Lunken Airport Master Plan

Volume II, Technical Report

Prepared by Landrum & Brown

AIRPORT MASTER PLAN REPORT

Lunken Airport
Cincinnati, Ohio

VOLUME II

TECHNICAL REPORT

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VOLUME II
TECHNICAL REPORT

TABLE OF CONTENTS

TABLE OF CONTENTS

VOLUME II
TECHNICAL REPORT

LIST OF EXHIBITS

LIST OF EXHIBITS

LIST OF EXHIBITS

LIST OF EXHIBITS

CHAPTER I

INVENTORY

CHAPTER I

INVENTORY

The purpose of this chapter is to present the results of the inventory phase of the Lunken Master Plan Study. The inventory was conducted to provide essential background information for the master plan in the areas of history, area planning efforts, airport facilities, airspace and meteorology. It also provided basic data for the development of forecasts and facility requirements. The inventory was accomplished primarily through surveys, field interviews, telephone calls, and collection and analysis of existing reports. For presentation, the results of the Lunken inventory have been divided into five sections:

- History of Lunken Airport
- Sources of Inventory Data
- Description of Existing and Planned Facilities
- Description of Lunken Airspace
- Description of Lunken Weather

These sections are contained in the following pages.

1. HISTORY OF LUNKEN AIRPORT

In 1928 Mr. Edward H. Lunken, a Cincinnati Industrialist, purchased 204 acres of land which he gave to the City of Cincinnati under a perpetual lease agreement for the purpose of constructing a municipal airport. The City supplemented this gift with an additional 800 acres and constructed Lunken Airport four and one-half miles east of downtown Cincinnati. Since it began operation in 1929, Lunken

has served virtually every segment of aviation ranging from the original home of American Airlines to the site of the Aeronca manufacturing plant until the flood of 1937. A turning point in the history of Lunken was when its role shifted from that of an air carrier facility to a general aviation facility in 1947. These two roles are discussed below.

(1) Air Carrier Role

On May 21 and 22, 1938 Lunken Terminal was dedicated to serve American and Marquette Airlines. The terminal was designed by the Cincinnati Architects Kruckemeyer and Strong and completed as a joint WPA and City project at a cost of $172,452. At the time of dedication there were three City hangars on the field, one aeronautical factory, two U. S. Army hangars, and one U.S. Army Administration building with three dwellings. In addition to the two commerical carriers, two local operators used the field and hangars under lease. In 1947, scheduled airline service was transfered to Greater Cincinnati Airport. This marked the beginning of Lunken's role as a general aviation airport.

(2) General Aviation Role

With the transfer of airline operations to Greater Cincinnati Airport, Lunken quickly became a nationally recognized general aviation airport because of its excellent facilities and proximity (4½ miles) to the downtown Cincinnati business district. Since 1947 Lunken has served as the area's largest general aviation airport and provides the following services:

- Aircraft storage (conventional and tee-hangar)
- Aircraft tie-down
- Fuel and oil sales
- Airframe, power plant, and avionics maintenance and repair
- Air charter service
- Aircraft rental
- Aircraft sales
- Flight instruction

In addtion to providing these services, Lunken is the base for several large corporate flight departments and a total of 232 general aviation aircraft ranging from gyrocopters to multi-engine business jets. The size and types of aircraft currently (January, 1975) based at Lunken are shown in Exhibit I-1.

2. SOURCES OF INVENTORY DATA

Inventory work in the master plan study included the collection and evaluation of data pertaining to existing facilities at Lunken Airport, as well as community economics, demographics, planning and historic air traffic information. The data was collected not only by reviewing airport plans and records, but also by interviewing persons associated with the airport. Those persons contacted are listed in Exhibit I-2, following Exhibit I-1. Data collection, review and evaluation focused principally on the following areas:

- Land use patterns and environmental data
- Airspace structure, navaids, and airport operations
- Past and present patterns of air traffic
- Existing airport master plans and studies
- Laws and ordinances affecting the airport
- Surface transportation data
- Socio-economic data
- Area meteorology

EXHIBIT I-1

Lunken Airport Master Plan

JANUARY, 1975 BASED AIRCRAFT

Aircraft Category	Based Aircraft
Single Engine - Propeller - Reciprocating	180
Twin Engine - Propeller - Reciprocating	24
Twin Engine - Propeller - Jet	11
Twin Engine - Jet	12
Four Engine - Jet	1
Helicopter	2
Balloon	2
Total	232

EXHIBIT I-2

Lunken Airport Master Plan

REPRESENTATIVES AND ORGANIZATIONS CONTACTED

Representative	Organization
John Arnold	Jet Centers
Joe Babis	Avionics
Mrs. Belcher	Maier Aviation
David A. Berger	OKI Regional Council of Governments
Bruce Brock	OKI Regional Council of Governments
Robert P. Brown	Airport Superintendent, Lunken
Edward Kenny	Airport Superintendent, Lunken
Robert Bucciere	Cincinnati Aircraft
Rodger G. Burdorf	Hamilton County Regional Airport Authority
Cleta Callahan	Avionics
Edward O. Chamberlin	Based Aircraft Owner
H. F. Coldiron	T. W. Smith (Engine)
Joe Derringer	Dalton, Dalton & Little
Don Fairbanks	Cardinal Air Training
Pat Fairbanks	Cardinal Air Training
Mark Haggard	Thriftway
Dave Heithous	T. W. Smith (aircraft)
Bill Helton	Cincinnati Aircraft
Erv Hoffman	City of Cincinnati
B. H. Kock	City of Cincinnati
John Kordenbrock	Air Flights
Jim Lewis	FAA
John H. Luchow	Procter & Gamble
Ebby Lunken	Midwest Aviation
Martha Lunken	Midwest Aviation

EXHIBIT I-2

Lunken Airport Master Plan

REPRESENTATIVES AND ORGANIZATIONS CONTACTED

Representative	Organization
Dale Lunsford	East End Area Council
Tony Maier	Maier Aviation
Bret McGinness	City of Cincinnati
Norb Meyer	FAA
Tom Moore	Jet Centers
Fred Payne	Cincinnati Park Board
Otto Pobantz	Federated Dept. Stores, Inc.
Wallace Powers	City of Cincinnati
Mr. Printz	FAA, FSS
Mr. Radabaugh	Jet Centers
Don Reis	FAA
Joe Rochford	City of Cincinnati
Nelson Rokes	Procter & Gamble
Jim Ross	CENCOM
Walter Rye	Tri State Aviation
Ray Schlinkert	City of Cincinnati
John Sheblessey	City of Cincinnati
Marshall D. Slagle	N. Ky. Planning Assoc.
Richard P. Stapleton	FAA
Tom Stitt	City of Cincinnati
Rodger Van Pelt	Key Aviation
Robert Vetter	Mt. Washington Civic Assoc.
J. R. White	FAA
Carl Whitman	Kinvernon Corp.
Walter H. Williamson	User's Committee, Lunken

The following is a brief description of the data collected and reviewed in each of these areas.

(1) Land Use Patterns and Environmental Data

Evaluation of community land use patterns and environmental data were necessary in order to determine the feasibility of facility expansion in later phases of the master planning effort.

The following sources were reviewed:

- U.S. Coast and Geological Survey topographic maps
- U.S. Coast and Geological Survey aerial photographs
- National Oceanic and Atmospheric administration aerial photographs
- City Planning Commission - "Land Use Plan for the River Area".
- Ohio-Kentucky-Indiana Regional Planning Authority
  - "Open Space Plan"
  - "Regional Development Plan"
  - "Regional Water System Plan"
- On-site observations

(2) Airspace Structure, Navaids, and Airport Operations

This part of the inventory consisted of identifying the structure and use of the airspace in the vicinity of Lunken Airport. Data sources included the following:

- Airport Location and Vicinity Map
- Airport Layout Plan
- Terminal Area Layout Plan
- Airman's Information Manual
- Sectional Aeronautical Charts
- State of Ohio Airport System Plan
- Letter of Agreement - Cincinnati Approach Control and Lunken Tower

In conjuction with this data collection effort, on-site inspections of the facility were conducted, and knowledgeable persons were interviewed regarding operations at the airport.

(3) Past and Present Patterns of Air Traffic

Historic data concerning aircraft operations, fleet mix, based aircraft, and air service were obtained from the following sources:

- "Airport Activity Statistics"
- "Census of Civil Aircraft"
- FAA Airport Master Record - Form 5010
- "Ohio Airport System Plan - Third Level Aviation Study"
- Interviews with FAA Control Tower Personnel
- Interviews with Lunken Management Personnel

(4) Existing Airport Master Plans and Studies

Previous planning studies used for background and historic planning information included:

- "Facility & Economic Master Plan", Landrum & Brown - 1961

- "Ohio Airport System Plan", Dalton, Dalton, & Little - 1975

(5) Laws and Ordinances Affecting the Airport

The inventory effort included a review of Chapter 402, Code of Ordinances - Airport, in addition to a review of local zoning laws as promulgated in the zoning resolution for Hamilton County. This information was compared to the airport model zoning ordinance outlined in the FAA Advisory Circular AC 150/5190-3A, "Model Airport Hazard Zoning Ordinance."

(6) Surface Transportation Data

Information collected in this area consisted of an inventory of surface access facilities serving Lunken Airport and the surrounding communities.

The Ohio-Kentucky-Indiana Regional Planning Authority furnished much useful surface transportation data, including:

- "Summary Report - Transportation Element."
- "Short Range Transportation Implementation Schedule."
- "Short Range Mass Transit Development Program, 1972 -1976."

In addition to the above data, traffic counts for the airport entrance road were obtained from the City for June, 1973.

(7) Socio-Economic Data

This phase of the inventory was necessary in order to update the existing data describing the socio-economic base for air transportation in the Cincinnati Area. Factors reviewed included:

- demographics
- the economic character of the area
- proposed major developments in the area

Data sources utilized in this analysis included:

- OKI [1/] "Population and Economic Growth"
- U.S. Department of Commerce
  - Census Data
  - County Business Patterns
  - General Social and Economic Characteristics
  - Population and Economic Activity in the United States and Standard Metropolitan Statistical Areas.

1/ Ohio-Kentucky-Indiana Regional Planning Authority

(8) Area Meteorology

Historic meteorological data were obtained from the National Oceanic and Atmospheric Administration, Environmental Data Service for the latest year's weather observations made at Lunken. In addition, weather data utilized in the 1961 Facility and Economic Master Plan, for Lunken were reviewed.

3. DESCRIPTION OF EXISTING AND PLANNED FACILITIES

The purpose of this section of Chapter I is to present, in quantitative terms, a description of existing facilities and planned or requested improvements at Lunken Airport. For ease of presentation, the section has been divided into the following sub-sections.

- Airfield Facilities
- Fixed Based Operator Facilities
- Corporate Facilities
- Public Use Facilities
- Ground Access and Transportation Facilities
- Airport Related Facilities and Services
- Planned or Requested Improvements

The quantitative descriptions furnished in sub-sections 1 through 6 and 8 above will provide the basis for the demand/capacity analysis and determination of facility requirements which are presented in Chapter III. The information presented in sub-section 7 was summarized so that all studies conducted during the Master Plan effort might take into account the existing firmly planned improvements and consider all requested improvements.

(1) Airfield Facilities

Airfield facilities at Lunken include parallel 2-20 runways, runway 6-24, daylight runway 15-33 (limited to propeller aircraft under 12,500 pounds), and associated taxiways. The geometry of the runway/taxiway system and the location of all physical airport facilities are shown in Exhibit I-3. Exhibit I-4 contains all runway data. Navigational and lighting details are presented in Exhibit I-5. All taxiways except taxiway D (connecting Taxiway A with Procter & Gamble facilities) are lighted with standard blue taxiway lights. In addition, runway 15/33 is lighted as a taxiway during nighttime operations.

(2) Fixed Base Operator Facilities

There are currently thirteen (13) fixed based operators (FBOs) at Lunken Airport (some operating from the same physical facilities) providing a broad range of services as presented in Exhibit I-6. Most of the facilities controlled by the FBO's are leased from the City of Cincinnati and, in general, are old and in poor repair. The hangars at the south end of Airport Road were built in France prior to World War I and moved to Lunken in 1925. A summary of fixed base operator facilities is presented in Exhibit I-7, following Exhibit I-6.

