircraft is very remote. However, the likelihood of crash damage is much greater in some areas near an airport.

Aircraft crashes which have caused death or injury to persons on the ground have generally occurred in a direct line within one-half mile of the end of the runways. Beyond this point accidents occur in a more random pattern.⁴⁰ Because of the increased danger of crash damage, activities requiring the assembly of large numbers of people are generally undesirable in the runway approach zones.

Regional and Community Characteristics

The potential for airport-oriented industrial and commercial development at any airport is in large measure determined by (1) the economic character of the community, and (2) its location within an economic region.

Economic Character

A 1963 report,⁴¹ published by the Federal Aviation Agency, indicates that the economic character of a community is an important factor influencing aviation potential. Within each population-size group, communities were classified as marketing centers, institutional centers, and industrial communities according to the relative importance of trade or industry in the local economy.

Marketing centers, i.e. those cities with high wholesale sales per capita and a relatively low industrial employment, show the greatest potential for both commercial and general aviation flying. This fact can be attributed to the intense economic activity that characterizes a community of this type. Executive and sales personnel affiliated with manufacturing firms as well as wholesale and retail businesses, center their activities, at least in part, in marketing centers near suppliers and potential customers. Professional and business services

also tend to locate near the center of economic activity. In short, a marketing center tends to attract high income, management-oriented personnel -- those most likely to require air transportation.

Institutional centers also demonstrate an excellent potential for aviation activity. Universities, government installations, research facilities and other similar activities often require a high percentage of highly-paid, professional people who rely heavily upon air travel.

Industrial communities, as defined by the FAA study, have a high percentage of blue collar workers employed in manufacturing. Management personnel represent a relatively small percentage of the labor force and, consequently, the demand for air transportation is generally low.

Location

Communities of comparable population and economic character may still exhibit a wide variation in aviation potential due to location. The location of a community within a growing economic region and its proximity to an intersection of multiple airline routes and transfer points, natural land barriers, and materials, markets and labor contribute to its potential for industrial development.

Location Within an Economic Region. The potential of an airport for industrial and commercial development depends to some extent upon the proximity of the community to a major economic center. Recent improvements in transportation and communications have facilitated the movement of branch plants, small subsidiary industries and other economic activities from metropolitan areas to smaller communities. This trend toward decentralization, however, has been largely restricted to those communities in close proximity to a metropolitan area where

adequate transportation facilities are available and economic activity is concentrated. While the introduction of general aviation business aircraft promises to change the locational policy of many industries, reasonable accessibility to a center of economic activity remains an important factor. As an example, communities within 50 and 100 miles of a growing metropolitan area should have a greater attraction for airport-oriented industrial and business development than those communities located in more remote areas.

Intersection of Multiple Airline Routes and Transfer Points. Communities located near an intersection of multiple airline routes and transfer points offer special incentives for non-aviation development near airports. The reliability and frequency of service at airports such as Atlanta Municipal, Chicago's O'Hare, and Love Field in Dallas provide definite locational advantages to firms that utilize air passenger or air freight facilities in their operations.

The attraction of a major airport for airport-oriented business and industry also extends into the surrounding region. Firms locating near smaller airports are only a short time away from these major air carrier facilities via general aviation aircraft. Non-aviation activities locating in satellite cities have the advantage of available air carrier operations without contending with the congestion that exists around major airports (both ground and air) nor having to compete for high-priced land near such a facility.

Natural Land Barriers. Airports which offer considerable time savings over ground transportation modes offer a special incentive to business and industry. Natural land barriers such as large bodies of

water and mountain ranges may greatly increase the cost of ground transportation and place air transportation in a highly competitive position.

Proximity to Materials, Markets and Labor. Industries seeking to locate within a region consider three major locational advantages: materials, markets and labor. Ideally each of these elements should be present, but this is seldom the case. Consequently, industries tend to locate near that element which is most difficult and expensive to obtain.

Governmental Regulations

Development in the vicinity of an airport is subject to regulations imposed by a variety of governmental bodies and agencies. The most important of these include regulations established by the Federal Aviation Agency regarding navigable airspace, and land use controls imposed by local governments in the form of zoning and comprehensive planning.

Federal Aviation Agency Regulations

The Federal Aviation Agency "develops, directs and fosters the coordination of a national system of airports and directs the Federal-Aid Airport program."⁴² Within this broad framework, FAA performs the following functions that are of significance to non-aviation development:

1. Develops air traffic rules and regulates all aspects of navigable airspace.
2. Implements the Federal Airport Act by (a) providing grants-in-aid for the development of public airports, and (b) establishing standards for airport development.

The Federal Aviation Agency has no legal authority to enforce its standards except as prerequisites for federal aid. The local government

has the responsibility of incorporating these regulations into practical land use controls such as zoning.

Flight interference is the primary concern of FAA regulations relating to development in the vicinity of airports. Flight interference may take three forms: (1) airspace obstructions, (2) electrical interference, and (3) obscuration of airport lights.⁴³

Airspace Obstructions. A set of imaginary surfaces have been established to define the navigable airspace in the vicinity of airports. These surfaces are described below and illustrated in Figure 1. Objects penetrating these surfaces are considered a hazard to aircraft operations.

1. The Horizontal Surface is a plane, circular surface 150 feet above the established airport elevation and having a radius from the airport reference point (the approximate center of the airport landing area) as indicated in Table 1.

2. The Conical Surface is a surface with a slope of one foot in height for each 20 feet in horizontal distance beginning at the periphery of the "horizontal surface" and extending outward a specified number of feet (see Table 1).

3. The Instrument Approach Surface is a fan-shaped surface beginning at the end of all instrument runways and increasing to a width of 16,000 feet at a distance of 50,200 feet beyond the end of the runway. This surface has a slope of one foot in height for each 50 feet in horizontal distance.

4. The Non-instrument Approach Surface is a fan-shaped surface beginning at the end of all non-instrument runways. The dimensions of

Table 1. Dimensions of Imaginary Surfaces by Type of Airport

Type of Airport	Radius of Horizontal Surface (feet)	Horizontal Extension of Conical Surface (feet)	Non-Instrument Approach Surfaces		
			Surface Width at End of Runway (feet)	Surface Width 10,000 feet from runway (feet)	Surface Slope
Secondary	5,000	3,000	250	2250	20:1
Local	7,000	5,000	400	2400	40:1
Trunk	10,000	5,000	500	2500	40:1
Continental	11,500	7,000	500	2500	40:1
Intercontinental	13,000	7,000	500	2500	40:1

Source: Criteria for Determining Obstructions to Air Navigation, U. S. Civil Aeronautics Administration, Technical Order N-18. Cited in Horonjeff, Robert. Planning and Design of Airports. New York, N.Y.: McGraw-Hill Book Company, 1962, p. 155.

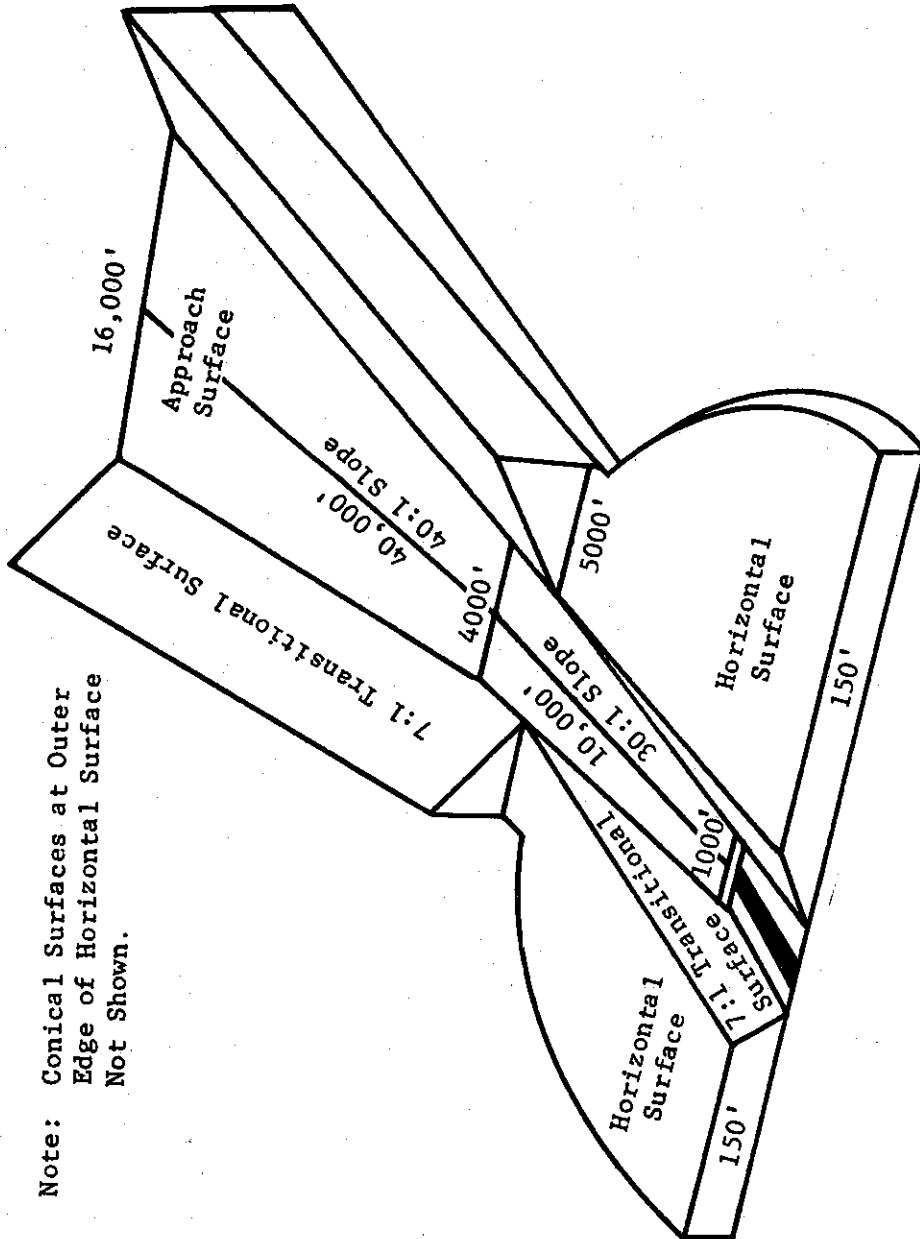


Figure 1. Approach, Horizontal and Transitional Surfaces for Obstruction Protection.

this surface vary with the type of airport as shown in Table 1.

5. Transition Surfaces include (a) inclined planes sloping upward and outward one foot vertically for each seven feet horizontally adjacent to all runways for the entire length of the approach zones, and (b) the zones of variable widths symmetrically located on either side of the runways.

6. Clear Zone. In addition to the imaginary surfaces, the Federal Aviation Agency has established a clear zone. This includes that area directly below the approach surface (instrument or non-instrument) extending to the point at which the approach surface is 50 feet above the elevation of the runway or 50 feet above the terrain at the outer extremity of the clear zone, whichever distance is shorter. Federal aid is contingent upon the airport's acquiring a proprietary interest in the clear zone sufficient to insure that the land remains free of obstructions.

Electrical Interference. The safe operation of airports, particularly under IFR (Instrument Flight Rules) conditions, demands the dependable operation of communication and navigation equipment. Under IFR conditions, electronic equipment must be relied upon exclusively until the aircraft is within a few hundred feet of the ground. Activities such as the testing of electrical equipment which might interfere with airport-to-aircraft communications must therefore be prohibited in certain areas.⁴⁴

Obscuration of Airport Lights. For safety reasons, the pilot of an aircraft must be able to readily identify airport lights. Consequently, lights from other sources which might be confusing or in any

way impair visibility must be prohibited.

Zoning

Zoning is perhaps the single most important legal land use control imposed by the local community. Comprehensive zoning restricts the height and bulk of buildings and other structures, the percentage of a lot that may be occupied, the size of required yards and other open spaces, and the use of buildings and land. "Airport" zoning is one common means of enforcing the FAA regulations outlined in the previous section.

Zoning in the vicinity of an airport should reflect sound airport planning for two reasons. First, inappropriate zoning may permit incompatible land uses to interfere with airport operations and impair the airport's value as a transportation facility. Second, inadequate zoning may severely restrict the activities of airport-oriented business and industry and eventually allow encroachment of residential and commercial development into the area.

It is in the interest of the airport operator to have the land surrounding the airport zoned for compatible uses; however, it is not necessarily in the interest of the suburban community or county which usually does the zoning to regulate land accordingly -- particularly from the point of view of strengthening the local property tax base.⁴⁵

If potential developers cannot be assured that property will be zoned in their best interests, the attraction of an airport for industrial and commercial development is greatly diminished.

Comprehensive Planning

Industrial and business firms look for sound planning. They seek order in development and protection against incompatible land uses.

Community relations problems for industry are minimized through planning

and the businessman can be assured of some continuity in government policy even though administrations may change.⁴⁶

Although good airport planning is essential to desirable non-aviation development, it is not sufficient of itself to insure proper development of the airport environment. Comprehensive planning in the political jurisdiction where the airport is located should also reflect the needs of the airport and its related development. All too often, such planning is at odds with the planning of the airport itself and future decisions made by local officials may drastically alter the attractiveness of the airport as an industrial or business site.

The elements involved in planning the development of an airport for non-aviation purposes are discussed in Chapter IV. The successful implementation of such plans may well depend upon the extent to which they are recognized and supported by comprehensive planning programs in the local community.

CHAPTER IV

PLANNING FOR AIRPORT-ORIENTED INDUSTRIAL AND COMMERCIAL DEVELOPMENT

Planned development of the airport environment for non-aviation purposes involves four basic steps: (1) an evaluation of the potential for airport-oriented industrial and commercial development, (2) site evaluation, (3) physical planning, and (4) plan implementation.

Evaluating the Potential for Airport-Oriented Industrial and Commercial Development

An airport's potential for airport-oriented industrial and business activity depends upon (1) the advantages offered by the community and (2) the demand for an airport location.

Advantages Offered by the Community

Industry and business seek to locate where they can realize maximum profit. That is, they seek to take advantage of community assets in terms of reduced labor and transportation costs, better markets, good industry-community relations, a pleasant working environment and a variety of other factors. To determine its potential for airport-oriented development, the community should assess its (1) airport facilities, (2) labor supply, (3) raw materials, (4) transportation and markets, (5) supporting facilities, and (6) amenities.

Airport Facilities. A complete inventory of available facilities at the airport under consideration should be made. This information should then be supplemented by a survey of other airports in the

community and the region. Particular emphasis should be placed upon the quality and extent of air passenger, air cargo and general aviation services, and possible competition for non-aviation development.

Direct, non-stop jet service to major cities is desired by most modern business firms. This service may be provided at the airport in question or at a major hub airport within reasonable commuting distance (by land or by air). In either case, consideration should be given to the frequency of schedules, route structure, rates and overall efficiency of passenger operations.

Warehousing, distribution centers and some manufacturing firms require efficient air cargo service. This service must be provided at the airport where these non-aviation activities are located. An analysis should be made of the service provided by air freight forwarders operating from the airport, the efficiency of cargo-handling equipment and procedures, and the availability of ground transportation facilities. If cargo service is not available, some consideration should be given to the capability of the airport for accommodating cargo aircraft.

Maintenance facilities and navigation aids are important to general aviation aircraft users. A recent survey by Industrial Development and Manufacturers Record of 100 airports now offering sites for industry, revealed that 96 per cent offered fuel and service for executive aircraft, 68 per cent maintained FAA radio facilities to handle flight plans and 61 per cent provided weather briefings.⁴⁷ The availability of maintenance and repair facilities is also an important factor, particularly for based aircraft.

Airport industrial and business sites do not, in general, compete

with other potential sites in the community. Mr. James R. Mettler, airport manager at the El Paso International Airport, states, "Our competition for our largest airport industrial tenant was not another site in El Paso, but rather two other airport sites at two other southwestern cities."⁴⁸ Before undertaking a plan for non-aviation development, the planner should be aware of the competition offered by other airports in the area.

Labor Supply. The available labor supply is one of the major determinants of a community's attraction for airport-oriented industrial and commercial development. Delineating the labor market area is the first step in evaluating this labor force. Such factors as the type of employment offered, wages, company benefits, competition, and ease of commuting all influence the extent of this market. The employment patterns, the characteristics of job seekers, and wage rates within the labor market area should be analyzed.

The planner should be aware of the existence of characteristics in the labor force that appeal to certain industries. Textiles, for example, require a large input of relatively unskilled labor, while other industries, such as scientific instruments, need a comparatively small number of employees, but require a high degree of skill.

Raw Materials. Sources of raw materials are a prime locational factor for many industries. This is particularly true if the raw material is perishable or costs more to transport than the finished product.

A study should be made of available raw materials in the community. Natural raw materials such as agricultural products, forest resources,

and petroleum and mineral resources are of importance to certain industries. Others require secondary raw materials (items which have undergone some degree of processing) for their operations.

Transportation and Markets. Reliable transportation is essential to industry for the distribution of products and the receiving of raw materials. The availability of trucking and rail facilities with adequate connections to major industrial centers and sources of raw materials are especially significant. Water transportation is also desirable, particularly if accessible to a deep water port.

The extent of a community's market area is closely associated with available transportation. Industrial and business firms may serve both regional consumer and industrial markets, and international markets. Regional consumer markets should be evaluated in terms of their size, the population within the area, and the average disposable income. The regional industrial market should be delineated based upon its accessibility to the community. It should be noted that the use of air transportation may sizeably increase the potential market area. International markets are largely contingent upon the accessibility of a deep water port, but aviation may also open this market for some products.

Supporting Facilities. Some communities possess facilities that attract certain types of industry. Research and development operations, for example, seek to locate near a university or government installation. Other activities may locate in the area to take advantage of highly skilled personnel that reside near facilities of this type.

Amenities. Air travel is attractive to highly-paid, well-educated executive and professional people. A recent survey showed that

the average aircraft owner earns more than \$20,000 each year.⁴⁹ These people have a wide choice of where they will live and work. They prefer communities that offer good schools, cultural facilities and a pleasant environment.

Demand for an Airport Location

Prior to the formulation of a site development plan and the expenditure of funds for site improvement, a thorough study of the potential market for airport-oriented business and industrial sites in the community should be made. The major question to be answered is what types of economic activities within the region are drawn to airport industrial parks and which of these activities will find a suitable location within the community.