LUNKEN AIRPORT

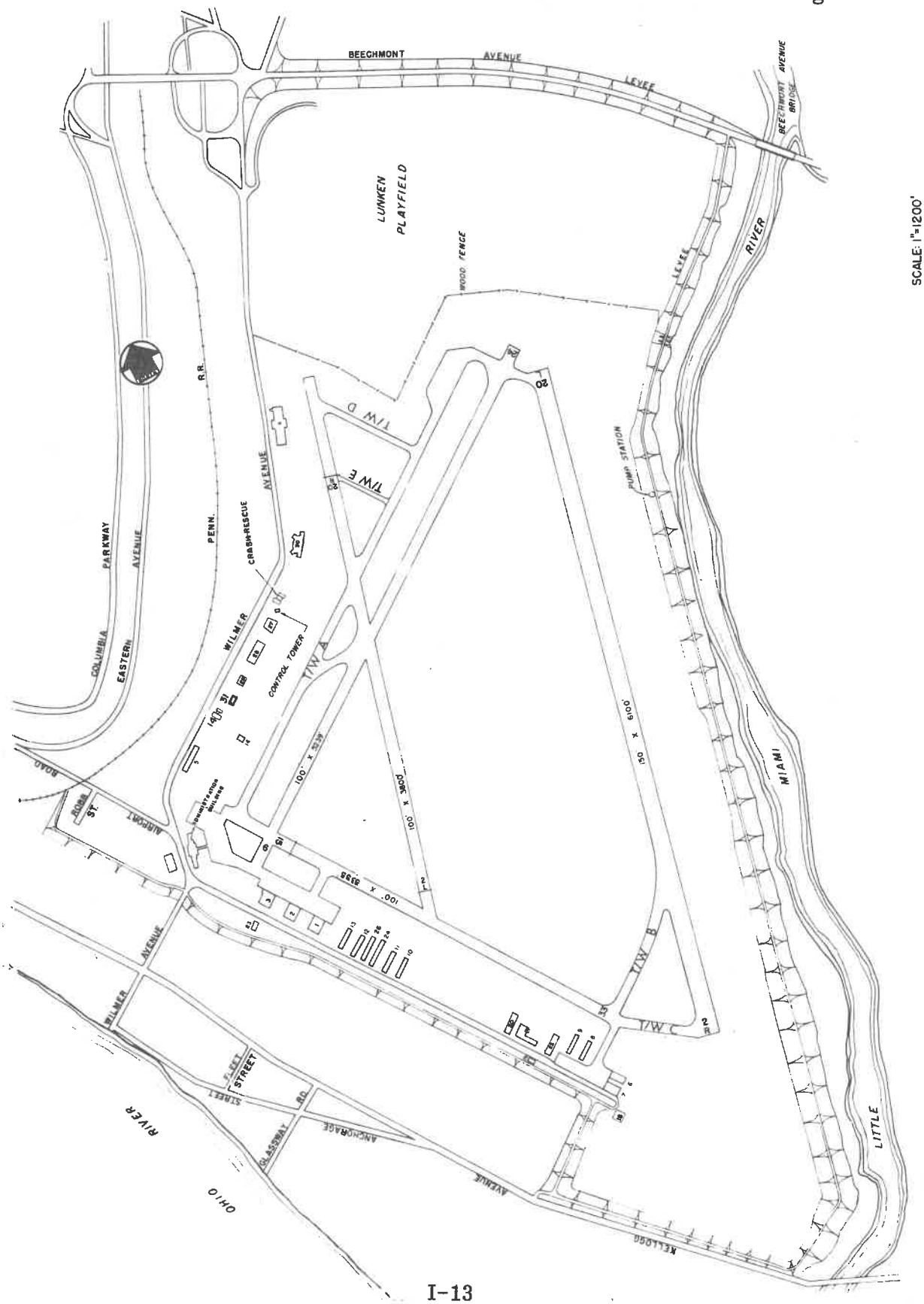


EXHIBIT I-3

Lunken Airport Master Plan

LUNKEN AIRPORT

Building Legend

Building Number	Building Name	Building Type	Building Condition
1	T. W. Smith Engine Repair	Conventional Hangar	Good
2	Cincinnati Aircraft	Conventional Hangar	Good
3	Avionics	Conventional Hangar	Good
4	Procter & Gamble	Conventional Hangar	Excellent
5	Cincinnati Aircraft	Conventional Hangar	Excellent
6	T. W. Smith Airframe Repair	Conventional Hangar	Poor
7	Midwest Air Service	Conventional Hangar	Poor
8	Air Flights	T-Hangar	Poor
9	Air Flights	T-Hangar	Poor
10	Maier	T-Hangar	Good
11	Maier	T-Hangar	Good
12	Blue Ash Aircraft	T-Hangar	Good
13	Blue Ash Aircraft	T-Hangar	Good
14	Key Aviation	Conventional Hangar	Good
14	Key Aviation	A-Frame Offices	Excellent
18	City Maintenance Building	Prefabricated Metal	Good
19	Maintenance	Storage	Good
20	Tri State Aviation	T-Hangar	Excellent
21	Tri State Aviation	Hangar & Offices	Excellent
22	Tri State Aviation	T-Hangar	Excellent
23	Maintenance	Prefabricated Metal	Good
24	Maier	T-Hangar	Good
26	Maier	T-Hangar	Good
27	Jet Centers	Conventional Hangar	Excellent
28	Federated Department Stores	Conventional Hangar	Excellent
29	Kinvernon	Conventional Hangar	Excellent
30	Lind Air	Conventional Hangar	Excellent
31	Chronis Industries	Conventional Hangar	Excellent

EXHIBIT I-4

Lunken Airport Master Plan

RUNWAY DATA

Runway	Physical Length (ft.)	Displaced Threshold	Usable Length (ft.)	Width (ft.)	Thickness (in.)	Effective Gradient	Material	Drainage	Approach Surface Slope	Weight Bearing Capacity (lbs.) Single Gear	Dual Gear	Dual Tandem Gear	Notes
2R/20L	6,100	--	6,100	150	8	.18%	Concrete	Conventional	50:1/50:1	50,000	75,000	138,000	Opened for use on January 14, 1965.
2L/20R	3,800	-/900	3,800	100	7 1/	.18%	Concrete 2/	Centerline	20:1/20:1	36,000	-	-	In good condition - should be maintained to same state as 2R/20L. Restricted to propeller aircraft under 12,500 lbs.
6/24	5,239	--	5,239	100	7 1/	.14%	Concrete 2/	Centerline	40:1/40:1	50,000	75,000	138,000	Needs to be overlayed
15/33	4,035	700/-	3,335	100	7 1/	.21%	Concrete 3/	Centerline	20:1/20:1	36,000	-	-	Limited to propeller aircraft under 12,500 lbs. Daylight runway only--lighted as a taxiway at night.

1/ or equivalent
2/ with asphalt patch
3/ with asphalt overlay

Note: Details of obstruction to approaches are in the airport plans section.

EXHIBIT I-5

Lunken Airport Master Plan

NAVIGATIONAL AND LIGHTING AIDS

Runway	Aids
2R	High Intensity Runway Lights (HIRL) Runway End Identifier Lights (REIL) Visual Approach Slope Indicator (VASI)
20L	Instrument Landing System (ILS) Outer Marker Middle Marker HIRL Medium Intensity Approach Light System (MALS) Runway Visual Range (RVR) Runway Alignment Indicator Lights (RAIL) Localizer
2L	Medium Intensity Runway Lights (MIRL)
20R	MIRL
6	MIRL
24	MIRL
15	Medium Intensity Taxiway Lights (MITL)
33	MITL

Other Off-Airport aids to Navigation:

Crescent, Madeira, and Cincinnati Non-directional Beacons (NDB)
Cincinnati VORTAC

Note: Lighting for runway 2R/20L was new in January, 1965, and is in good repair. In 1974, a project was completed which included the installation of new cable, transformers, and light fixtures (approximately 200 feet on center) for medium intensity lighting on runways 15/33, 6/24, and 2L/20R.

EXHIBIT I-6

Lunken Airport Master Plan

FBO SERVICES

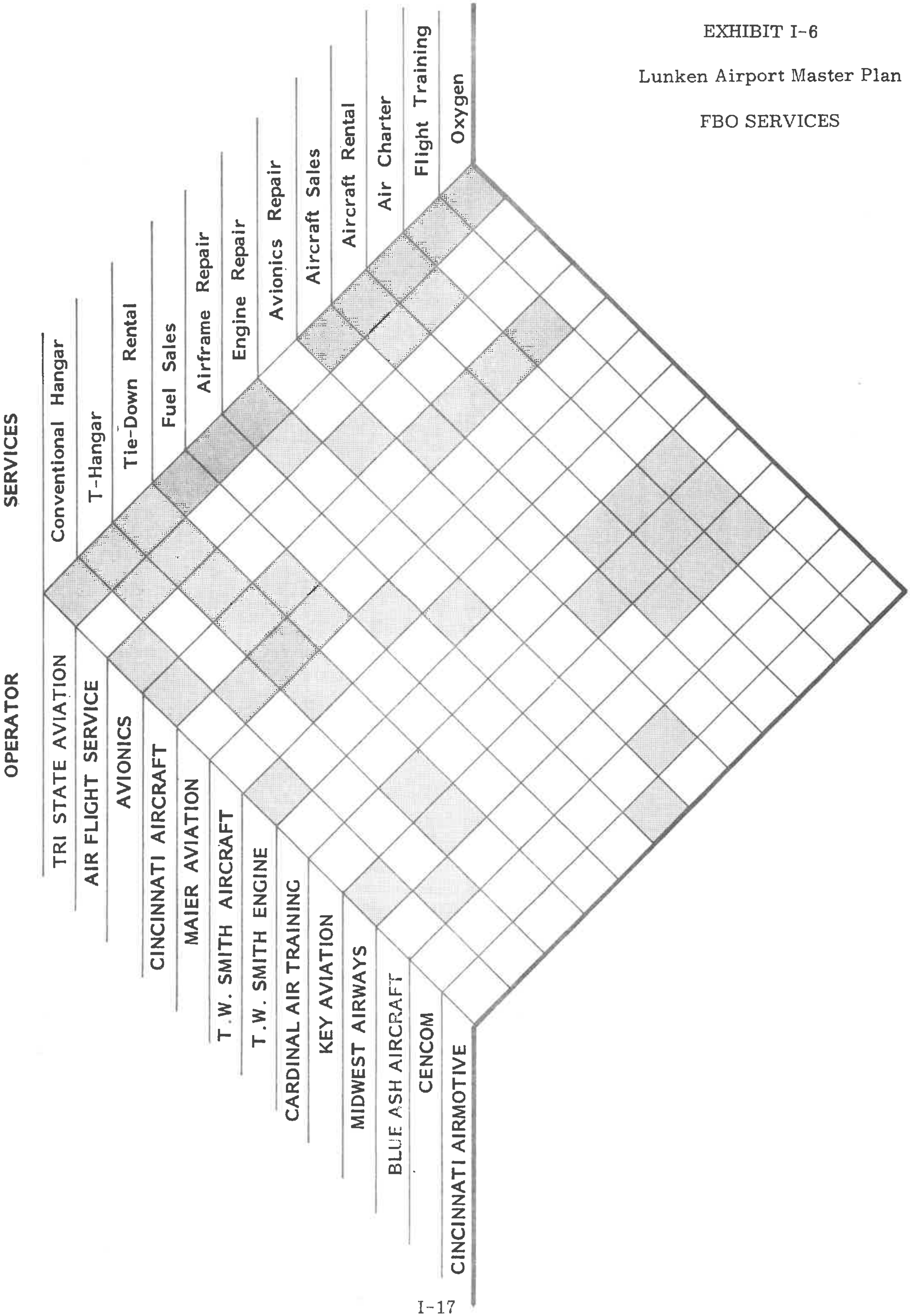


EXHIBIT I-7

Lunken Airport Master Plan

SUMMARY OF FIXED BASED OPERATOR FACILITIES

Facility	Capacity
Conventional Hangar Area	83,400 Square Feet
Conventional Hangar - associated Ramp Area	86,786 Square Feet
T-Hangar Stalls	68 Stalls
T-Hangar - associated area	219,200 Square Feet
Total Lease Area	955,344 Square Feet
Fuel Storage Capacity	93,000 Gallons
FBO Office Space 1/	14,710 Square Feet
Local Ramp Space	296,500 Square Feet
Itinerant Ramp Space	5,600 Square Feet
Tie-Down Rental Area	121
Number of Based Aircraft	213

1/ Does not include office space located within conventional hangars.

(3) Corporate Facilities

At present, there are five (5) corporate flight centers at Lunken with a sixth under construction. The following companies presently have facilities at the airport:

- Federated Department Stores, Inc.
- Jet Centers, Inc.
- Kinvernon Corporation
- Lind Air, Inc.
- Procter & Gamble

All corporate hangars at Lunken are privately-owned on land leased from the City and are newer and in much better condition than the City-owned hangars. A summary of corporate facilities and aircraft is presented in Exhibit I-8.

(4) Public Use Facilities

The public use facilities consist of the Lunken Airport terminal building and the public aircraft parking ramp.

The public-use ramp provides 160,000 square feet of parking area and is free of charge. No tie-down facilities are available on the public ramp.

Lunken Airport terminal was dedicated on May 21 and 22, 1938 and was the original home of American Airlines. Later addition of the north and south wings increased the usable floor space to 20,000 square feet. Facilities currently located in the terminal include:

EXHIBIT I-8

Lunken Airport Master Plan

SUMMARY OF CORPORATE FACILITIES

Facility	Capacity
Conventional Hangar Area	84,650 Square Feet
Ramp Space	125,320 Square Feet
Total Lease Area	766,100 Square Feet
Total Fuel Storage	230,000 gallons
Number of Based Aircraft	19 Aircraft

- Sky Galley restaurant
- Airport superintendent's office
- Cardinal Air Training
- FAA flight service station
- Airmen's Club
- Pilot's lounge
- Waiting lobby
- Restrooms

Exhibit I-9 provides a detailed description of usable space in the terminal.

(5) Ground Access and Transportation Facilities

Lunken Airport is approximately 15 minutes from downtown Cincinnati via Columbia Parkway or Eastern Avenue, both of which carry moderate to heavy traffic to and from the central business district. Off-airport access roads are Wilmer Avenue between Kellogg and Beechmont and Airport Road from Eastern Avenue to Wilmer Avenue. Airport Road continues across Wilmer Avenue and becomes a private, on-airport access road parallel to runway 15-33. Both are two-lane, two-way traffic streets. The private portion of Airport Road is in extremely poor repair, particularly the south section running from Tri-State Aviation to Midwest Airways. Lack of adequate drainage for this section of Airport Road creates hazardous driving conditions after heavy rains and severely limits access to businesses at the south end of the road.

EXHIBIT I-9

Lunken Airport Master Plan

SUMMARY OF LUNKEN TERMINAL SPACE

Location		Usable Space
Main Floor		8,500 Square Feet.
. Sky Gallery Restaurant	2,100	
. Kitchen	1,150	
. Insurance Office	375	
. Restrooms	800	
. Lobby Area	2,400	
. Telephone Area	200	
. Pilots Lounge	150	
. Miscellaneous	1,325	
Second Floor		5,500 Square Feet
. Office Space (offices 20 thru 27)	4,850	
. Restrooms	400	
. Miscellaneous	250	
North Wing		1,700 Square Feet 1/
. Cardinal Air Training	1,700	
South Wing		4,300 Square Feet
. FAA Flight Service Station	3,100	
. Miscellaneous	1,200	
TOTAL		20,000 Square Feet

1/ This figure excludes that space occupied by the kitchen addition in the North Wing.