Mr. Leigh Fisher, President of Airport Investors, Inc., wrote in a recent article:

Evidence to date tends toward the conclusion that while airport industrial developments do little for the creation of new industrial activities in a metropolitan economic region, an airport does have a specific, strong tendency to attract an industrial activity to a particular site among those otherwise competitive in the same metropolitan economic region. This factor prevails only when the location is good in all other respects.

Summed up, an airport oriented industrial development can cause the concentration of industrial [and commercial] growth at a particular point in an economic region, when and where all other economic forces for the industrialization [or commercialization] of that economic region already exists.⁵⁰

As the preceding excerpt suggests, the market analysis should be directed toward the economic region. The first step is, therefore, to delineate this economic region on some rational basis.

Answers to the following three questions should provide insight into the community's potential for airport-oriented industry and business:

1. What types of economic activity seek an airport location?
2. Which of these activities are located within the economic region?
3. What locational factors influence these economic activities and to what extent are they present in the local community?

The answer to the first of these questions is, for the most part, contained within this study. The discussion presented in Chapter II should provide valuable information for the planner concerning the appropriateness and potential of certain types of land uses in the airport environment. More specific data concerning the aviation potential of major industry groups is presented in Appendices B, C, and D. A comparison of this information and an inventory of activities within the economic region should provide an excellent starting point for determining the regional demand for an airport site.

The locational factors influencing potential industrial and business firms should then be evaluated. Appendix A should be helpful in identifying these locational factors for major industry groups. Particular emphasis should be placed upon the relationship to a parent industry, market characteristics, labor requirements, and the nature of products, services and raw materials. A comparison of these factors with the advantages offered by the community in terms of airport facilities, labor supply, raw materials, transportation, markets, supporting facilities and amenities should be indicative of its potential for airport-oriented development.

Site Evaluation

Although a community's potential for non-aviation development may

be good, its attraction for airport-oriented industrial and business firms is not assured. The airport site itself must be competitive.

Mr. James Mettler, airport manager of the El Paso International Airport, stated:

Your land must be competitive or it has no value to industry. If you cannot offer rail, highway and other advantages on a competitive basis in addition to your airport location advantage, don't spend money building something that has no competitive marketability.⁵¹

The airport site must be evaluated to determine the feasibility of developing it for non-aviation use. The evaluation should include (1) an inventory of existing development, (2) a topographical survey, (3) a transportation study and (4) an analysis of available community services.

Land Use Survey

The extent and nature of development in the vicinity of an airport has significant bearing on the feasibility of site development. Extensive urban development means higher land values and increased property costs. Even if these costs are not prohibitive, legal restrictions may prevent the acquisition of private property for resale or lease to private interests. The condition of buildings is also an important consideration. Blighted and deteriorating structures may adversely affect the entire development if not removed.

A detailed inventory of existing land uses near the airport should be made and shown graphically. The study should encompass an area of sufficient size to include all development that might affect or be affected by the airport and airport-related land uses. Emphasis should be placed not only on the location of structures, but also upon

their condition, present use and current value. Information should also be obtained concerning the ownership and availability of adjoining property.

Topographical Survey

Adverse topographical conditions such as steep terrain, poor drainage and unsuitable soil and sub-surface conditions may limit development potential and greatly increase development costs. Land suitable for industry is level, well-drained, flood-free and capable of bearing heavy loads. Fortunately, the flat terrain required for airport development normally meets the site requirements of modern industrial operations and topography is seldom a major problem.

The analysis of topographical conditions at an airport site is greatly facilitated by information obtained during the design and construction of the airport itself. Results of soil samplings and test borings should be analyzed and additional tests conducted if warranted. Consideration should also be given to site drainage patterns and the cost of providing adequate drainage facilities.

Transportation Study

Fast, reliable and flexible air transportation is the most important locational advantage an airport has to offer prospective development. However, industrial and business firms using air transportation also require both dependable inbound service of raw materials and supplies, and the efficient distribution of their products. Accessibility, therefore, becomes a prime factor in the proper development of an airport and its surrounding area.

Adequate highway facilities are absolutely essential to extensive

industrial and commercial development. Direct access to nearby population centers and major highway routes, especially the interstate highway system is highly desirable. Roadways must also be capable of accommodating projected traffic volumes without unnecessary congestion. A thorough analysis of existing and proposed highway facilities should be made and efforts initiated with state and federal agencies at an early stage for needed improvements.

Direct connections with major rail systems are desired by many industries. An investigation should be made of the proximity of existing rail lines, the policies of the railroad company concerning extension to industrial sites, and the cost of constructing the necessary facilities. Efforts should be made to secure a rail spur if at all possible.

Water transportation is relatively inflexible and is not a major consideration in the development of most airport sites. If waterways are available, however, access should be provided if possible. Consideration should be given to the relative proximity of docking facilities and the cost of providing access to these facilities. The Huntsville-Madison County Airport Authority has undertaken a project of this type. Efforts are now under way to provide access between the airport and the Tennessee River, a major inland waterway. Completion of this project will afford a transportation capability found at few airports.⁵²

Community Services Study

Certain services cannot economically be provided by prospective tenants and must be furnished by the public and private sectors of the community. The services include (1) water, (2) sewage disposal, (3)

electric power, (4) natural gas, (5) communications, and (6) fire and police protection.

Water. A recent study showed that 94 per cent of the airports now offering sites for industry provide water to the site.⁵³ Certain industries, notably chemicals, require large volumes of water of specified quality. Water temperature may also be significant at various seasons because of air conditioning and certain processing needs. For industries using water for plant sanitation purposes, system pressure and rate schedules are of importance.⁵⁴

If a public water system serves the area, consideration should be given to the capability of the system to meet industrial water standards and fire protection standards. The policy concerning the extension of water lines to industrial sites and the rate schedule should also be investigated. If a public system is not accessible, the cost of constructing an independent system should be determined.

Sewage Disposal. Sewage disposal facilities are preferably furnished by the community. Sewerage is now provided to 72 per cent of the existing airport industrial sites.⁵⁵ Consideration should be given to the ability of existing facilities to handle anticipated needs and to the cost of providing adequate facilities if required.

If the quantities of waste are large or wastes contain a high percentage of solids, chemicals, or other materials, independent sewage systems may become necessary. Under these circumstances, consideration should be given to the availability of surface streams for discharge, downstream usage of the water, present quality of the receiving stream, and the proposed treatment of the anticipated wastes.

Electric Power. Electric power, in most cases, must be provided by the community as evidenced at 99 per cent of the airports now offering industrial sites.⁵⁶

Industrial power requirements vary widely. Certain chemical processes, for example, have power requirements that are quite large while other industries desire low-cost electric current. Dependability of service is important to some types of industrial processing, where interruptions of power may be costly. Such industries often prefer communities affording multiple-line power service.

Available electric power service should be evaluated in terms of the ability of the local substation to meet industrial power requirements, the cost of improving service, if necessary, and the cost of electric power to the user.

Natural Gas. Large, dependable volumes of natural gas at reasonable rates are attractive to industry. Of the airports offering sites to industry, 78 per cent furnish natural gas.⁵⁷

Consideration should be given to the cost of providing gas service to the site, and the cost to the user. It should be noted that proximity to a natural gas pipeline does not assure service. Extension of such facilities must first have federal approval.⁵⁸

Communications. Good communications are essential to modern business. Many firms, particularly those with branch operations, rely largely on long-distance telephones and teletype to transact much of their daily business and to complete all order and shipment transactions. Generally, communication facilities are readily available to prospective customers, although in isolated instances, the local telephone company

may not be capable of providing modern services.

Fire and Police Protection. Protection of the investment in plants and equipment, the safety of employees, and insurance rates are dependent upon adequate fire protection. An evaluation should therefore be made of available fire protection facilities and their ability to serve the airport site. If such facilities are not adequate, the cost of providing service should be investigated.

Police protection is also required for the security of industrial and business property. The ability of the local government to provide adequate police protection should be investigated. Such protection may be difficult to obtain in smaller communities and in isolated areas.

Physical Planning

The actual design and physical layout of an airport development district is an important step in formulating the overall development plan. It is essential that this effort be coordinated with the airport master plan and that design standards be established concerning (1) the location of non-aviation development with regard to airport facilities, (2) lot design, (3) taxiway access, (4) streets, (5) off-street parking and loading, (6) railroad access, and (7) the extension of utilities. A typical layout of planned airport development district is shown in Figure 2.