(6) Airport Related Facilities and Services

The inventory of airport related facilities and services was divided into the following areas:

- Crash/Fire/Rescue
- Maintenance equipment and storage
- Automobile parking
- Flood control
- Fencing
- FAA Control Tower
- FAA Flight Service Station

Each of these areas is described in the following paragraphs.

1. Crash/Fire/Rescue

The Lunken Airport Fire House provides crash/fire/rescue services to the airport and the surrounding communities. Normal minimum staffing is fifteen (15) men consisting of one (1) captain, two (2) lieutenants, and twelve (12) firefighters. Six (6) vehicles are assigned to the firehouse. A description of the vehicles and staffing assignments is given in Exhibit I-10, following this page.

EXHIBIT I-10

Lunken Airport Master Plan

CRASH/FIRE/RESCUE EQUIPMENT AT
LUNKEN FIRE HOUSE

Equipment	Quantity	Number of Assigned Personnel
Pumper *	2	8 (4 per pumper)
Ladder truck	1	4
Water Tank Truck	1	0
Ambulance	1	2
Crash Truck**	1	1
Proximity Suits	5	-
Entry Suits	5	-
Reserve Aqueous Film Forming Foam (AFFF)	4,600 gallons	-
Reserve Dry Chemical	7,900 pounds	-

* Description of Pump Trucks (usable on an as-available):

Extinguishing Agents: 20 gallons of AFFF (16:1 mixing ratio)
500 gallons of water

** Description of Crash Truck (only vehicle permanently assigned to Lunken):

Name: Ansul Magnum 480 (International 1700 Loadstar)

Extinguishing Agents: 1,350 pounds dry chemincal (purple)
200 gallons Aqueous Film Forming Foam

Orifices: 1 Turret for dry chemical @ 60 lbs./sec.
1 Turret for AFFF @ 180 gal./min.
1 Handline for dry chemical @ 25 lbs./sec.
1 Handline for AFFF @ 60 gal./min.

2. Maintenance Equipment and Storage

The City of Cincinnati is responsible for maintenance of all City-owned land and facilities at Lunken. Maintenance is accomplished on both a scheduled and as-needed basis. Exhibit I-11, lists all City-owned maintenance building and equipment.

3. Automobile Parking

Public parking consists of 15 metered stalls in front of the terminal along Wilmer Road, a 20 car lot across Wilmer Road from the terminal, an 18 car lot adjacent to the North Wing of the terminal, and a 54 car lot off Airport Road adjacent to the South Wing.

Other parking facilities are located at or near each FBO and are provided free of charge for customers and employees of the FBO. In addition to public and FBO parking lots, each corporate flight center maintains a parking lot for its employees and users.

EXHIBIT I-11

Lunken Airport Master Plan

AIRPORT MAINTENANCE EQUIPMENT
AND BUILDINGS

Equipment Description	Quanity
Dodge pick-up Truck	1
GMC pick-up Truck	1
International 2½ ton Dump Truck	1
Ford Tractor	1
Massey Ferguson Tractor	1
John Deere Tractor with Front Loader	1
Road Broom	1
Toro 30" Mower	1
Lawnflight 20" Mower	2
114" Mower	3
Valk Snow Plow	1
Chevrolet Van	1
Plymouth Valiant	1
Dodge Sedan	1

Building Number	Area
#18 Garage	6,000 Square Feet
Shop	1,500 Square Feet
#19	1,920 Square Feet

The automobile capacities given above for public use lots are approximate and depend upon how efficiently the lots are actually used. For this reason the area of each lot has also been approximated. The areas of public use, FBO, and corporate parking lots are shown in Exhibit I-12.

4. Flood Control

Lunken Airport is bounded on the West by the Ohio River and on the South and East by the Little Miami. This unusual location has forced the airport to rely on a system of levees surrounding the airport property on all but the North and Northwest sides for flood protection.

Prior to the construction of runway 2R/20L the Little Miami River flowed through what is now on-airport property. In preparation for the new runway the Little Miami was re-routed and a new levee to the West of Lunken constructed. The old river bed still presents problems to the airport however, as water seeps up through the bed and under the levee. To counteract this water problem a pump house was constructed by the levee on the west side of the field. The house contains three pumps which empty a common sump at a combined capacity of 18,000 gallons per minute. Each pump is rated at 75 horse power and can pump 6,000 gallons per minute.

EXHIBIT I-12

Lunken Airport Master Plan

PARKING FACILITIES

Location	Number of Spaces	Area (sq. ft.)
Terminal - Front	15 (metered)	2,625
Terminal - Across street	17	5,000
Terminal - South Wing	54	34,920
Terminal - North Wing	18	9,000
Hangar #2 and #3	40	12,000
Hangar #1	8	4,000
Air Flight	30	12,000
Tri State Aviation	18	2,500
Maintenance Building # 18	14	2,100
Midwest	18	2,000
Hangar #3 (along Airport Road)	38	8,000
Cincinnati Aircraft	50	15,000
Key Aviation	18	5,000
Jet Centers	8	1,000
FAA Tower	20	5,000
Federated Dept. Stores	20	10,000
Procter & Gamble	47	13,000

5. Fencing

Fencing at Lunken Airport is of several different types, most of which would not be suitable, from a security standpoint, if third level service were ever introduced. The following paragraphs describe Lunken's existing fencing, counterclockwise, around the airport perimeter, beginning at the Procter & Gamble facility.

- Parallel to Wilmer Avenue, roadside of the corporate hangars, the fencing consists of the following:
  - Three foot high chainlink fence from property line at golf course past the Procter & Gamble hangar to the Lind Air facility. Openings for auto entrance are gated.
  - Three foot high split rail fence at Lind Air Hangar. Openings for auto entrance not gated.
  - No fencing at firehouse.
  - Three foot high chainlink fence at control tower. Openings for auto entrance are not gated.
  - Three foot high split rail fence from Federated Hangar to new hangar. Openings for auto entrance are not gated.
  - Three foot high chainlink fence from new hangar to terminal building. Openings for auto entrance not gated.
  - Three foot high chainlink fence airside to terminal building with gates at entrance points.
- Along Airport Road fencing is exclusively three foot high chainlink fence. Openings for autos are not gated except at Tri State Aviation.
- The Levee forms a natural boundary along the eastern side (along 2R-20L) of the airfield and along Kellogg Avenue at the southern end of airport property. At this southern tip of the airport, there is a six foot high chainlink fence with barbed wire between the Levee and Kellogg Avenue.

- A six foot chainlink fence has been installed at the point where the bike trail descends from the top of the levee to Lunken Playfield. From this point, a five foot wooden fence runs to the northwest, dividing the playfield and the airport, until the section parallel to the Taxiway A run-up pad is reached, where a several hundred foot gap exists. The remainder of fencing (beginning at the run-up pad) between the airfield and playfield is three foot high post and cable.

6. FAA Control Tower

The Federal Aviation Administration maintains a control tower at Lunken Airport to provide for the safe, orderly, and expeditious flow of traffic on and in the vicinity of the field. Hours of operation of the tower are daily from 7:00 AM to 11:00 PM. During the hours from 11:00 PM to 7:00 AM one runway is left lighted according to the prevailing wind direction. There is one set of controls for all runways and approach lights; these controls are in the tower.

7. FAA Flight Service Station

The Federal Aviation Administration also maintains a flight service station (FSS) at Lunken. The services provided by the FSS include:

- pre-flight pilot weather briefing
- enroute communication with VFR flights
- assisting lost VFR flights
- originating notices to airmen (NOTAMS)
- broadcasting aviation weather reports
- accepting and closing flight plans
- operating the national weather teletype writer system

FSS offices are located in the South Wing of the terminal building.

(7) Planned and Requested Improvements

The Superintendent of Lunken Airport has requested funds from the City of Cincinnati for the purpose of improving Lunken through 1979. These requests are summarized in Exhibit I-13, according to the year in which the need for the improvement will occur. As stated in the Introduction to Section 3, all planning conducted during the Master Plan will take these requests into account according to whether the improvement is firmly planned or tentative.

EXHIBIT I-13

Lunken Airport Master Plan

REQUESTS FOR IMPROVEMENTS

Year	Request
1975	Repair Levee & Flood Relief Well *
	Repair River Erosion*
	Repave Runway 6-24
	Install Auxiliary Pumping Station
	Rebuild Airport Road
	Construct Holding Apron for Runway 2L
1976	Construct Taxiway F
	Purchase Illuminated Runway & Taxiway Guidance Signs
	Purchase and Install Additional Obstruction Lighting & Marking
	Purchase Airport Fencing
	Install Lighting for Holding Apron on Runway 2L
1977	Purchase and Install Taxiway F Lighting
	Construct Taxiway E Parallel to 2R-20L
	VASIs & REILs
1978	Purchase and Install Taxiway E Lighting
	Rebuild Drainage on Runway 2L-20R
	Purchase Lighted Wind Cones
	Auto Parking Lots
1979	Extend Public Ramp to South
	Light Public Ramp
	Renovate Terminal Building
	Purchase and Install Auto Parking Lot Lighting

* Approved for 1975.

4. DESCRIPTION OF LUNKEN AIRSPACE

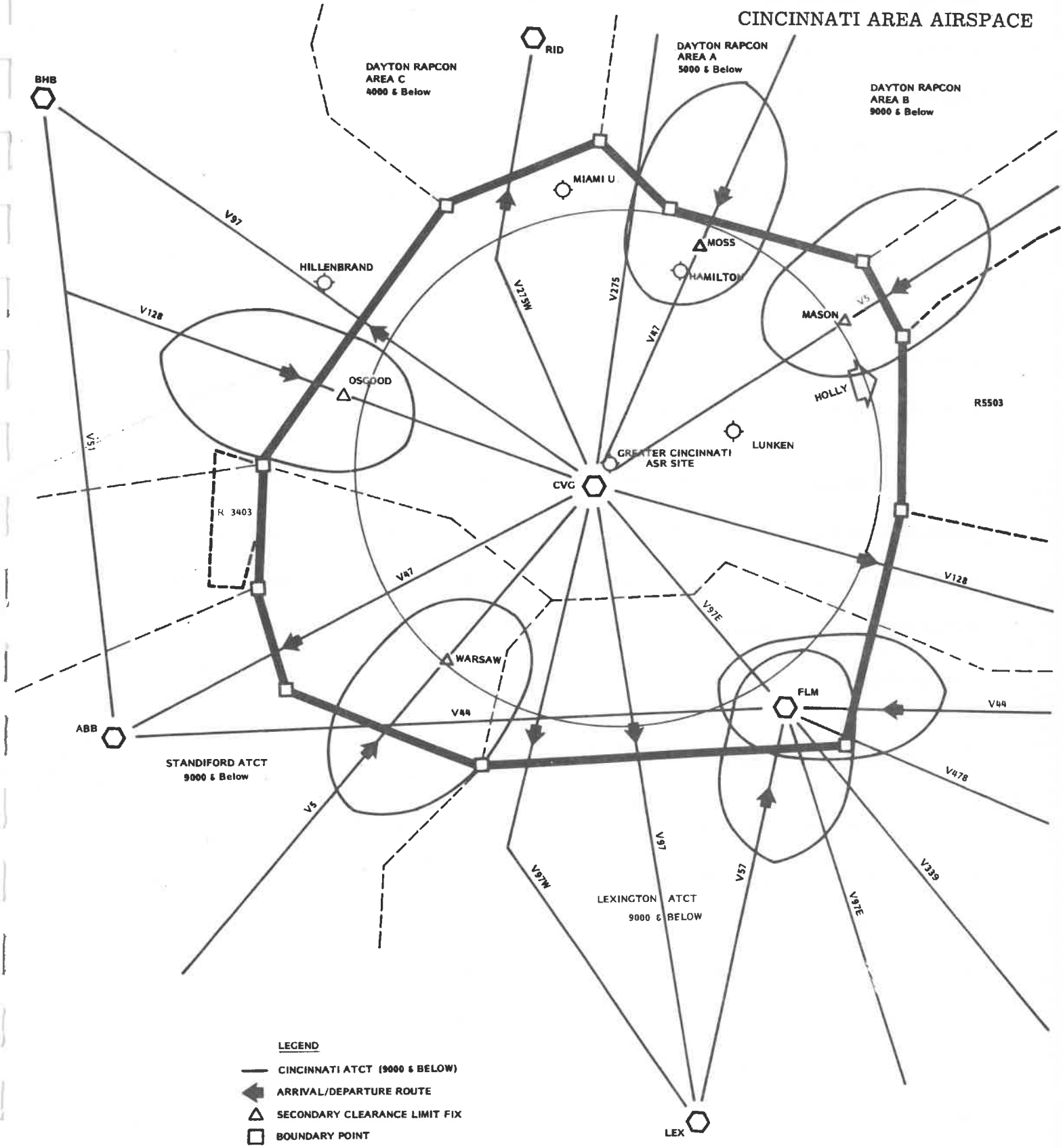
Lunken Airport's airspace was reviewed as it relates to the airspace of the Greater Cincinnati Area, which contains not only Lunken, but Greater Cincinnati and Blue Ash Airports as well.

Greater Cincinnati Airport is located in Boone County, Kentucky nine miles west-southwest of Cincinnati's central business district (CBD). The airport's runway system consists of parallel 9/27 runways and a single 18/36 runway serving all of Greater Cincinnati and Northern Kentucky's commerical air carrier requirements. The airport is fully instrumented, has an air traffic control tower, and is equipped with the Automated Radar Terminal System (ARTS III). The ARTS III equipment provides controllers with target messages indicating the location, ground speed, identification and altitude (if reported by transponder) of all aircraft within the Cincinnati airspace (see Exhibit I-14).

Blue Ash Airport, located 12 miles northeast of Cincinnati's CBD, has a single 6/24 runway which is 3,500 feet long. Blue Ash is an uncontrolled field and serves general aviation aircraft with non-precision approaches to both runway 6 and 24.

The existing Greater Cincinnati area airspace (which includes Lunken), where aircraft flying instrument rules are under positive control, is shown in Exhibit I-14. The airspace includes individual control zones at Lunken and

CINCINNATI AREA AIRSPACE



Greater Cincinnati Airports (Blue Ash is uncontrolled) and consists of airspace extending upward from the ground to 9,000 feet (MSL). The area is monitored by airport surveillance radar and aircraft operating within this area are provided Stage III (radar sequencing and separation) service by the FAA air traffic control tower at the Greater Cincinnati Airport.

The Greater Cincinnati airspace is served by 12 low altitude federal airways which provide inbound and outbound routes for the Cincinnati area as shown in Exhibit I-14. In addition to these airways, Lunken Airport is served by "Holly Two" Standard Instrument Departure (SID).

The existence of restricted area R-5503, 17 miles east of Lunken, should be noted on Exhibit I-14. The airspace within this area (from 4,000 to 60,000 feet) is used daily from 8: 00AM to 10: 00PM by the Aeronautical Systems Divisions, Wright Patterson Air Force Base. Thus, all traffic to and from the east coast must fly around this area.

5. DESCRIPTION OF LUNKEN WEATHER

Historic weather data for Lunken Airport were obtained from the National Climatic Center, U.S. Department of Commerce, at Asheville, North Carolina, for the most recent one year period on record. For weather occurrence analysis, a total of 2,189 observations of wind direction, speed, cloud ceiling and visibility limits were organized into the standard weather categories presented in Exhibit I-15, following this page. The historic frequency of occurrence for each weather category is also shown in Exhibit I-15 in terms of hours of occurrence per year.

EXHIBIT I-15

Lunken Airport Master Plan

STANDARD WEATHER CATEGORIES AND FREQUENCY OF OCCURRENCE

Weather Category	Definition				Percentage Occurances	Annual Hours of Occurance
	Minimum		Maximum			
	Ceiling	Visibility	Ceiling	Visibility		
All Weather	0	0	None	None	100.0%	8,760
VFR	1,000 ft.	3 mi.	None	None	82.4%	7,218
IFR	0	0	1,000 ft.	3 mi.	17.6%	1,542

Since only one year of Lunken weather data was used, because of the extreme expense of translating hard copy to magnetic tape, a comparison was made with available weather at Greater Cincinnati Airport. The all weather, VFR and IFR wind roses for Greater Cincinnati Airport, based on the most recent 10 years, compared favorably with Lunken's weather data.

For runway wind coverage analysis, the weather data were summarized according to the average annual occurrence of wind conditions by velocity and direction for both instrument and visual flight rule weather categories (IFR and VFR). The results of these weather summaries are presented on wind roses, in Exhibits I-16 through I-18.

From the weather occurrence information presented on the wind roses, the weather coverage provided by each runway (for each weather category) was determined. These coverages are presented in Exhibit I-19 for both 12 and 15 MPH crosswind limits. As indicated in the Exhibit, runway 6/24 provides the greatest single-direction coverage (96.13 percent in VFR weather) and the maintenance of 15/33 as a runway only provides an additional 1.46 percent VFR coverage over runways 2R/20L, 2L/20R and 6/24 with 12 MPH crosswind limits.

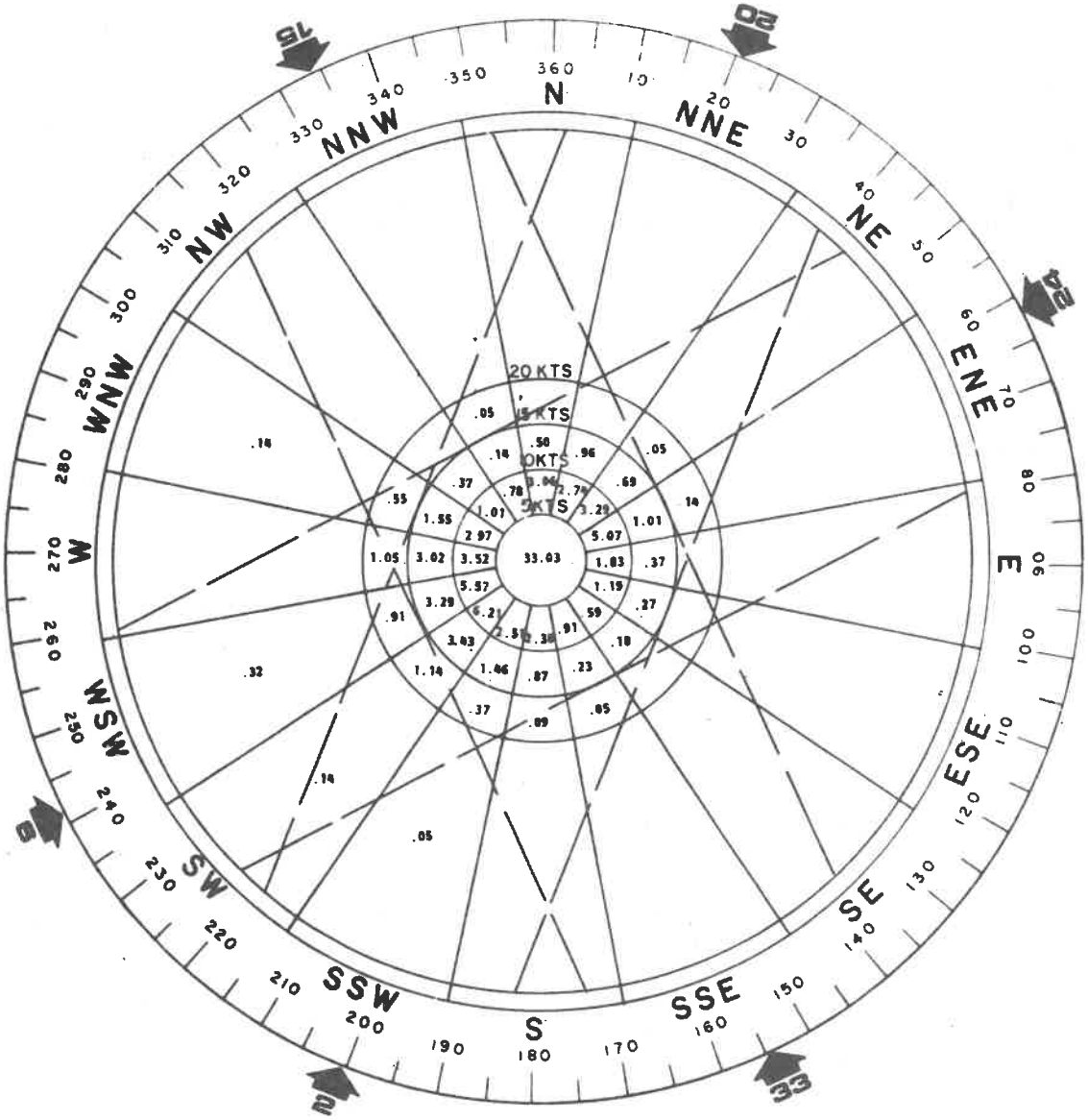
* * * * * * * *

Presentations of other pertinent data and detailed discussions of the analyses performed on the inventory data are contained throughout this report in support of various elements of the study.

EXHIBIT I-16

Lunken Airport Master Plan

ALL WEATHER WIND ROSE



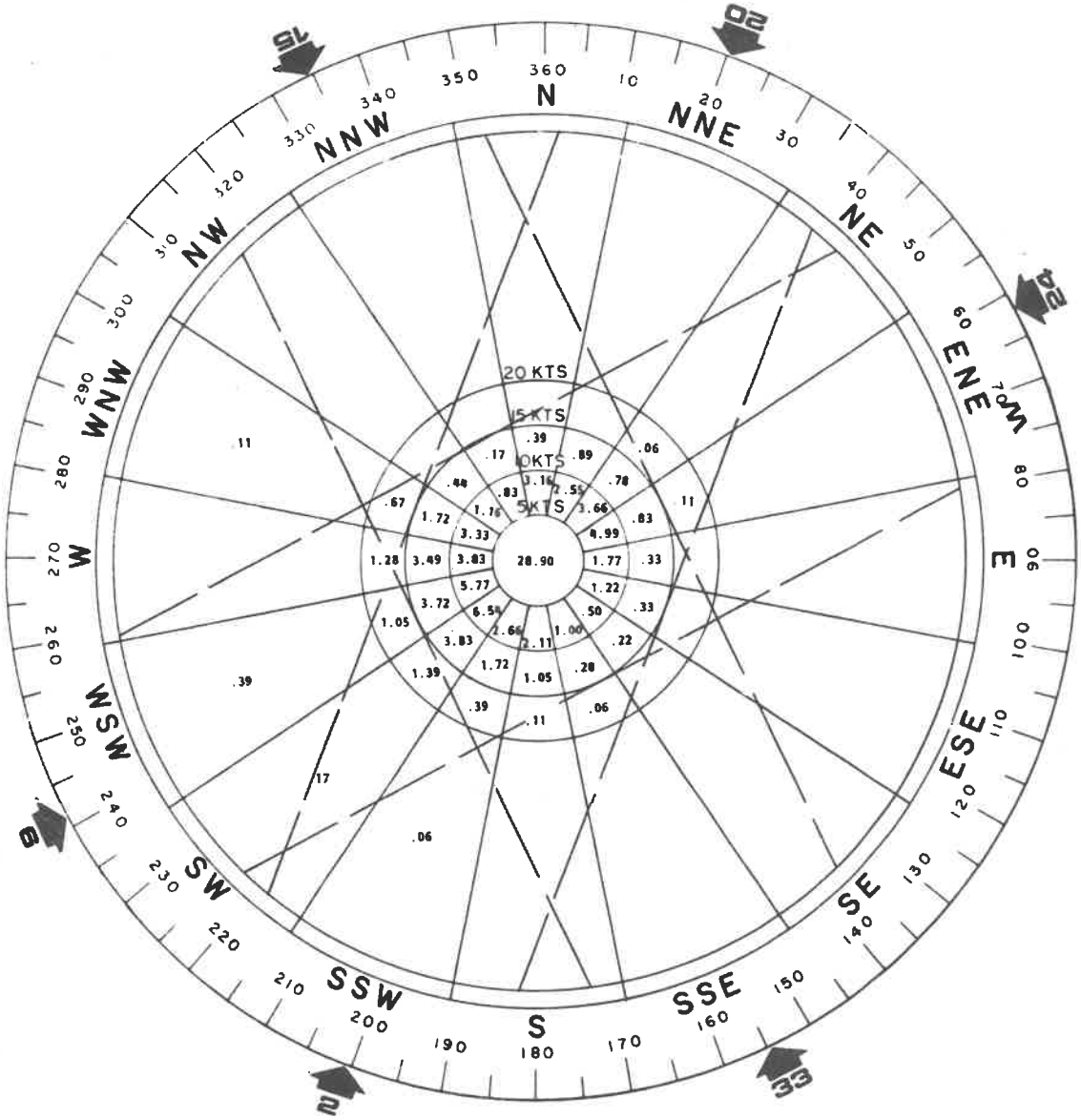
SOURCE: National Climatic Center, U.S. Department of Commerce, Asheville, North Carolina. From Lunken Airport

PERIOD: January thru December, 1974.

EXHIBIT I-17

Lunken Airport Master Plan

VFR WIND ROSE



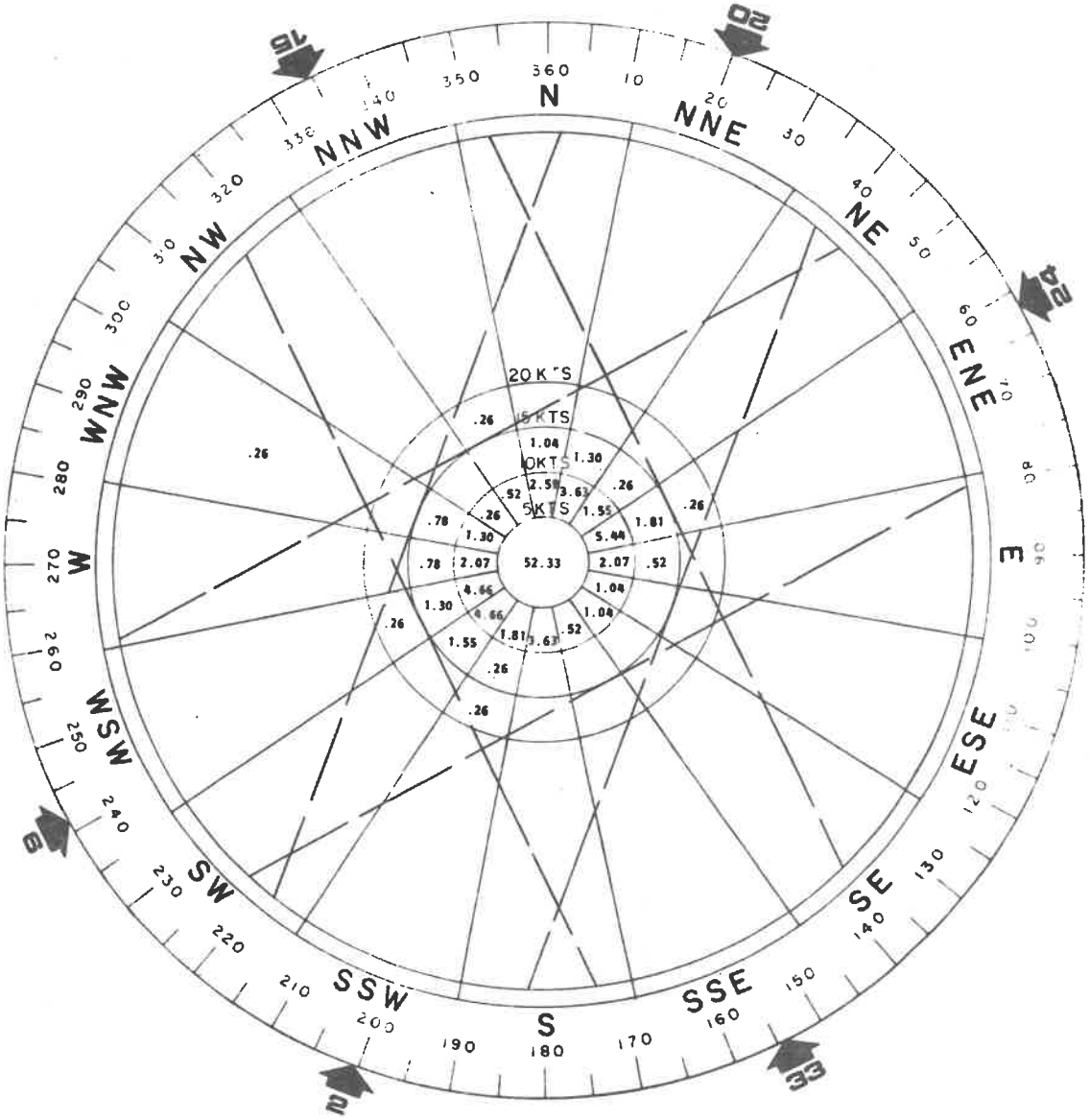
SOURCE: National Climatic Center, U.S. Department of Commerce, Asheville, North Carolina. From Lunken Airport

PERIOD: January thru December, 1974.