Coordination with the Airport Master Plan

Non-aviation development should in no way compromise the efficient operation of the airport or impair its expansion capability. Development should not be undertaken unless an airport master plan reflecting

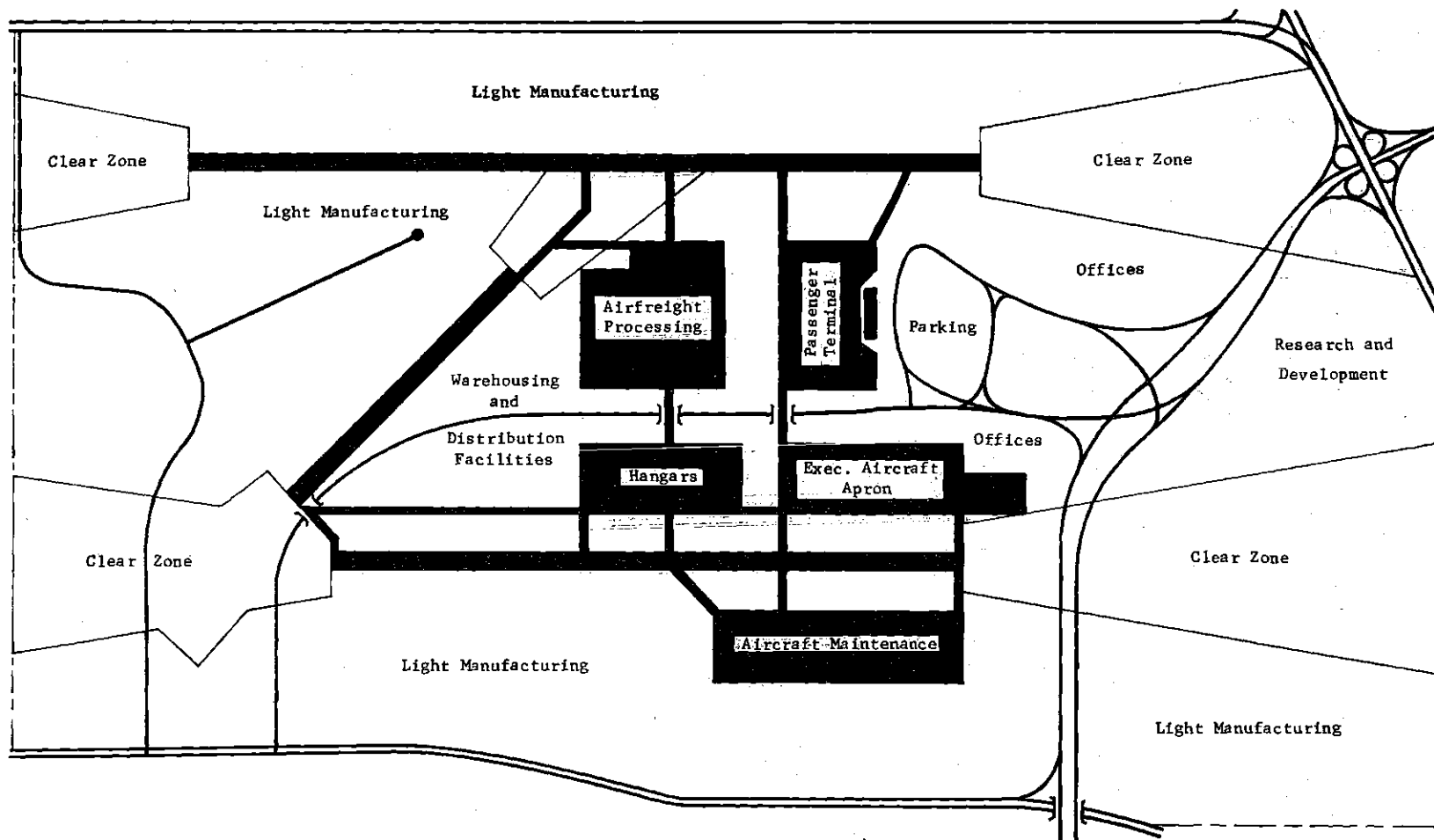


Figure 2. Typical Layout of an Airport Development District.

the existing and anticipated needs of the airport has been adopted. Space must be allocated for adequate aircraft handling facilities, terminal facilities, and vehicular and pedestrian circulation near the terminal area.

Sufficient land must be reserved for aircraft handling facilities, including runways, taxiways, clear zones, airport lighting and guidance systems, aprons and hangars. Care should also be taken to preserve the required separation clearances between existing and proposed runways.

Industrial and commercial development near the terminal area should not encroach on space needed for terminal facilities such as the terminal building, passenger loading positions, cargo-handling facilities and necessary concessionaires such as car rental. Particular attention should be given to vehicle parking for airport patrons. At large airports, adequate parking space within reasonable walking distance is difficult to provide and often expensive structures must be constructed for this purpose. The airport parking requirements should, therefore, be determined and these needs respected in any future planning.

Vehicular and pedestrian circulation in the airport area should also be a major consideration of the airport master plan. It is imperative, particularly at large airports, that ground vehicles move safely and efficiently to and from the terminal. It is desirable that airport traffic be separated from traffic destined for other facilities near the airport. Consequently, separate access should, in most cases, be provided for planned industrial and commercial development in the vicinity.

Within the limits established by the airport master plan, it is

advisable to free the maximum amount of land for non-aviation purposes.

Location on the Airport

Land available for development should be designated for use by those industrial and commercial activities that are most suited for its location in relation to airport facilities.

A location on the side of the runway opposite the terminal is generally good for industrial activities that use general aviation aircraft. This is particularly true at air carrier airports where diversion of traffic is advisable. Also, in this area, land uses are not competing for property needed for those activities requiring proximity to the terminal area. A location in the vicinity of the general aviation area may be advantageous to some industrial firms. In this case, plants are located near the area where aircraft will be stored and maintained thus reducing ground taxi time.⁵⁹

Land in the vicinity of the terminal area should be reserved for appropriate commercial activities. This area is also desirable for office and other activities that use air passenger services. Industry and warehousing operations that require air cargo service should be located near the air freight terminal if possible.

Lot Design

A variety of lot sizes and shapes is desirable in a planned airport district. For industrial purposes, the most popular lot sizes range from one to five acres,⁶⁰ but larger lots of ten to fifteen acres should also be provided. For maximum flexibility, subdivision design should also allow the combination of lots to create a tract of up to 35 acres without adversely affecting the overall layout of the property.⁶¹

Office and commercial development requires smaller lots. Space required for office buildings, for example, generally ranges between 600 and 20,000 square feet.⁶²

Taxiway Access

Taxiway access should be provided to as many lots as is feasible. Two variations for providing access are: (1) a taxiway into an aircraft parking apron with lots on all sides and (2) a taxiway providing access to only those lots directly abutting the aircraft movement areas.⁶³

A 50-foot service taxiway within a 150-foot right-of-way is generally sufficient for business aircraft. To minimize conflict with the street system, taxiway right-of-way should be located at the rear of the lots served. Intersections between streets and taxiways should be avoided if at all possible.

Streets

The street system within the district should be designed to facilitate the movement of all anticipated traffic. In general, minimum pavement widths of 24 feet (2-lane) for secondary streets and 48 feet (4-lane) for primary feeder streets should be maintained. Additional lanes should be added if traffic volume warrants. Excessive pavement widths are undesirable, however, because they tend to encourage on-street parking and loading.

A minimum right-of-way width of 40 feet may suffice for secondary streets if curbs and gutters are used and no future expansion is anticipated. However, a 50 foot right-of-way is recommended. A minimum right-of-way width of 60 feet is recommended for primary feeder streets.

Street intersections should have a curb radius of at least 40 feet to accommodate tractor-trailer vehicles. A curb radius of 25 feet is recommended for truck access entrance drives. Driveways for automobiles should have a minimum curb radius of 15 feet.

Curb and gutters are recommended in order to keep right-of-way width to a minimum, facilitate drainage, and assure a more attractive site.⁶⁴

Off-Street Parking and Loading

Off-street parking should be provided for employee, visitor, and company vehicles. One space should be allowed for every 1.3 employees (allows for overlapping requirements of successive shifts). One visitor parking space for every 15 employees on the main shift and one parking space for each company vehicle is recommended. Three hundred (300) square feet should be allowed for maneuvering and parking each vehicle.⁶⁵

Adequate off-street loading facilities should be provided for truck trailers and small pickup trucks. To accommodate truck trailers, berths should be 14 feet wide and 60 feet deep with an additional 60 feet for maneuvering. Berths 10 feet wide and 20 feet in depth with an additional 20 feet for maneuvering are usually sufficient for pickup trucks.⁶⁶

Railroad Access

If rail service is available to the site, a decision should be made at an early date as to what proportion of the lots are to be served. Arrangements should then be made with the railroad company for the construction of the desired rail spurs in accordance with railroad standards and the development plan.

A 20-foot right-of-way is usually sufficient for a single-track spur.⁶⁷ This right-of-way should be located so as not to conflict with vehicular or aircraft movement.

Utilities

Water, sanitary sewers, electric power, gas distribution, fire hydrants, storm sewers and telephone service should be provided by the sponsor either through his own resources or by contract with local utility companies.

Utility easements should be provided in the right-of-way reserved for streets and rail spurs where possible. All utilities should be underground.

Phase Development

The development of a district should be designed so that it can be implemented in phases. This reduces the initial cost of improvement and allows the budgeting of capital expenditures so that latter phases of the development can be financed in part from revenues derived from initial development. It is not recommended, however, that the purchase of suitable land be deferred. To do so would permit the encroachment of undesirable development and adversely affect the airport environment.

The Airport Development District

The purchase, planned development and subsequent sale or lease of property adjacent to an airport by a municipality or its agent is the most appropriate method of developing the airport environment. This procedure is referred to in this thesis as the "airport development district" concept. The principles which apply to the implementation of any planned industrial district may also be applied generally to an

"airport development district" with two possible exceptions. Both development organization and development controls take on special significance with regard to development near an airport and, therefore, warrant discussion.

Development Organization

Four organizational alternatives are normally used for the implementation of an "airport development district". These include (1) municipal ownership and operation, (2) the development foundation, (3) the contract developer, and (4) the private developer.