EXHIBIT I-18

Lunken Airport Master Plan

IFR WIND ROSE



SOURCE: National Climatic Center, U.S. Department of Commerce, Asheville, North Carolina. From Lunken Airport

PERIOD: January thru December, 1974.

12 MPH (10.5 Knot) Crosswind Limit

Weather Category	Runways 2R/20L, 2L/20R				Runway 6/24				Combined Coverages Runways 2R/20L, 2L/20R, 6/24	Runway 15/33				Combined Coverages Runways 2R/20L, 2L/20R, 6/24 15/33
	2	20	Calms [1]	Total	6	24	Calms	Total		15	33	Calms	Total	
All Weather	23.33	35.29	33.05	91.67	22.17	41.36	33.05	96.59	98.16	24.63	27.80	33.05	85.48	99.44
VFR [2]	23.65	37.94	28.90	90.49	22.11	45.12	28.90	96.13	97.85	25.44	29.40	28.90	83.74	99.31
IFR	21.61	23.03	52.34	96.98	22.34	23.84	52.34	98.52	99.33	20.80	20.29	52.34	93.42	99.77

15 MPH (13 Knot) Crosswind Limit

Weather Category	Runways 2R/20L, 2L/20R				Runway 6/24				Combined Coverages Runways 2R/20L, 2L/20R, 6/24	Runway 15/33				Combined Coverages Runways 2R/20L, 2L/20R, 6/24 15/33
	2	20	Calms	Total	6	24	Calms	Total		15	33	Calms	Total	
All Weather	24.43	38.52	33.05	96.00	22.74	43.00	33.05	98.79	99.49	28.06	31.37	33.05	92.48	99.86
VFR	24.77	41.65	28.90	95.32	22.67	47.05	28.90	98.62	99.39	29.16	33.37	28.90	91.43	99.82
IFR	22.62	23.96	52.34	98.91	22.96	24.05	52.34	99.35	99.69	22.87	21.94	52.34	97.15	99.78

1/ Calms are less than or equal to 5 knots.
2/ Ceiling/visibility greater than or equal to 1000/3.

EXHIBIT I-19
Lunken Airport Master Plan
RUNWAY WIND COVERAGE DATA

CHAPTER II

FORECAST OF AVIATION DEMAND

CHAPTER II

FORECAST OF AVIATION DEMAND

This chapter documents the analyses undertaken to forecast both unconstrained and constrained aviation demand at Lunken Airport for the short, intermediate, and long range planning periods (through 1995). By unconstrained, it is meant that forecast demand elements were not influenced by any potential lack of physical facilities at Lunken resulting in a true potential growth of aviation demand. The forecast of constrained demand takes into account the limitations or constraints of the particular location. The elements of demand considered in the analyses were:

- Annual average based aircraft,
- Annual number of aircraft operations,
- Peak hour aircraft operations,
- Based aircraft fleet mix

The unconstrained forecast values selected for each of these elements were based upon the results of various quantitative techniques (described in the following sections), judgment regarding the soundness of the growth and relationships implied, and comparisons between these and other forecasts.

The constrained forecast values for these elements were based upon the selected alternative airfield development plan and the maximum airfield capacity achieveable with this concept. The selection of the preferred alternative airfield development plan and the constraints which limit the potential of Lunken Airport are discussed in Chapter IV.

The basis for the unconstrained aviation demand forecasts was the socio-economic data base of the area served by Lunken - consequently this base and forecasts of its future values are presented in Section 1. Sections 2 through 5 present discussions of the analyses conducted in order to forecast each element of demand listed above. Section 6 presents the basis for Landrum & Brown's forecast of constrained aviation demand at Lunken Airport. Exhibit II-1 presents the forecast of constrained aviation demand at Lunken Airport.

1. SOCIO-ECONOMIC DATA AND FORECASTS

The socio-economic base of the area served by Lunken Airport provided a foundation for forecasting aviation demand during the short, intermediate, and long range planning periods. The selection and analysis of this data base are described below.

(1) Selection of Data Base

Both local and national sources of historic and forecast socio-economic and demographic data were considered for their applicability in this study. The selected historic data base and forecasts are presented in Exhibit II-2.

The primary sources analyzed were:

- The Obers Projections, Economic Activity in the U.S., developed by the Bureau of Economic Analysis.

EXHIBIT II-1

Lunken Airport Master Plan

FORECAST OF CONSTRAINED
AVIATION DEMAND

Year	Based Aircraft	Operations			
		Itinerant	Local	Total	Peak Hour
1980	344	127,887	144,213	272,100	190
1985	410	152,421	171,879	324,300	196
1990	436	162,150	182,850	345,000	198
1995	436	162,150	182,850	345,000	198

Year	Based Aircraft	Fleet Mix					
		Single Engine	Multi-Engine			Helicopter	Other
			Piston	Turbo-Prop	Jet		
1980	344	267	35	17	19	2	4
1985	410	318	42	20	23	2	5
1990	436	338	45	21	25	2	5
1995	436	338	45	21	25	2	5

EXHIBIT II-2

Lunken Airport Master Plan

HISTORIC SOCIO-ECONOMIC BASE AND FORECASTS [1]

Year	SMSA Population (000's)	SMSA Per Capita Personal Income (1967 - $)
1962	1,313.5	2,765
1963 [2]	1,331.0	2,792
1964 [2]	1,345.7	2,890
1965	1,344.6	3,036
1966	1,352.0	3,217
1967	1,361.6	3,354
1968	1,374.1	3,494
1969	1,376.6	3,609
1970	1,389.1	3,653
1971	1,392.5	3,688
	Forecasts	
1980	1,498.9	5,000
1985	1,565.9	5,700
1990	1,635.8	6,400
1995 [3]	1,685.5	7,400

---

[1] U.S. Department of Commerce, Bureau of Economic Analysis, 1972 OBERS Projections, Series E Population.

[2] Data points estimated by Landrum and Brown.

[3] 1995 Forecast developed by interpolation by Landrum and Brown.

. OKI Population and Economic Growth, December, 1973, Ohio-Kentucky-Indiana Regional Planning Authority.

The Cincinnati, Ohio-Kentucky-Indiana Standard Metropolitan Statistical Area (SMSA) was chosen as the socio-economic area of relevance to Lunken's aviation activity. This region consists of the following seven counties:

Clermont, Ohio
Hamilton, Ohio
Warren, Ohio
Dearborn, Indiana
Boone, Kentucky
Campbell, Kentucky
Kenton, Kentucky

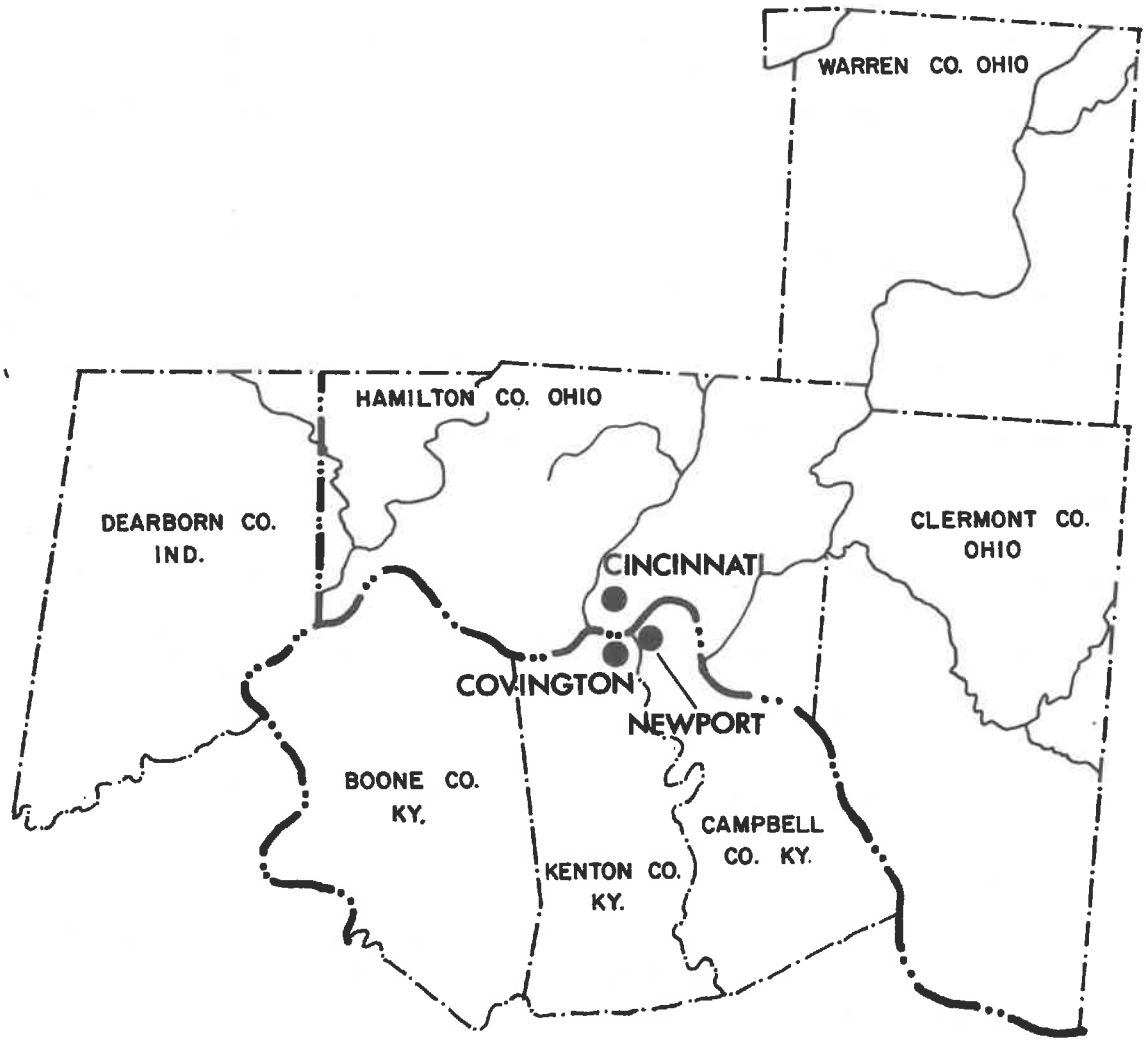
This area is graphically presented in Exhibit II-3.

The Bureau of Economic Analysis (BEA) study contained historic data for the years 1929, 1959, 1962, 1965-1972 on population, income, employment and other variables for the Cincinnati SMSA and included forecasts for 1980, 1985, 1990, 2000, and 2020 for these same variables. The forecasts were developed by forecasting national industrial trends and production activity, allocating this activity to 173 regions based upon historical trends, and distributing the regional activity among SMSA and non-SMSA areas within each region. This most recent set of projections by the BEA embodied a series E population growth rate assumption, which

EXHIBIT II-3

Lunken Airport Master Plan

CINCINNATI SMSA



is that the average number of births per woman will be 2.1 upon completion of childbearing. Other possible fertility assumptions 3.1, 2.8, and 2.5 births per woman with series B through C, respectively, or 1.8 births per woman with series F assumptions.

> "In general, the most critical assumption in population forecasting is the birth rate or fertility rate assumption. At the U.S. level of population forecasting, the projection series are known as A thru F. The series A and B have both found disfavor among population forecasters, in that each of these series produces population projections that are unrealistically high. The series F population growth is very nearly the zero population growth projection. The projection series that best reflect current population growth trends, and which are, therefore, in most frequent use today are C through F." 1/

It is the opinion of Landrum & Brown that the E series population projections are the most appropriate for developing the forecasts of population in the Cincinnati SMSA.

The Ohio-Kentucky-Indiana (OKI) Regional Planning Authority study contained historic data for the 1950, 1960, and 1970 census years on population and employment by county for nine (9) counties, including the seven (7) SMSA counties, and included forecasts for 1975 through 2000 in five year intervals. Population forecasts were developed by a ratio technique based upon population projections for the limited United States developed by the U.S. Bureau of the Census. Two employment forecasts were developed, one by applying forecast participation data to the projected population

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1/ "Airport Feasibility Study for the Lake Erie Regional Transportation Authority," Howard, Needles, Tammen & Bergendoff in association with Landrum & Brown, September, 1974.

to predict a labor force (assuming an employment rate); and the second by assuming a ratio of employment to population and applying this to population projection.