Municipal Ownership and Operation. Municipal ownership and operation is the simplest means of organizing an "airport development district". Under this arrangement, the municipality performs all management functions including planning, negotiating leases and enforcing development standards. The management role is normally performed by the airport manager.⁶⁸

Promotion may be handled by the municipality with the help of the local chamber of commerce. Marketing of available sites can be done through a single representative or broker, or by a standard agreement with all licensed real estate agencies in the area.

The municipality provides the basic site improvements such as clearing and grading, streets and utilities. The land is then leased to individual tenants that meet the development standards.

One of the more successful development projects, El Paso International Airport Industrial Park, provides an excellent example of the airport owner as developer and manager. The municipality in 1951 designated 196 acres of excess airport property for non-aviation use.

A plan was prepared and site improvements provided at municipal expense. Protective covenants were developed and incorporated into a standard lease program. The responsibility for the operation and promotion of the project as well as the administration of the standard lease program was vested in the airport manager.⁶⁹

At Louisville, Kentucky, the Jefferson County Air Board introduced a variation to this procedure. Concerned with the problems of leasing and property administration, the Air Board appointed a private realty company as its exclusive agent.⁷⁰

Municipal ownership and operation offers the following advantages:

1. The municipality has absolute control of development thus assuring compatibility with airport operations.
2. The municipality may take full advantage of the development potential created by the airport.

Municipal ownership, however, is not possible in all cases. Statutory limitations and multiple jurisdictions may prohibit a development organization of this type. Even if possible, municipal ownership and operation may have the following disadvantages:

1. The municipality becomes directly involved in the real estate business.
2. City officials, and in particular the airport manager, may be distracted from their primary duties.
3. The municipality may be required to employ a full-time industrial manager with adequate experience to manage a competitive industrial park -- a prospect which may be financially infeasible.

The Development Foundation. The formation of a nonprofit

development foundation is one alternative to public ownership. Such organizations are normally formed by civic-minded leaders in an effort to improve the economic stability of their community.

The development foundation may contract for planning and engineering consultant services, administer the lease and sale of lots, enforce the development standards and covenants, and handle financial arrangements with the prospective tenants. The municipality normally provides utilities and other site improvements, and signs the sales contracts or lease agreements since ownership is seldom transferred to the foundation.⁷¹

The development foundation offers three advantages for the development of the airport property for non-aviation purposes:

1. A minimum involvement of municipal personnel is required.
2. The municipality is freed of political pressure.
3. Foundations qualify as nonprofit organizations under Section 501 (e)(3) of the Internal Revenue Code. This means that their entire earnings can be reinvested in the development project.⁷²

The Contract Developer. The municipality may contract with a private company for the organization of an airport development district. The contract developer normally assumes the responsibility of financing the development, preparing the development plan, development standards and standard lease forms, entering into contracts for engineering services, negotiating and signing subleases, promotion, and the continuing operation and maintenance of the project.⁷³

The Skywest project in Hayward, California offers the best example of the contract developer method. Airport Investors, Inc., a private corporation, obtained a 50-year lease on 290 acres of land which is

surplus to the needs of the Hayward Air Terminal.⁷⁴ The corporation subsequently prepared the development plan, standard lease clauses and development standards. These documents were adopted by the city council thus assuring the City of the specified quality of development. Under the existing agreement, the City will share 50 per cent of the developer's profits.⁷⁵

The contract developer method offers the following advantages:⁷⁶

1. A minimum involvement of municipal personnel is required.
2. The project is operated and managed by full-time personnel experienced in the field of land development.
3. The developer has the ability to conduct negotiations for leases and enter into financial arrangements which the city might be prohibited in doing itself.
4. The developer is free to take advantage of whatever methods he considers proper for promoting the project.

The Private Developer. Private corporations may (1) organize an airport development district adjacent to a publicly-owned airport or (2) construct an airport to provide accessibility to a totally private development.

In some instances, it is to the advantage of the airport owner to encourage private developers to develop adjacent property for non-aviation purposes. This method offers the following advantages:

1. The municipality is relieved of the development cost.
2. The private developer is often able to provide a wider range of development services to prospective tenants than other types of developers.

3. Land that might have otherwise been devoted for incompatible land uses may be properly developed.

These advantages must be weighed against the following disadvantages:

1. The municipality must relinquish much of its control over the development of the property.

2. The airport will not benefit from the value created by its existence.

In 1959, the City of Hartford, Connecticut sold the airfield portion of Brainard Field to the State of Connecticut for use as a general aviation airport. The remaining acreage was sold to a private developer. To insure desirable development, this property was placed in a special industrial zone requiring higher standards of development than typical industrial zoning provisions. A contrasting example is offered by the Oceanside Industrial Center in Oceanside, California. In this case, the developer donated land on which the City constructed a new airport.⁷⁷

A number of industrial parks have been developed around privately owned airports. In such cases, however, prospective tenants have no guarantee that the airport will not be sold for additional development when the original project is completed. The Rancho Conejo Light Manufacturing and Research Center in Ventura County, California is a case in point. The developer constructed a 4300 foot runway in 1959 to serve the adjacent industrial district. In 1965, this runway had been abandoned and sold for industrial use.⁷⁸

Development Controls

Adequate development controls are necessary to insure that planned development is properly implemented and the established standards are maintained. Local zoning provisions and protective covenants are commonly used for this purpose.

Zoning. Zoning regulations represent the governmental exercise of the police power to insure the public welfare. Zoning restrictions must reflect airport planning if desired development is to be achieved. However, because comprehensive zoning is generally not entirely beneficial to planned developments, the airport district and the planned unit development should be evaluated as possible zoning control measures.

The creation of an airport zoning district to include the airport and the surrounding area is one means of solving the special zoning problems associated with an airport environment. Land uses located within the airport district would be subject to restrictions designed to protect the airport environment and promote its proper development.

Planned unit development controls are based on an evaluation of proposed development by a reviewing board. Zoning restrictions are then imposed on the basis of the approved plans. This method is particularly applicable to an airport development district because the local government retains final authority on the quality of airport development.

The control of land development through zoning is reserved for local governments. Consequently, the owner of an airport development district must rely upon local officials to adopt and enforce zoning provisions in accordance with the development plan.

Protective Covenants. "Protective covenants [often called

"restrictive covenants"] are contracts between the land subdivider and the lot purchaser expressing agreement covering the use of the land.⁷⁹ Because they are private contracts, protective covenants go further toward protecting the amenities, architectural standards and good design built into planned developments than do regulations imposed by public authority. Suggested protective covenants are included as Appendix E.

Protective covenants regulate the following aspects of land use and performance: types of operations permitted, site size, site coverage, building line setbacks, parking and loading areas, outdoor storage, landscaping, sign control, and building construction and design.

Protective covenants may be imposed by deed restrictions or by standard lease contracts depending upon how the property is marketed. Such controls are enforced by the owner of the airport development district and the cooperation of local governments is not required.

Planning Development Controls. The judicious use of both zoning and protective covenants is a prerequisite for the proper development of an airport for desirable industrial and commercial uses. Careful planning of these development controls is essential to insure that the desired quality of development is maintained without sacrificing the flexibility required to market competitive industrial and business sites.

Zoning should establish the minimum development standards for the airport environment. Such standards should be restrictive enough to preserve the airport's aeronautical function and the overall quality of development. This objective can perhaps best be achieved through the

establishment of an airport zoning district and the incorporation of minimum performance standards into the zoning ordinance.

Once minimum standards have been established through zoning, more restrictive provisions can be imposed through protective covenants. Because covenants are private contracts, they need not apply equally to all prospective tenants. The developer, therefore, can tailor the covenant provisions to suit his needs and the needs of the tenant. Obviously, the restrictions placed upon a \$10 million manufacturing plant could vary significantly from those placed upon a small research operation. The use of protective covenants affords the developer a flexibility to make appropriate adjustments and to meet the demands of a wide range of prospective business and industrial firms. As a safeguard for the tenant, a "recourse" clause is generally included in protective covenant provisions. This clause gives the tenant legal recourse should be standards established for a neighboring tenant be less restrictive than those established for his own operation. 80

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

The planned development of the airport environment for industrial and commercial purposes is a relatively new concept and has, to date, been largely confined to isolated tracts designated as "airport industrial parks". The "airport development district" as envisioned in this thesis encompasses the total airport environment and represents a substantial improvement over the "airport industrial park" concept as it is currently being implemented. The previous four chapters have discussed the considerations involved in planning the "airport development district" and have outlined the basic elements required in formulating the development plan. The conclusions and recommendations presented in this chapter are intended to place the previous discussions in their proper perspective in terms of airport and community planning and development.

Conclusions

Throughout the course of this study it became apparent that the planned development of the airport environment offers advantages both to the industry or business seeking a good location, and to the developers. The following paragraphs discuss these advantages and outline some minimum criteria that must be met to insure the successful development of the airport and its surrounding area.

Planned airport developments are attractive to private industrial and business firms for a variety of reasons:⁸¹

1. High quality, high capacity highway access provided to serve the airport also provides direct and efficient access to nearby development.

2. Open land beyond the intensely developed sections of the urban areas served by the airports provides the required space for modern horizontal-type industrial and business facilities.

3. Flat terrain required for airport development usually meets the needs of modern large-scale industrial site development.

4. Utilities installed to serve airports can also serve nearby development.

5. Prestige location results from architecturally distinguished surroundings often found in airport facilities.

6. Availability of air transportation including commercial, air cargo and privately-owned aircraft is a bonus which results from air-field proximity especially for selected land uses.

The development of the airport environment for desirable non-aviation uses offers the following advantages to the community:

1. The ultimate development of the airport's aeronautical function is assured. Proper allocation of space to desirable land uses on or near an airport prohibits the use of this land by incompatible development that may eventually interfere with efficient airport operation and restrict the airport's expansion capabilities. This advantage is most significant in the case of large air carrier airports.

2. Complementary land uses provide services to passengers and

airport employees that cannot be legally or economically provided by the airport itself. Motels, restaurants and other commercial facilities, for example, enhance the attractiveness of the airport and increase its efficiency if properly planned and controlled.

3. The economic potential of the airport can be fully realized. An airport is an economic asset to a community and proper planning can insure that land in its vicinity will be used for its most productive use.

4. The development of airport sites for industry and business can boost a community's potential for economic development. Small communities, in particular, often compete with peer cities for industry. The proper development of its airport may well give a community a needed competitive advantage.

Recommendations

As a result of the study required in the development of this thesis, the following general recommendations are made with regard to planning for industrial and commercial development in the vicinity of airports:

1. Consideration of the airport and its environment should be an integral part of the comprehensive planning program for the community. Efforts should be made to determine what types of development are proper in the vicinity of the airport and steps taken to promote this type of development. The community services necessary to the airport's development should also be part of a comprehensive planning program.

2. The "airport development district" concept should be utilized.

The airport development plan should consider the appropriate use of land surrounding the airport for desirable non-aviation purposes as well as the development of airport facilities. If this concept is followed, particularly during the initial planning of the airport, suitable areas can be reserved for non-aviation development. In this manner, haphazard growth can be prevented and the full economic potential of the airport can be ultimately realized.

3. Evaluate the airport's potential for non-aviation development and plan accordingly. The steps outlined in this thesis should provide a sound basis for such an evaluation. If careful study reveals little or no attraction for airport-oriented industrial or commercial development, as will likely be true for many small airports, efforts should be directed toward the preservation of adjacent land areas for recreation, agriculture, open space or other compatible uses.

In planning the "airport development district," one basic principle should always be followed. The present and future operations of the airport should be the primary concern of the planner and should never be sacrificed to achieve non-aviation development. Consequently, any plan for the overall development of the airport environment must be based upon a plan for the ultimate development of the airport itself.

APPENDICES

APPENDIX A

LOCATIONAL CHARACTERISTICS OF INDUSTRIES AT
AIRPORTS AND/OR OWN PRIVATE AIRCRAFT⁸²

The factors influencing the location of industries that have located at airports or own general aviation aircraft are presented in this appendix. The terms used herein are defined as follows:

1. Labor and Capital Intensiveness. These are relative terms based primarily upon value-added per production worker for each industry. Based upon Preliminary Area Series Reports (MC 63 (P) - S) of the 1963 Census of Manufactures.
2. Economies of Scale. Noted only for industries in which there is a strong bias toward larger establishment size. Based upon size distribution of firms from the 1958 Census of Manufactures, Location of Manufacturing Plants, by Industry, County, and Employment Size (MC 58 (S) - 2).
3. Special and Standardized Products. Rough differentiation between industries of the job-shop, small-run variety and mass-production industries where large quantities of a standard product are produced.
4. External Linkages. Backward linkages to suppliers and forward linkages to customers are noted only for those industries in which these are major location factors. Concentration dependence is the result of general external economies involved in the joint use of services and suppliers where this dependence appears to have significant locational influence. Urban orientation is based on an actual measure of urban

concentration. Only those industries in which 70 per cent of the employment is located in an SMSA are included.

5. Labor Requirements. This category is divided into (a) professional, (b) skilled, (c) semi-skilled, (d) secondary, and (e) cheap labor:

a. Professional indicates a high percentage of scientists, engineers, designers and other professionals, and implies that urbanization amenities may be significant as a location factor.

b. Skilled labor is likely to go with concentration dependence as a location factor.

c. Semi-skilled labor includes most of the operatives in manufacturing.

d. Secondary labor generally applies to a non-urban industry where it is known that the industry employs a large number of females.

e. Cheap labor applies where it is known that wages are low and/or that labor economies are an important location factor.

6. Raw Material Orientation. Those industries which seek to locate in proximity to raw materials are included.

7. Market Size. A natural, although arbitrary, division based upon general knowledge of the industry.

LOCATION CHARACTERISTICS OF INDUSTRIES
AT AIRPORTS AND/OR OWN PRIVATE AIRCRAFT

Major Industry Group	SIC Code	Located at Airport	Own Private Aircraft	Type of Production			Type of Output				External Linkages				Labor Requirements					Raw Material Orientation	Market Size		
				Labor Intensive	Capital Intensive	Economies of Scale	Special Product	Standard Product	Intermediate Product	Final Product	Forward Linkages	Backward Linkages	Concentration Dependence	Urban Orientation	Professional	Skilled or Special	Semi-skilled	Secondary	Cheap		Local	Regional	National
Printing & Publishing	271	X	X	X			X		X		X	X	X		X	X			X				
	272	X	X			X		X			X	X	X		X	X			X	X			
	273	X	X	X			X		X		X	X	X		X	X				X			
	274	X		X			X		X		X	X	X		X	X				X			
	275	X	X	X			X		X		X	X	X		X	X					X		
	276	X					X		X		X		X			X			X	X			
	277	X		X			X			X			X		X	X					X		
Chemicals & Allied Products	281	X	X		X	X		X	X				X		X	X			X				
	282	X	X		X	X		X	X		X	X	X		X	X					X		
	283	X			X			X		X		X		X	X	X					X		
	284	X	X		X			X		X		X		X	X	X				X	X		
	287		X		X			X	X		X		X		X	X				X			
	289		X		X			X	X		X		X		X	X					X		
Petroleum & Related Products	290		X		X	X		X		X			X		X					X			
	291		X		X	X		X		X			X		X					X			
	295		X		X	X		X		X			X		X					X			
Rubber & Misc. Plastic Prod.	306		X		X			X		X		X			X						X		
	307		X		X			X	X			X			X					X	X		
Primary Metal Industries	331		X		X	X		X	X		X	X	X	X	X						X		
	332		X		X			X	X		X	X	X	X	X								
	333		X			X		X	X		X		X		X				X				
	335		X		X			X	X		X		X		X								
	336		X		X			X	X		X	X	X	X	X								
	339		X					X	X		X		X		X								
Fabricated Metal Products	341	X			X	X		X	X		X		X			X							
	342	X	X		X			X	X		X		X			X					X		
	343	X	X					X	X		X		X			X							
	344	X	X	X				X	X		X	X	X	X	X								
	345	X	X	X				X	X		X	X	X	X	X								
	346	X	X	X				X		X		X	X	X	X								
	347	X	X	X				X		X		X		X		X							
	348	X	X	X				X	X		X		X	X	X								
	349	X	X	X		X		X	X		X		X		X	X					X		

APPENDIX B

TYPES OF INDUSTRY REPORTED AT AIRPORTS
IN THE U. S. AND CANADA⁸³

Aircraft Manufacturing
Aircraft Overhaul
Aircraft Parts, Mfg.
Apparel, Mfg.
Automobile, Truck & Tractor, Mfg.
Automobile Parts, Mfg.
Boats, Mfg.
Candy, Mfg.
Chemicals, Mfg.
Container, Mfg. (cardboard and metal)
Contractors, Office & Storage
Construction Equipment, Mfg.
Cosmetics, Mfg.
Drugs, Mfg.
Electrical Machinery, Mfg.
Electronic Equipment, Mfg.
Feed Milling
Furniture, Mfg.
Hatchery Operations
Household Appliances, Mfg.
Lumber Storage & Milling
Machinery, Mfg.
Metal Fabricating
Mobile Home, Mfg.
Offices
Paper & Allied Products, Mfg.
Plastics, Mfg.
Publishing and Printing
Refrigerator Equipment, Mfg.
Research Facilities
Warehousing

APPENDIX C

INDUSTRY BREAKDOWN FOR SIC CODE FOR OWNERS
OF LARGE BUSINESS AIRCRAFT⁸⁴

SIC 223	Broad Woven Fabric Mills, Wool including dyeing & finishing
SIC 262	Paper Mills, except Building Paper Mills
SIC 265	Paperboard Containers and Boxes
SIC 281	Industrial Inorganic and Organic Chemicals
SIC 282	Plas Materials & Syn Resins, Syn Rubber, Syn & Other
SIC 284	Soap, Detergent, Cleaning Preparations, Cosmetics & other toilet preparations
SIC 290	Petroleum Refining and Related Industries
SIC 306	Rubber & Misc. Plastics Products
SIC 324	Cement, Hydraulic
SIC 331	Blast Furnaces, Steel Works, and Rolling & Finishing Mills
SIC 335	Rolling, Drawing and Extruding of Non-Ferrous Metals
SIC 344	Fabricated Structural Metal Products
SIC 346	Metal Stampings
SIC 348	Miscellaneous Fabricated Metal Products
SIC 353	Construction, Mining & Materials
SIC 355	Special Industry Machinery, except Metalworking machinery
SIC 357	Office, Computing & Accounting Machines
SIC 361	Electric Transmission & Distribution Equipment
SIC 367	Electronic Components and Accessories
SIC 371	Motor Vehicles and Motor Vehicle Equipment
SIC 372	Aircraft and Parts