The population and employment forecasts in the two studies did not differ substantially. The forecast selected was that produced by the Bureau of Economic Analysis which employed a more substantial data base. Estimating the 1963 and 1964 data points provided a historic data string, 1962-1972, which was used for a socio-economic regression. The 1950, 1960 and 1970 data points that provided the historical input to the OKI study would not allow such an analysis to be validly preformed. The BEA study also included historic data and forecasts for income, which were not available in the OKI study.

(2) Economic Character of Cincinnati, Ohio-Kentucky-Indiana SMSA

A mid-1960's Federal Aviation Administration study ("Air Traffic Patterns and Community Characteristics") classified general aviation air trade centers as having either a marketing, institutional, industrial, or balanced character and analyzed the demand for air transportation generated by communities within these respective classifications. Exhibit II-4 indicates that the Cincinnati SMSA economic characteristics are changing toward a large concentration in the Government and Services area. The FAA study concluded that communities with an

EXHIBIT II-4

Lunken Airport Master Plan

CINCINNATI SMSA ECONOMIC CHARACTER

Industry	% of Earnings 1950	1962	1969	1970	1971
Agricultural, Forestry & Fisheries	1.76	.66	.39	.36	.34
Mining	.15	.10	.06	.07	.08
Contract Construction	5.63	5.76	6.65	6.00	6.03
Manufacturing	38.53	39.10	37.36	37.17	35.76
Transportation, Communications & Public Utilities	10.35	8.83	8.21	8.46	8.74
Wholesale & Retail Trade	20.63	18.27	17.53	17.47	17.55
Finance, Insurance & Real Estate	4.63	5.26	5.07	4.98	5.25
Services	11.68	12.38	14.23	14.62	14.99
Government	6.64	9.64	10.50	10.87	11.26

institutional or marketing character generate the greatest levels of air traffic. Thus, as the character of the Cincinnati SMSA is tending toward these areas, the demand for air transportation can be expected to remain at least as strong as it has been in the past.

2. BASED AIRCRAFT DATA AND FORECASTS

In spite of recent economic events the general aviation industry is still growing. Production of general aviation aircraft increased substantially in fiscal 1974 over the same period in 1973. Unlike forecasts of air carrier activity, recent forecasts of over all general aviation activity have not changed significantly from prior years' projections.

Rising costs of fuel and the lack of availability have affected all modes of transportation. The potentially negative effect on general aviation, however, has been somewhat counteracted by a shift to this mode as it begins to compare more favorably with alternative transportation due to these cost increases. Increased shorthaul fares resulting from the CAB's Domestic Passenger Fare Investigation, reduced airline flight frequencies because of fuel shortages, and increased costs of automobile travel due to fuel price increases are viewed on a national basis as having long term positive implications for general aviation activity.

Taking these economic developments into consideration, trend analysis, socio-economic regression, and share-of-the-U. S. market techniques were each investigated for the purpose of forecasting Lunken based aircraft. However, no forecast resulted from the socio-economic regression analysis. The estimates resulting from the share-of-the-U.S. market and trend analysis techniques are presented in Exhibit II-5 along with the selected forecast. Discussions of these analyses are presented in the following subsections along with the analysis conducted to select a based aircraft forecast and compare it to other, independent, forecasts.

(1) Trend Analysis

Trend analysis of historic data provided a quantitative estimate of the future growth rate of based aircraft. Selection of the actual trend of these data was accomplished using a combination of statistical techniques and informed judgment.

Examination of 1973, 1974 and 1975 data revealed a slight downturn in based aircraft at Lunken relative to previous years. However, this downturn was felt to be a short-term reaction to the oil embargo and recession and not indicative of overall long-term growth. Further, 1972 data were analyzed and found to be inaccurate and unusable. Remaining data (1955-1971) were analyzed to determine the

EXHIBIT II-5

Lunken Airport Master Plan

BASED AIRCRAFT ESTIMATES
AND FORECASTS

Year	Trend Analysis Estimates	Share-of-the-Market Market Estimates	Selected Forecast
1980	344	316	344
1985	410	410	410
1990	489	504 1/	489
1995	584	598 1/	584

1/ Extrapolated from 1980 and 1985 forecasts.

presence of any consistent growth patterns. This historic data base, as well as the selected based aircraft forecast developed from extrapolation of past trends, is presented in Exhibit II-6.

The forecast presented implies a 3.6 percent per year annual growth rate as compared to the 1955-1971 experience of 4.1 percent per year. The form of the trend equation selected embodies a constant growth rate throughout the forecast years.

(2) Socio-Economic Regression Analysis

Regression analysis of socio-economic and demographic data with based aircraft data provided a structural set of relationships between these data and based aircraft. Given future estimates of the socio-economic and demographic variables, attempts were made to estimate future based aircraft at Lunken.

It was considered that based aircraft might be forecast as a function of the socio-economic characteristics of an individual county, such as Hamilton. However, socio-economic forecasts were available only at the SMSA level. The utility of any socio-economic data developed by disaggregating the SMSA level data into county level data can be suspect. Therefore, the entire SMSA was utilized as the geographic basis for the based aircraft forecasts. The regression analysis conducted attempted to functionally relate the based aircraft at Lunken to the

EXHIBIT II-6

Lunken Airport Master Plan

HISTORIC AND FORECAST TRENDS
IN GROWTH OF BASED AIRCRAFT

Year	Based Aircraft
1955	132
1956	121
1957	165
1958	171
1959	171
1960	198
1961	172
1962	172
1963	194
1964	237
1965	203
1966	203
1967	203
1968	209
1969	223
1970	237
1971	260
Forecast	
1980	344
1985	410
1990	489
1995	584

socio-economic characteristics of the SMSA. The results of this analysis were statistically insignificant and not explanatory of based aircraft at Lunken.

(3) Share-of-the-U.S. Market Analysis

Analysis of Lunken Airport's historic based aircraft in relation to U.S. general aviation based aircraft (the share of the U.S. market technique) provided a basis for determining how future activity levels might be affected by nation wide developments in the industry. While the regression analysis technique connected Lunken's based aircraft to local factors, the share-of-market approach related Lunken's based aircraft to the development of general aviation activity throughout the country.

The U.S. forecast of based aircraft employed in this analysis is presented in Exhibit II-7 along with the assumed .17 percent Lunken share and the resultant estimate of Lunken based aircraft. Lunken Airport's historic share of U.S. total based aircraft has fluctuated from a high of .267 percent in 1964 to a low of .168 percent in 1968. Since 1968, Lunken's Market share has been increasing. However, the increase is felt to be a reflection of a change in reporting procedures instituted in 1968. Prior to this year the U.S. Census of Civil Aircraft reported any flyable aircraft as a based aircraft. The

EXHIBIT II-7

Lunken Airport Master Plan

SHARE OF U.S. MARKET HISTORIC DATA AND FORECAST ESTIMATE OF BASED AIRCRAFT

Year	Lunken Based Aircraft 1/	U.S.Based Aircraft 2/	Lunken % Share of U.S. (%)
1955	132	58,790	.225
1956	121	62,886	.192
1957	165	65,289	.253
1958	171	67,839	.252
1959	171	68,727	.249
1960	198	76,549	.259
1961	172	80,632	.213
1962	172	84,121	.204
1963	194	85,088	.228
1964	237	88,742	.267
1965	203	95,442	.213
1966	203	104,706	.194
1967	203	114,186	.178
1968	209	124,237	.168
1969	223	130,806	.170
1970	237	131,743	.180
1971	260	131,148	.198
	Forecasts		
1980	316	186,000 3/	.17
1985	410	241,000	.17
1990	504 4/		
1995	598 4/		

1/ Lunken Airport FAA 5010 Forms.

2/ Census of U.S. Civil Aircraft December, 1971, December, 1964.

3/ Aviation Forecasts, Fiscal Years 1975-1986.

4/ Extrapolated from 1980 and 1985 forecasts.

change in procedures required that in order to be classified as a based aircraft, a minimum of one hour flying time must have been logged by the aircraft in the previous twelve months.

(4) The Selected Forecast

The forecast selected for planning purposes was that developed from trend analysis of the historic data. This forecast, while lower than other estimates, is felt to be statistically and judgmentally the best estimate of based aircraft throughout the forecast years.

Statistically, the relationship established in the trend forecast is more significant than either of the other two estimates. The significance of the socio-economic regression was limited by the brevity of the historic data string, and the degree of historic variation in the number of based aircraft explained by population was much less than in the case of the trend analysis. Also, the form of the most explanatory regression equation among the socio-economic relationships analyzed did not appear to be appropriate. The share-of-the-market approach failed to establish any consistent historic behavior in based aircraft and, therefore, the estimated future share-of-the-market is presented only as a measure of the reasonableness of the trend estimate.

(5) Comparison of the Selected Forecast With Other Forecasts

Two other forecasts have been developed for Lunken Airport, one by Dalton, Dalton, Little & Newport (for the Ohio Airport System Plan) and the other by the FAA (for the "Ten Year Plan 1974-1983", August 1974). It was not possible to compare Landrum & Brown forecasts to those of the Ohio Airport System Plan because those forecasts were not airport specific, but aggregated for Lunken and Blue Ash Airports. However, the results of the selected Landrum & Brown forecast compare reasonably with FAA developed forecasts for Lunken Airport as presented in Exhibit II-8.

The FAA Ten Year Plan forecasts 402 based aircraft at Lunken in 1985. This represents a discrepancy of less than two percent from Landrum & Brown's 1985 forecast. The FAA Ten Year Plan does not forecast past 1985.

The 1980 Landrum & Brown and FAA forecasts differ by more than two percent. However, long term forecasts, by nature, are not intended to measure cyclical deviations in short run growth patterns, but rather a long term average growth. Therefore, the 1980 discrepancy between the two forecasts is not considered major in view of their convergence in 1985.

EXHIBIT II-8

Lunken Airport Master Plan

COMPARISON OF BASED AIRCRAFT FORECASTS

Year	Landrum & Brown	FAA Ten Year Plan
1975	1/	253
1980	344	287 2/
1985	410	402
1990	489	N/A 3/
1995	584	N/A 3/

1/ Landrum & Brown did not forecast average 1975 based aircraft.
2/ Arrived at by Interpolation.
3/ N/A FAA based aircraft forecast only through 1985.

3. ANNUAL AIRCRAFT OPERATIONS DATA AND FORECASTS

The historic data upon which the operations forecasts are based are presented in Exhibit II-9. The forecast of operations and the division between itinerant and local are also presented in Exhibit II-10.

Both operations and based aircraft have displayed erratic growth patterns over the historic period analyzed. Attempts to relate these two variables yielded equations of no statistical significance. Operations were considered independently as a function of socio-economic variables and these analyses also provided no significant relationships. Therefore, operations were forecast as a function of based aircraft. As previously stated, based aircraft were available only through 1972, which was subsequently discovered to be a bad data point. Thus, operations per based aircraft were computed for 1959 through 1971. The average of these operations per based aircraft was used to forecast operations through 1995.

The division of operations between the local and itinerant categories was done through an analysis of this historic split. With the exception of four (4) of the last 13 years of data, local operations have accounted for the larger portion of operations. Airport officials believe that this condition will persist, although no particular trend could be perceived, either in

EXHIBIT II-9

Lunken Airport Master Plan

HISTORIC OPERATIONS DATA AND
UNCONSTRAINED FORECASTS FOR LUNKEN AIRPORT

Year	Itinerant Operations	Local Operations	Total Operations	Operations per Based Aircraft
1959	68,813	80,936	149,749	876
1960	66,385	54,060	120,445	608
1961	63,239	52,497	115,736	673
1962	69,517	60,292	129,804	755
1963	70,250	57,642	127,892	659
1964	84,220	84,872	169,092	713
1965	79,033	89,896	168,929	832
1966	88,547	102,536	191,083	941
1967	88,648	99,060	187,717	923
1968	87,111	109,291	196,402	940
1969	95,506	113,390	208,896	937
1970	85,428	91,596	177,024	746
1971	80,583	96,236	176,819	680
			1959-1971 Average	791
	Forecasts			
1980	127,887	144,213	272,100	791
1985	152,421	171,879	324,300	791
1990	181,796	205,004	386,800	791
1995	217,093	244,807	461,900	791

EXHIBIT II-10

Lunken Airport Master Plan

HISTORIC DIVISION OF OPERATIONS
BETWEEN LOCAL AND ITINERANT

Year	% of Operations Local (%)	% of Operations Itinerant (%)
1959	54.05	45.95
1960	44.88	55.12
1961	45.36	54.64
1962	46.45	53.55
1963	45.07	54.93
1964	50.19	49.81
1965	53.22	46.78
1966	53.66	46.34
1967	52.78	47.22
1968	55.65	44.35
1969	54.28	45.72
1970	51.74	48.26
1971	54.43	45.57
1964-1971 Average	53.24	46.76

their judgment, or statistically. Therefore, the data from 1964 through 1971 have been averaged to determine the percentage of forecast operations expected to be local. The historic data used to arrive at this 53 percent - 47 percent split are presented in Exhibit II-10.

As explained in Section 2, a comparison between Landrum & Brown forecasts and Ohio Airport System Plan forecasts was not possible; however FAA Terminal Area Forecasts have been prepared for Lunken and are compared to Landrum & Brown forecasts in Exhibit II-11. Implied in the FAA forecasts is an operations per based aircraft ratio which is unsupported by past trends. This, in addition to the belief that Landrum & Brown based aircraft forecasts (upon which the operations forecasts are based) are the most accurate led to the selection of the Landrum & Brown operations forecasts over FAA forecasts.