APPENDIX D

BEEHCRAFT INDUSTRY BREAKDOWN BY SIC CODE
 NEW AIRCRAFT SOLD RETAIL
 CALENDAR YEAR 1963⁸⁵

SIC 202	Dairy Products
SIC 203	Canning & Preserving Fruits, Vegetables, & Sea Foods
SIC 204	Grain Mill Products
SIC 208	Beverage Industries
SIC 222	Broad Woven Fabric Mills, Man-Made Fiber and Silk
SIC 223	Broad Woven Fabric Mills, Wool including dyeing & finishing
SIC 225	Knitting Mills
SIC 233	Womens, Misses, and Juniors Outerwear
SIC 242	Sawmills and Planing Mills
SIC 249	Miscellaneous Wood Products
SIC 251	Household Furniture
SIC 262	Paper Mills, except Building Paper Mills
SIC 265	Paperboard Containers and Boxes
SIC 271	Newspaper Publishing, publishing and printing
SIC 273	Books
SIC 275	Commercial Printing
SIC 281	Industrial Inorganic and Organic Chemicals
SIC 282	Plas Materials & Syn Resins, Syn Rubber, Syn & other man-made fibers
SIC 284	Soap, Detergent, cleaning preparations, Cosmetics & other toilet preparations
SIC 287	Agricultural Chemicals
SIC 289	Miscellaneous Chemicals Products
SIC 290	Petroleum Refining and Related Industries
SIC 291	Petroleum Refining
SIC 295	Paving and Roofing Materials
SIC 306	Rubber and Miscellaneous Plastics Products
SIC 307	Miscellaneous Plastics Products
SIC 324	Cement, Hydraulic
SIC 329	Abrasive, Asbestos & Miscellaneous Nonmetallic Mineral Products
SIC 331	Blast Furnaces, Steel Works, and Rolling & Finishing Mills
SIC 332	Iron and Steel Foundries
SIC 333	Primary Smelting and Refining of Nonferrous Metals
SIC 335	Rolling, Drawing and Extruding of Nonferrous Metals
SIC 336	Nonferrous Foundries
SIC 339	Miscellaneous Primary Metal Industries
SIC 342	Cutlery, Hand Tools, and General Hardware
SIC 343	Heating Apparatus/except electric/ and Plumbing fixtures
SIC 344	Fabricated Structural Metal Products

- SIC 345 Screw Machine Products, Bolts, Nuts, Screws, Rivets and Washers
- SIC 346 Metal Stampings
- SIC 347 Coating, Engraving and allied services
- SIC 348 Miscellaneous Fabricated Wire Products
- SIC 349 Miscellaneous Fabricated Metal Products
- SIC 352 Farm Machinery and Equipment
- SIC 353 Construction, Mining & Materials, Handling Machinery and Equipment
- SIC 355 Special Industry Machinery, except metalworking machinery
- SIC 356 General Industrial Machinery & Equipment
- SIC 357 Office, Computing, and Accounting Machines
- SIC 358 Service Industry Machines
- SIC 359 Miscellaneous Machinery, except electrical
- SIC 361 Electric Transmission & Distribution Equipment
- SIC 362 Electrical Industrial Apparatus
- SIC 364 Electric Lighting and Wiring Equipment
- SIC 366 Communication Equipment
- SIC 367 Electronic Components and Accessories
- SIC 371 Motor Vehicles and Motor Vehicle Equipment
- SIC 372 Aircraft and Parts
- SIC 379 Miscellaneous Transportation Equipment
- SIC 384 Surgical, Medical, and Dental Instruments & Supplies
- SIC 396 Costume Jewelry, Novelties, Buttons and Notions, except precious
- SIC 399 Miscellaneous Manufacturing Industries

APPENDIX E

SUGGESTED PROTECTIVE COVENANTS⁸⁶

This Declaration, made this _____ day of _____, 19____, by the City of (City), a political subdivision of the State of (State), hereinafter called "Declarant".

WITNESSETH:

Whereas, Declarant is the owner of certain real property located in the County of (County), State of (State), and being more particularly described as follows:

and

Whereas, Declarant has established a general overall development plan for said property, and

Whereas, Declarant desires to subject the development of said lots to certain conditions, restrictions and covenants in order to insure the development of a desirable environment for said activities, and to insure that said development will be compatible with adjacent use on the airport by performance, appearance, and general operating characteristics.

Now, therefore, the City of (City) hereby declares that said property is and shall be held and conveyed subject to the conditions, restrictions and covenants hereinafter set forth, each and all of which are for the benefit of each tenant/owner of any portion of said property and each and all of which shall apply to and bind the respective successors in interest of said property thereof, as follows:

ARTICLE I

DEFINITIONS

Whenever used in this Declaration, the following items shall have the following meanings:

A. "Buildings" shall include both the main portion of such building and all projections of extensions therefrom, including garages, outside platforms, docks, carports, canopies and porches. Ground cover shall not be included.

B. "Lot" shall mean one of the parcels on the map entitled "(City) Industrial Airpark" as filed with the Register of Deeds, County of (County), (State).

C. "Building Site" shall mean the entire lot or lots (if contiguous) leased or purchased by one tenant.

D. "Street" shall mean any street, highway or other thoroughfare shown on the map entitled "(City) Industrial Airport" as filed with the Register of Deeds, County of (County), (State).

E. "Set Back" shall mean the distance a building must be set back from the property line of the parcel.

F. "Front lot line" shall mean the property line which faces the street; of corner parcels the "front lot line" shall mean the property line which is the width dimension of the parcel.

G. "Rear lot line" shall be the property line usually parallel to the front lot line and contiguous to another parcel of property.

H. "City" shall mean the city of (City), (State); its duly elected Council or any duly constituted agent/committee appointed through said Council to fulfill the obligations herein required.

ARTICLE II

PERFORMANCE STANDARDS

No land or structure shall be used or occupied in any manner so as to create any dangerous, injurious, noxious, or otherwise objectionable conditions which may affect any other property, including, but not limited to:

- Fire and explosive hazard
- Noise, vibration, or shock
- Smoke, dust, odor or other forms of air pollution
- Heat
- Glare
- Electrical or other disturbance
- Liquid or solid refuse or wastes
- Other substance, condition, or element in such amount as to affect the surrounding area or adjoining premises

A. FIRE AND EXPLOSIVE HAZARD - No activity shall be undertaken involving fire or explosive hazard which shall endanger the property, improvements or employees of any other property owner or tenant.

B. VIBRATION OR SHOCK - No vibration or shock perceptible to a person of normal sensibilities shall be permitted within 50 feet of the property line.

C. AIR POLLUTION:

1. Any use producing smoke, gas, dust, odor, fumes, aerosols, particulates, products of combustion or any other atmospheric pollutant, shall be conducted within a completely enclosed building.

2. Visible emissions of smoke will not be permitted which exceed Ringlemann No. 1 on the Ringlemann Chart of the U. S. Bureau of Mines other than the exhausts emitted by motor vehicles or other transportation facilities. This requirement shall also be applicable to the disposal of trash and waste materials. Windborne dust, sprays, and mists originating in plants will not be permitted.

3. No plant or operation shall discharge into the atmosphere toxic or noxious matter.

4. The emission of odors which are detectable at any point beyond the property line of any plant will not be permitted.

D. DUST CONTROL - All ground areas not covered by structures shall be landscaped or surfaced with concrete, asphaltic concrete, asphalt oil or other comparable dust-free surfacing; shall be maintained in good condition, free of weeds, dust, trash and other debris; and shall be properly drained and graded. Such development shall be accomplished before issuance of a certificate of occupancy.

E. HEAT OR GLARE - Any operation producing intense glare or heat shall be performed within an enclosed or screened area in such manner that the glare or heat emitted will not be discernible from the property line.

F. ILLUMINATION:

1. The source of illumination of any kind within the property shall not be visible at the property line except for normal installation of standard interior lighting fixtures within buildings.

2. The maximum height of any lighting standard shall be limited to 30 feet above curb level.

3. The intensity of illumination shall be limited to 10-foot candles or 0.1 lumens per square foot for open areas or surfaces visible at the property line.

4. The design and location of exterior lighting shall comply in all respects to the requirements of the Federal Aviation Administration or any successor agencies and other governmental agencies having applicable jurisdiction with respect to height, type and placement of lighting standards as they may affect the safety of flight operations into, from and around the Airport.

G. SIGNS - The following regulations shall apply to all signs displayed for observations from outside a building whether displayed on, near or within a building.

1. Permitted Signs - Signs on the property shall be limited to those identifying the uses conducted on the site, to those necessary for directional purposes and to those required to advertise the rental of the specific property on which the sign is displayed. The size, design and location of all signs shall require the written approval of the City or its authorized agent prior to installation. Outdoor advertising, billboards, or flashing lighting shall not be permitted.

2. Area and Location - One sign may be permitted on the front setback line and one sign may be attached to the side of the building which faces a public street, both to state only the name, products, and services of the occupant. The sign on the front setback line shall not exceed one square foot area for each lineal foot of lot frontage and shall not extend more than ten feet in height above the floor line of the building. An approved product or company symbol or device may be used in addition to each sign and, on the front setback line, may extend up to any point on the building. Any such symbol or device shall be considered a sign for the purposes of this Article and shall require the written approval of the City prior to installation.

3. Construction - All signs shall comply with all building codes of the City of (City) and with all rules and regulations of the Federal Aviation Administration or any successor agencies.

H. REFUSE AND TRASH - No refuse or trash shall be kept or stored or allowed to accumulate on any parcel.

I. SEWAGE DISPOSAL SYSTEMS - No cesspool, septic tank or other sewage disposal system or device shall be installed, maintained, or used upon any parcel without the approval of the City of (City).

ARTICLE III

DEVELOPMENT OF SITE - REQUIRED IMPROVEMENTS

A. OFF-STREET PARKING - Off-street parking facilities shall be provided for employees, customers and visitors at a ratio of one space for every one and one-half employees, one space for each managerial employee; and one visitor space for each two managerial staff. A "parking space" shall be two hundred (200) square feet set aside for the parking of a car; driveways and other spaces for the movement of cars shall not be included in computing the minimum required parking space hereunder. The parking area may be provided anywhere on the premises except in the minimum front yard. Plants requiring shift operations may have the parking space requirement adjusted upon approval in writing by the City.

B. VEHICLE LOADING - All provisions for the loading and maneuvering of vehicles incidental to the operation of the business shall be placed on the lot(s); onstreet vehicle loading shall not be permitted. Vehicle loading shall be permitted only at the rear of building, or on a side; except that such loading performed at a side shall be screened from front street visibility.

C. SETBACKS:

1. Frontyard - all buildings shall be set back a minimum of 50 feet from lot lines facing the street.

2. Sideyard - There shall be a minimum sideyard of 35 feet except in the case of a corner lot in which case the sideyard facing the street shall be 50 feet.

3. Rearyard - Rear setbacks shall be 20 feet from the lot line or utility easement line, except that buildings on sites abutting railroad spurs may have loading docks extending to the rear property line, providing such construction does not interfere with utility services.

One hundred per cent of the required minimum front setback area and side setback area facing the street shall be landscaped and planted, unless covered by paving or outdoor construction.

D. LANDSCAPING - Any area not paved shall be landscaped. Such landscaping is to include the planting of ground covers, shrubs and trees. The removal of undergrowth, weeds, debris, rubbish, trash, excess dirt, industrial wastes or garbage and any other unsightly material from the property shall be at not expense to the City. Landscaping of required areas shall be begun within a period not to exceed one hundred eighty (180) days after completion of the initial building.

E. MAINTENANCE - It shall be the responsibility of the tenant to keep the premises, buildings and all improvements in safe, clean, healthful and presentable condition at all times.

F. BUILDING HEIGHTS - Building heights shall be limited to a maximum of thirty-five feet above the curb line, including any building equipment, penthouse, extrusions, etc.

G. SITE COVERAGE - All buildings and structures, or portions thereof, placed on the lot(s) shall not cover more than 40 per cent of the total lot area.

H. TYPE OF CONSTRUCTION - All buildings shall be framed with reinforced concrete or masonry, structural steel, structural aluminum or wood which has been satisfactorily treated to resist fire, rot and insects. Siding shall be masonry, glass, enameled steel or treated wood. Common masonry and treated wood siding shall be kept neatly painted, if

used. All building shall conform to all local building codes and ordinances.

I. STORAGE - Outside storage shall not be permitted unless fenced with an opaque screen of sufficient height to hide the materials. All fencing for screening, security or other purposes shall be attractive in appearance and shall be of a durable type approved by the City.

ARTICLE IV

PREPARATION AND SUBMISSION OF PLANS FOR IMPROVEMENTS

A. GENERAL - All plans for improvements shall be prepared by registered engineers and architects, shall be of contemporary design and shall require a prior written approval by the City or its authorized agent before any construction can take place. Upon the execution of a lease or sale of a building site, the City and the tenant or owners shall jointly determine a reasonable period of time in which final plans and specifications shall be submitted, such period to be set forth in writing by the City. The following plans shall be required for submission to the City within the time period determined:

1. A plot plan at a scale not smaller than 1-inch equals 100 feet showing the relationship of the proposed improvements to the lot(s) demised and to the improvements on adjacent lots, utilities and access thereto, curbs, walks, driveways, parking areas, etc.

2. Floor plans at a scale not smaller than 1/16-inch equals 1 foot.

3. Ground cover plans, including landscaping.

4. A true architectural rendering of the proposed buildings, including the proposed exterior color scheme, style, materials, and design and placement of signs.

5. Any other plans, specifications or design features which the City or its authorized agent may deem necessary and request.

B. FORM AND CONTENT OF PLANS - The City may promulgate rules governing the form and content of plans to be submitted for its approval and may issue statements of its policy with respect to approval or disapproval of architectural styles, details or other matters pertaining to the plans.

Such rules and such statements of policy may be amended or revoked by the City at any time; and no inclusion in, omission from, or amendment of any such rule shall be deemed to bind the City to its approval or disapproval of any matter subject to its approval or to waive the exercise of the City's discretion as to any such matter.

C. CODES AND REGULATIONS - All improvements shall be planned and constructed in accordance with rules and regulations prescribed by the City or its authorized agent; with the laws and ordinances of the City of (City); with applicable building codes and in compliance with the rules and regulations of the Federal Aviation Administration or any successor agencies, where applicable.

D. APPROVAL OF PLANS - Approval of plans and specifications shall be at the sole discretion of the City, such approval not to be arbitrarily or unreasonably withheld. If the City or its authorized agent fails to approve or disapprove such plans and specifications within 30 days after submission thereof, this shall serve as authorized approval of said plans and specifications as submitted.

Approval of said plans and specifications may be withheld because of:

1. Failure to comply with any of these restrictions.
2. Failure to include such information as may be reasonably requested.
3. Reasonable objection to the design and appearance of the proposed structure.
4. Failure to conform with existing structures upon other parcels.
5. The disapproval of the location, grading plan, color scheme, finish, design, proportions, style or architecture, height or appropriateness of the proposed structure or because of any other matter which, in the judgment of the City, would render the proposed structure harmonious with the general plan for improvement of the industrial park.

Approval of any plans or specifications for use on any one parcel shall not be deemed a waiver of the City's right, in its discretion, to disapprove the same plans or specifications if such plans or specifications are subsequently submitted for approval for use on any other parcel or parcels.

E. COMMITMENT TO CONSTRUCT - Upon approval by the City of plans for construction of any structure, a copy of the approved plans shall be deposited for permanent record with the City and a copy of such plans bearing the written approval of the City shall be returned to the owner of the parcel upon which such structure is or will be placed. Approval of these plans by the City shall constitute a commitment on the part of the tenant or owner of the building site to erect and maintain the improvements as proposed and approved and within a reasonable time period, such period to be determined jointly by the City and the tenant or owner of the building site and to be set forth in writing by the City.

F. CONSTRUCTION WITHIN TIME SPECIFIED - Any approved construction shall be prosecuted diligently in accordance with the approved plans and

specifications and shall be completed within the time period specified. Failure to complete such work in the time specified shall cause such approval to be automatically withdrawn unless the City grants written extension of such approval.

G. LANDSCAPING PLANS - Trees, shrubs, fences, hedges or other landscaping shall not be planted, placed or maintained upon any parcel until a complete plan thereof has been submitted to and approved by the City in a manner similar to that required for architectural plans.

All plans for landscape improvements shall be prepared by registered or approved landscape architects. Approval shall be by the City or its representative consultants.

H. PLANS FOR ALTERATIONS IN IMPROVEMENTS - All plans for alterations to lot(s), either for the construction of additional facilities or alterations to existing buildings, shall be prepared, submitted and approved as outlined in Paragraphs A through G above, and shall be subject to the same restrictions as herein provided. This paragraph shall apply only to exterior or structural changes; alterations to the interior of buildings shall not be considered unless they affect the performance standards set forth in Article II.

I. CONSTRUCTION WITHOUT APPROVAL - If any structure shall be altered, erected, placed or maintained upon any parcel other than in accordance with plans and specifications approved by the City, such alterations, erection and maintenance shall be deemed to have been undertaken without the approval required herein. This restriction shall be applicable to landscaping plans, as well as architectural plans.

ARTICLE V

GENERAL COVENANT REQUIREMENTS

The covenants herein set forth shall run with the land and bind the present owner, its successors and assigns, and all parties claiming by, through, or under it shall be taken to hold, agree and covenant with the owner of said building sites, its successors and assigns, and with each of them, to conform to and observe said restrictions as to the use of building sites, and the construction of improvements thereon, but no restrictions herein set forth shall be personally binding on any corporation, person or persons, except in respect to breaches committed during its, his or their ownership of, or title to, said land, and declarant or owner of any of the above land shall have the right to sue for and obtain an injunction prohibitive or mandatory to prevent the breach of or to enforce the observance of the restrictions above set forth, in addition to ordinary legal action for damages, and the failure of declarant and the owner of any other lot or lots or building sites hereby restricted to enforce any of the restrictions herein set forth at the time of its violation, shall in no event be deemed to be a waiver of the right to do so as to any subsequent violation. The

violation of these restrictions shall not defeat nor render invalid the lien or any mortgage (or deed of trust) made in good faith and for value.

Invalidation of any one of these covenants or any part thereof by judgements or court order shall in no wise affect any of the other provisions which shall remain in full force and effect.

IN WITNESS WHEREOF, the City of (City), (State), has caused this instrument to be executed by its (Mayor), attested by its (City Clerk) and its corporate seal to be hereto affixed this _____ day of _____, 19____.

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