4. PEAK HOUR OPERATIONS DATA AND FORECASTS

Empirical planning standards were employed to project peak hour activity (in terms of operations) at Lunken. These standards were derived by analyzing the historical relationship between peak hour and average hour operations at general aviation airports across the United States whose operational levels have already reached those forecast at Lunken. Historical

EXHIBIT II-11

Lunken Airport Master Plan

COMPARISON OF OPERATIONS FORECASTS

Year	Landrum & Brown (000's)	Year	FAA Terminal Area Forecasts* (000's)
1975	N/A	-	-
-	-	1978	242
1980	272.1	-	-
-	-	1981	287
1985	324.3	-	-
-	-	1986	412
1990	386.8	-	-
-	-	1991	N/A
1995	461.9	-	-
-	-	1996	N/A

N/A - Not Available

* September, 1974

data obtained from "Terminal Area Air Traffic Relationships" were examined for the latest one year period available in order to determine these relationships. Specifically, a mean ratio of peak hour to average hour operations was determined at each of four forecast operational levels (1980, 1985, 1990 and 1995). These individual determinations at each forecast annual demand level were necessitated by the "leveling out" effect of daily demand as annual demand increases. For example given the same runway configuration, daily demand peaking characteristics are much different at 100,000 annual operations than at 400,000. The selected ratios of peak hour to average hour demand are presented in Exhibit II-12, along with peak hour operations forecasts for each demand year.

5. BASED AIRCRAFT FLEET MIX DATA AND FORECASTS

Lunkens historic fleet mix was compared to the historic national general aviation fleet mix in order to determine any similarities in growth or mix. It was established that Lunken's mix of based aircraft does not compare to the national mix; however, the growth trend at Lunken does compare favorably to national growth.

Lunken's mix of twin-engine and turbine aircraft has historically been higher than the overall U.S. mix (20.7 percent at Lunken Vs. 2 percent nationally in 1974). This fact is intuitive, when the economic character of Cincinnati and surrounding areas and the nature of general aviation at Lunken are considered. That is, the Greater Cincinnati area is highly industrialized

EXHIBIT II-12

Lunken Airport Master Plan

PEAK HOUR OPERATIONS FORECASTS

Year (1)	Forecast Annual Operations (2)	Average Daily Operations (3)	Average Hourly Operations (4)	Ratio of Peak/Average Hour (5)	Peak Hour Operations (6)
1980	272,100	745	46	4.15	190
1985	324,300	888	56	3.50	196
1990	386,800	1,059	66	3.02	199
1995	461,900	1,265	79	3.28	259

Source: Col. 1 - Design Years
Col. 2 - Forecast of Aviation Demand
Col. 3 - Col. (2)/365
Col. 4 - Col. (3)/16
Col. 5 - See text
Col. 6 - Col. (4) x Col. (5)

and provides a large economic base with which to support corporate (twin-engine and turbine) aircraft. Lunken is the only airport in the area with all the requirements (complete instrumentation, tower, cross-wind runway, maintenance and storage, and easy access to the city) for these types of aircraft and thus has an above average share.

Although the number of single and twin-engine piston aircraft is growing nationally, turbine equipment is growing at a faster rate, thus decreasing the mix of single and twin engine piston aircraft and increasing the mix of turbine aircraft. This same growth trend has been experienced at Lunken in the past but is not expected to continue in the future due to the unusually large percentage of turbine equipment already present. It is estimated that Lunken's mix will remain constant throughout the planning years.

Lunken's January 1975 fleet mix was determined by actual on-site inventory and is presented in Exhibit II-13. As stated above, this existing mix was considered representative of the mix during the planning years. It was used in conjunction with the forecast of based aircraft discussed in Section 2 to project the numbers of aircraft in each of six categories (helicopter, single engine, multi-engine prop, multi-engine turbo-prop, multi-engine turbine, other) for the short, intermediate, and long range time frames. These projections are also presented in Exhibit II-13.

EXHIBIT II-13

Lunken Airport Master Plan

BASED AIRCRAFT FLEET MIX
1980 - 1995

	Existing		Forecast			
	1975	% of Total	1980	1985	1990	1995
Based aircraft	232	-	344	410	489	584
Aircraft Mix:						
Single Engine	180	77.6	267	318	380	453
Multi-Engine (Piston)	24	10.3	35	42	50	60
Multi-Engine (Turbo-Prop)	11	4.8	17	20	23	28
Multi-Engine (Jet)	13	5.6	19	23	28	33
Civil and Military Helicopter	2	1/	2	2	3	3
Other 2/	2	1/	4	5	5	7

1/ Helicopters (Civil and Military and "other" aircraft accounted for a combined total of 1.7% of Lunken's mix throughout the planning years and were divided as shown above.

2/ Balloon, Military (non-helicopter)

Exhibit II-14 presents a summary of the unconstrained forecast of the elements presented in Sections 2 through 5.

6. FORECAST OF CONSTRAINED AVIATION DEMAND

Both physical and environmental constraints exist on the landside and airfield segments of Lunken Airport which will inhibit the growth of air traffic to the unconstrained forecast levels. Reasonable alternative airfield development concepts were identified in an attempt to satisfy the unconstrained aviation demand. A preferred alternative was selected based on weighing the advantages and disadvantages of each concept identified. The maximum airfield capacity of the preferred alternative is 345,000 operations and since this figure is much less than the forecasted level of unconstrained demand of 461,900 operations for Lunken Airport, it defines the upper limit of reasonable potential growth for the airport.

Chapter IV presents a more detailed discussion of the constraints and the selection of the preferred alternative.

It was assumed that the individual elements of demand would grow at their normal rate until they reached a level corresponding to the operational level of 345,000 operations which should occur around 1987. Exhibit II-1 presents a summary of the constrained forecast of aviation demand for Lunken Airport.

EXHIBIT II-14

Lunken Airport Master Plan

UNCONSTRAINED AVIATION DEMAND FORECASTS

Year	Based Aircraft	Operations			
		Itinerant	Local	Total	Peak Hour
1980	344	127,887	144,213	272,100	190
1985	410	152,421	171,879	324,300	196
1990	489	181,796	205,004	386,800	199
1995	584	217,093	244,807	461,900	259

Year	Based Aircraft	Fleet Mix					
		Single Engine	Multi-Engine			Helicopter	Other 1/
			Piston	Turbo-Prop	Jet		
1980	344	267	35	17	19	2	4
1985	410	318	42	20	23	2	5
1990	489	380	50	23	28	3	5
1995	584	453	60	28	33	3	7

Year	Total	Operations by Aircraft Type					
		Single Engine	Multi-Engine			Civil & Military Helicopter	Other 1/
			Piston	Turbo-Prop	Jet		
1980	272,100	211,151	28,026	13,060	15,238	4,100	525
1985	324,300	251,658	33,403	15,566	18,161	4,950	562
1990	386,800	300,158	39,840	18,566	21,661	5,950	625
1995	461,900	358,431	47,576	22,172	25,866	7,150	705

1/ Balloon, Military (non-helicopter).

CHAPTER III

DEMAND/CAPACITY ANALYSIS AND DETERMINATION OF FACILITY REQUIREMENTS

CHAPTER III

DEMAND/CAPACITY ANALYSIS AND DETERMINATION OF FACILITY REQUIREMENTS

In the last chapter, both the constrained and unconstrained aviation demand forecasts for Lunken Airport were presented. By unconstrained, it is meant that if past trends continue in future years, and Lunken's growth is not inhibited by lack of facilities, usable land or financial crises, then aviation demand in terms of operations, based aircraft, and fleet mix will be as calculated. Constrained demand takes into account the limitations or constraints of the particular situation. The purpose of this chapter is to present the results from comparing aviation demand in the short, intermediate, and long range time frames with the capacity of Lunken to serve this demand. In any year in which forecast demand exceeded capacity a determination was made of the additional facilities required to adequately serve that demand. For example, if five (5) acres of local parking apron is the anticipated demand for a future time period and two (2) acres presently exist, there is a requirement for three (3) additional acres of parking apron.

During the conduct of the demand/capacity analysis and determination of facility requirements, the intent was not to construct a complete facilities development program for Lunken (this will be presented later in the report). The intent was to highlight any functional area found to be critical, in terms of space requirements in the coming years, if Lunken develops as it has in the past. Having established facilities requirements, a basis was established for the indentification and evaluation of reasonable development alternatives in the following chapter.

Two main sections and several functional areas within each were included in the demand/capacity and facilities requirements analysis:

- Airfield
  - Runways
  - Taxiways
  - Navaids
  - Pavement Strength
  - Lighting and Runway Marking
  - Drainage
- Terminal Area
  - Fixed Based Operator (FBO)
  - Corporate Area
  - Public Area
  - Ground Access
  - Auto Parking

The following sections of Chapter III present the results of analyses conducted in each of these areas.

1. AIRFIELD

(1) Runways

The methodology used for this analysis was derived from the FAA "Airport Capacity Handbook," second edition, dated June 1969. Briefly, the procedure determines the existing annual and hourly capacity of the airfield and compares these values with projected demand levels in order to identify the timing of the possible capacity oriented development during the planning

period. This analysis, described in detail in Appendix A, indicated that the current, or "do-nothing" capacity of Lunken is 320,000 annual operations (324,000 with the addition of radar). When this capacity or ability to process demand is compared to the demand levels expected in 1980, 1985, 1990, and 1995, it is seen that by 1995 Lunken will be unable to process 137,900 operations unless delay levels considered intolerable are introduced. This relationship between demand and capacity is shown in Exhibit III-1 and indicated a requirement for additional runways sufficient to process 137,900 annual operations by 1995 and 77 peak hour operations by 1995.

(2) Taxiways

The airfield capacity analysis indicated a need to process an additional 137,900 aircraft operations by 1995 over and above what the existing airfield can process today. This indicates a need for additional airfield facilities, i.e., runways and taxiways. The addition and/or improvement of an airport's taxiway system is relative to runway capacity in that an adequate runway taxiway system will increase the airport's ability to process a higher rate of arriving and departing aircraft. The adequacy of a taxiway system is also beneficial for the expeditious handling and processing of taxiing aircraft from or to the terminal area and the assigned operational runway(s).

EXHIBIT III-1

Lunken Airport Master Plan

AIRFIELD DEMAND VS CAPACITY

Demand Year	Demand		Capacity		Annual Delay Hours
	Annual	Peak Hour	Annual	Peak Hour	
1974	177,921	162	320,000	182	674
1980	272,100	190	324,000	182	1,653
1985	324,300	196	324,000	182	2,438
1990	386,800	199	324,000	182	3,800
1995	461,900	259	324,000	182	6,710

(3) Navaids

Airport and runway navigational aid requirements for the Lunken Airport were based on FAA recommendations as described in DOT/FAA Handbook 7030.2B - "Airway Planning Standard Number One" and FAA Advisory Circular 150/5300-2C - "Airport Design Standards, Site Requirements for Terminal Navigational Facilities."

Navigational aids as related to airport operations provide two primary services: (1) they provide precision guidance to a specific runway end and/or (2) they provide non-precision guidance to a runway or the airport itself. The distinction between a precision and non-precision navigational aid is that where the former provides electronic descent, alignment (course) and position guidance, the latter only provides alignment and position location information. The necessity to equip the airport with either or both capabilities is usually determined by design standards predicated on safety considerations and airport operational needs. The type, mission or volume of aeronautical activity using or expected to use the airport are factors which have been used in association with the results of the meteorological, airspace and capacity analysis, presented earlier in this report, to determine the navigational aids required to sustain Lunken's aviation activity through the twenty year planning period.

Lunken Airport is currently capable of accepting precision approaches on Runway 20L and non-precision approaches to Runways 2R and 24. Although the forecast of demand for the airport indicates a potential need for upgrading certain non-precision approaches to precision and possibly adding additional instrument approaches, it is not practical under present design criteria because of the obstructions, i.e., hills in the area. It is recommended that Lunken's instrumentation needs be further examined when the Microwave Landing System (MLS) becomes available. It is possible that there will be different less restrictive siting criteria for the MLS than with the present system.

As mentioned previously, Lunken control tower is not in operation during the hours of 11:00 p.m. to 7:00 a.m. During these hours one runway is left lighted according to the prevailing wind direction. Currently, the only set of controls for all runway and approach lights is in the control tower. In light of the possible need to change runways after the FAA Control Tower has closed, Landrum and Brown recommends that a duplicate set of lighting controls be installed in the Flight Service Station at the Airport (which is open 24-hours per day).

(4) Pavement Strength

Future pavement strength requirements are identified in this section and are based upon the projected types of aircraft expected to operate at the airport.

Based on strength requirements for both basic transport and general utility aircraft, the inventory work and through discussions with the FAA and Airport Management it is recommended that primary runways be designed to support a 60,000 pound airplane with dual landing gear. This requirement is based upon Landrum and Brown's assumption that the Grumman Gulfstream II is and will remain the critical aircraft.

All secondary runways should be designed to general utility standards, i.e., 12,500 pounds.

The strength requirement of taxiways depends upon their location. Taxiways to or from the corporate areas, transient itinerant ramp or primary runways should be able to support a 60,000 pound aircraft with dual landing gear. All others should be designed to general utility standards.

The transient itinerant ramp should be designed to support a 60,000 pound aircraft with dual landing gear.

Tiedown areas should be designed to general utility standards.

(5) Runway Lighting and Marking

The necessity to improve, change, add, or relocate airport lighting and marking is based upon the extent of airport develop-

ment recommended thus far in this report, as required by and in compliance with appropriate FAA standards. This Master Plan report did not identify any deficiencies in existing lighting and marking equipment. The final determination of lighting and marking requirements will be made in Chapter VI, Airport Plans, upon completion of the identification and evaluations of alternatives in Chapter IV.

2. TERMINAL AREA

(1) Fixed Base Operations (FBO)

The methodology employed to project demand for FBO facilities at Lunken was to develop a relationship between the number of aircraft currently based with the FBOs and the facilities they support and require. When forecasts of FBO based aircraft were used in conjunction with these established relationships, demands for future facilities resulted. In all cases, these demands were examined, judgmentally, for soundness and adjusted as necessary to reflect general aviation facility requirements as they are perceived by experts in the field.

The number of aircraft currently utilizing FBO facilities was arrived at by assuming that all aircraft not stored in private corporate hangars are based with FBOs. The percentage of total based aircraft now based with FBOs was found to be 92 percent. This division between corporate and FBO usage was

also considered to be representative of future facility use and was employed to develop the projected numbers of FBO and corporate based aircraft as shown in Exhibit III-2, following this page.

A demand/capacity analysis was conducted for five FBO areas and facility requirements were determined for the 1980, 1985, 1990, and 1995 time periods. The analyses conducted for these five areas are described in the following paragraphs.

1. Conventional Hangar and Hangar Apron Area

As described in Chapter I, Lunken Airport presently has eight conventional FBO hangars, providing 83,400 square feet of net usable space and served by approximately 9,643 square yards of adjoining apron area.

Accepted planning standards for the design of hangar apron areas dictate that hangar apron area be equal in size to the hangar area it serves. In this respect, Lunken's existing hangar area was found to be adequate. Therefore, for planning guidelines, it was assumed that Lunken presently can support 83,400 square feet of conventional FBO hangar area and 9,643 square yards of adjoining apron area.

The next step in the conventional hangar and hangar apron analysis was to develop a relationship between the conventional hangar space now available at Lunken and the aircraft demanding conventional hangar storage. This methodology was developed with the assumption that construction of hangars has been and will continue to be a function of demand for storage. Implied in this methodology is the further assumption that future development of aviation related small business (housed in conventional hangars) will grow because a demand for aircraft storage has led to construction of new facilities.

EXHIBIT III-2

Lunken Airport Master Plan

DIVISION OF BASED AIRCRAFT BETWEEN
FBO AND CORPORATE FACILITIES
EXISTING AND FORECAST

Year	Total	Based Aircraft	
		FBO	Corporate
1975	232	213	19
1980	344	316	28
1985	410	377	33
1990	489	450	39
1995	584	537	47

As stated above, the relationship developed was between conventional hangar space and aircraft demanding hangar space. In order to determine this relationship, it was first necessary to examine the current split between conventional hangar storage, T-hangar storage, and tiedown storage. The results of this examination are presented in Exhibit III-3, following this page, and indicate that 11 percent, 32 percent, and 57 percent of all aircraft stored with FBOs use conventional hangars, T-hangars, and tiedowns, respectively. Further, these storage facilities are near but not yet saturated, therefore the split between storage modes is considered indicative of user desires. Assuming these trends are likely to continue, the numbers of aircraft demanding each of the three types of FBO storage were projected for 1980, 1985, and 1995. These projections also are presented in Exhibit III-3.

Since the conventional hangar area (83,400 sq. ft.) is supported by 24 aircraft, a planning ratio of 3,475 square feet of hangar area and 386 square yards (3,475 sq. ft./9 sq. ft. per sq. yd.) of apron area per FBO based aircraft was established.

These planning ratios led to the requirements for conventional hangar and hangar apron areas shown in Exhibit III-4. Comparing the total future requirements (demand) with the existing capacity resulted in requirements for hangar and hangar apron area in addition to that area currently existing at Lunken. These requirements are also shown in Exhibit III-4. For ease of final presentation, hangar and apron area requirements have been converted to acres in the Exhibit.

2. T-Hangar Area

As discussed in the previous section, a determination was made of the number of aircraft desiring T-hangar storage in 1980, 1985, 1990, and 1995 (see Exhibit III-3). Since the major concern in this facility requirement analysis was that sufficient space be set aside at Lunken for future development of all necessary facilities (if Lunken develops in an unconstrained fashion), T-hangar stalls were converted into space requirements (acreage).

EXHIBIT III-3

Lunken Airport Master Plan

PROJECTIONS OF AIRCRAFT UTILIZING FBO CONVENTIONAL HANGAR, T-HANGAR, AND TIE DOWN STORAGE IN 1980, 1985, 1990, AND 1995

Year	Total Aircraft Based With FBO	Mode of Storage		
		Conventional Hangar	T-Hangar	Tie Down
1975	213	24	68	121
1980	316	35	101	180
1985	377	41	121	215
1990	450	49	144	257
1995	537	59	172	306

EXHIBIT III-4

Lunken Airport Master Plan

REQUIREMENTS FOR CONVENTIONAL
HANGAR AND HANGAR APRON AREA

Year	Hangared Aircraft	Hangar Area Required Sq.Ft.	(Acres)	Hangar Apron Area Required Sq.Yds.	(Acres)	Total Hangar And Apron Area Requirement Acres	Existing Hangar & Apron Area Acres	Requirement For Additional Are Acres
(1)	(2)	(3)		(4)		(5)	(6)	(7)
1975	24	-	-	-	-	-	3.9	-
1980	35	121,625	(2.8)	13,510	(2.8)	5.6	3.9	1.7
1985	41	142,475	(3.2)	15,826	(3.2)	6.4	3.9	2.5
1990	49	170,275	(3.9)	18,914	(3.9)	7.8	3.9	3.9
1995	59	205,025	(4.7)	22,474	(4.7)	9.4	3.9	5.5

Source:
- Col. 1 - Current and design years.
- Col. 2 - Chapter II, Forecasts of Aviation Demand.
- Col. 3 - Col. 2 x 3,475 sq. ft. per based A/C.
- Col. 4 - Col. 2 x 386 sq. yds. per based A/C.
- Col. 5 - Col. 3 + Col. 4.
- Col. 6 - Inventory of existing facilities.
- Col. 7 - Col. 5 - Col. 6.

To accomplish this, guidelines presented in FAA advisory circular AC 150/5300-4A were first compared with present T-hangar land utilization at Lunken. These guidelines provide for 14 T-hangar units to be placed on an acre of land, or an allowance of .0714 acre per stall. The land associated with Lunken's 68 stalls is approximately five (5) acres or .0735 acres per stall, therefore the planning ratio of .0735 acres per stall was used in conjunction with the projected need for stalls to arrive at the additional area required for T-hangar development in each of the planning years. These results are presented in Exhibit III-5, following this page.

3. Paved Parking Apron (Local)

As with other facilities, conversion from aircraft tiedowns to area requirements was necessary for the purpose of allocating space on the airport property throughout the design years. This conversion was accomplished using a planning figure of 300 square yards per aircraft on the local parking apron. This planning figure is a standard in airport design and may be found in the FAA advisory circular AC 150/5300-4A.

Requirements for local aircraft parking area were developed for the years 1980, 1985, 1990, and 1995. These requirements are listed in Exhibit III-6, following this page. Note that according to FAA standards, Lunken's local ramp is at present inadequate for the number of aircraft it serves.

4. FBO Office and Storage Space

During the inventory conducted for general aviation facilities at Lunken Airport, it was found that the fixed base operators (FBOs) have space for ancillary functions (pilot lounges, offices, storage, etc.) either in their respective hangars or in separate buildings or both. All of this space has been combined into the category called office and storage. The future requirements for office and storage space in the hangars was included in the analysis of conventional hangar areas.

EXHIBIT III-5

Lunken Airport Master Plan

REQUIREMENTS FOR T-HANGAR AREA

Year (1)	T-Hangar Stalls Required (2)	Required Area Acres (3)	Existing T-Hangar Stalls (4)	Existing Area Acres (5)	Requirement For Additional Area Acres (6)
1975	-	-	68	5.0	-
1980	101	7.4	68	5.0	2.4
1985	121	8.9	68	5.0	3.9
1990	144	10.6	68	5.0	5.6
1995	172	12.6	68	5.0	7.6

Source:
Col. 1 - Current and design years.
Col. 2 - Sub-Section (1), this section of Chapter III.
Col. 3 - Col. 2 x .0735 acres per stall.
Col. 4 - Inventory of existing facilities.
Col. 5 - Inventory of existing facilities.
Col. 6 - Col. 3 - Col. 5.

EXHIBIT III-6

Lunken Airport Master Plan

REQUIREMENTS FOR LOCAL PARKING
APRON AREA

Year	Aircraft Desiring Tie Downs	Area Required Sq.Yds. (Acres)	Existing Parking Spaces	Existing Area Sq.Yds. (Acres)	Requirements For Additional Area Acres
(1)	(2)	(3)	(4)	(5)	(6)
1975	121	36,300 (7.5)	121	32,994 (6.8)	0.7
1980	180	54,000 (11.2)	121	32,994 (6.8)	4.4
1985	215	64,500 (13.3)	121	32,994 (6.8)	6.5
1990	257	77,100 (15.9)	121	32,994 (6.8)	9.1
1995	306	91,800 (19.0)	121	32,994 (6.8)	12.2

Sources:
- Col. 1 - Current and design years.
- Col. 2 - Sub-Section (1), this section of Chapter III.
- Col. 3 - Col. 2 x 300 sq. yds. per A/C.
- Col. 4 - Inventory of existing facilities.
- Col. 5 - Inventory of existing facilities.
- Col. 6 - Col. 3 - Col. 5.

Through on-site inspections, in addition to interviews with the FBOs, it was determined that the existing office and storage areas are sufficient for current levels of demand at Lunken. Therefore, these existing facilities furnished the basis for a planning ratio from which the future requirements were projected.

Currently, a total of 13,068 square feet of FBO office and storage space is supported by 213 FBO based aircraft. This resulted in a planning ratio of 61.35 square feet of FBO office and storage space per FBO based aircraft. This ratio, when used in conjunction with the projection of FBO based aircraft yielded estimates of FBO requirements for office and storage space in the planning years. The results of this analysis are presented in Exhibit III-7, following this page.

5. Fuel Storage

Fuel storage at Lunken was analyzed only for the purpose of estimating the quantity which can reasonably be expected to be provided throughout the planning years (1980, 1985, and 1995). Actual space requirements will depend on City policies regarding fuel control. For example, if the City decides to exercise control over all fuel, then land might need to be set aside for a fuel farm. However, if fuel control is allowed to remain with FBOs, then fuel storage tanks can be placed on land accounted for in other areas of the Master Plan Study.

Currently, 93,000 gallons of fuel storage is adequately serving the needs of all FBO based aircraft and itinerant aircraft. In terms of fuel storage capacity per based aircraft (437 gallons per based aircraft), Lunken was found to be consistent with four other general aviation airports investigated for purposes of comparison. The other airports investigated were Philip Billard Municipal in Topeka, Kansas, Fort Lauderdale Executive in Fort Lauderdale, Florida, and Opa Locka and New Tamiami in Miami, Florida. While the character of operations at each of these airports is not identical to that at Lunken, a range of fuel stored per based aircraft was established in order to determine Lunken's fuel storage

EXHIBIT III-7

Lunken Airport Master Plan

FBO OFFICE AND STORAGE AREA[1/]

Year (1)	FBO Based Aircraft (2)	Area Required Sq. Ft. (3)	(Acres)	Existing Area Sq. Ft. (4)	Requirements For Additional Area Sq. Ft. (5)	(Acres)
1975	213	-	-	13,068	-	-
1980	316	19,386	(.44)	13,068	6,318	(.14)
1985	377	23,128	(.52)	13,068	10,060	(.23)
1990	450	27,608	(.63)	13,068	14,540	(.33)
1995	537	32,944	(.76)	13,068	19,876	(.46)

Source: Col. 1 - Current and design years.
Col. 2 - Sub-Section (1), Section 1, of this Chapter.
Col. 3 - Col. 2 x 61.35 sq. ft. per based aircraft.
Col. 4 - Inventory of existing facilities.
Col. 5 - Col. 3 - Col. 4.

1/ Office and Storage Area External to Hangar Area.

capability relative to that of other general aviation airports. This existing relationship between based aircraft and fuel storage capacity was used in projecting the demand for fuel storage throughout the design years. The results of this analysis are presented in Exhibit III-8, following this page.

6. Summary of FBO Facility Requirements

As previously stated, the requirements for FBO facilities at Lunken (as presented in this Chapter) have been developed based upon the assumption that the airport will grow in an unconstrained manner.

Exhibit III-9 graphically displays how the FBO facility requirements are expected to grow during the design years if this assumption is correct. The exhibit also allows a comparison of the magnitude of the required facilities to the magnitude of existing facilities at Lunken. Exhibit III-10 summarizes all FBO facility requirements developed in this section.

(2) Corporate

Corporate facilities requirements for Lunken Airport during the planning years were determined by assuming that existing corporate facilities are representative in size and type of those which will be built in the future. Underlying this assumption is the fact that utilization of airport space by corporate operators is much different from the utilization of space by fixed based operators. That is, each corporate lease holder generally builds his own exclusive use facilities, a practice which greatly increases the proportion of total airport land dedicated to corporate use (but is at least

EXHIBIT III-8

Lunken Airport Master Plan

FBO FUEL STORAGE REQUIREMENTS
(GALLONS)

Year (1)	FBO Based Aircraft (2)	Required Fuel Storage Capacity (3)	Existing Fuel Storage Capacity (4)	Requirement For Additional Capacity (5)
1975	213	-	93,000	-
1980	316	138,000	93,000	45,000
1985	377	164,000	93,000	71,000
1990	450	196,000	93,000	103,000
1995	537	234,000	93,000	141,000

Source: Col. 1 - Current and design years.
Col. 2 - Sub-Section (1), Section 1, this Chapter.
Col. 3 - Col. 2 x 437 gallons storage per based aircraft.
Col. 4 - Inventory of existing facilities.
Col. 5 - Col. 3 - Col. 4.

EXHIBIT III-9

Lunken Airport Master Plan

FIXED BASE OPERATOR
FACILITY REQUIREMENTS

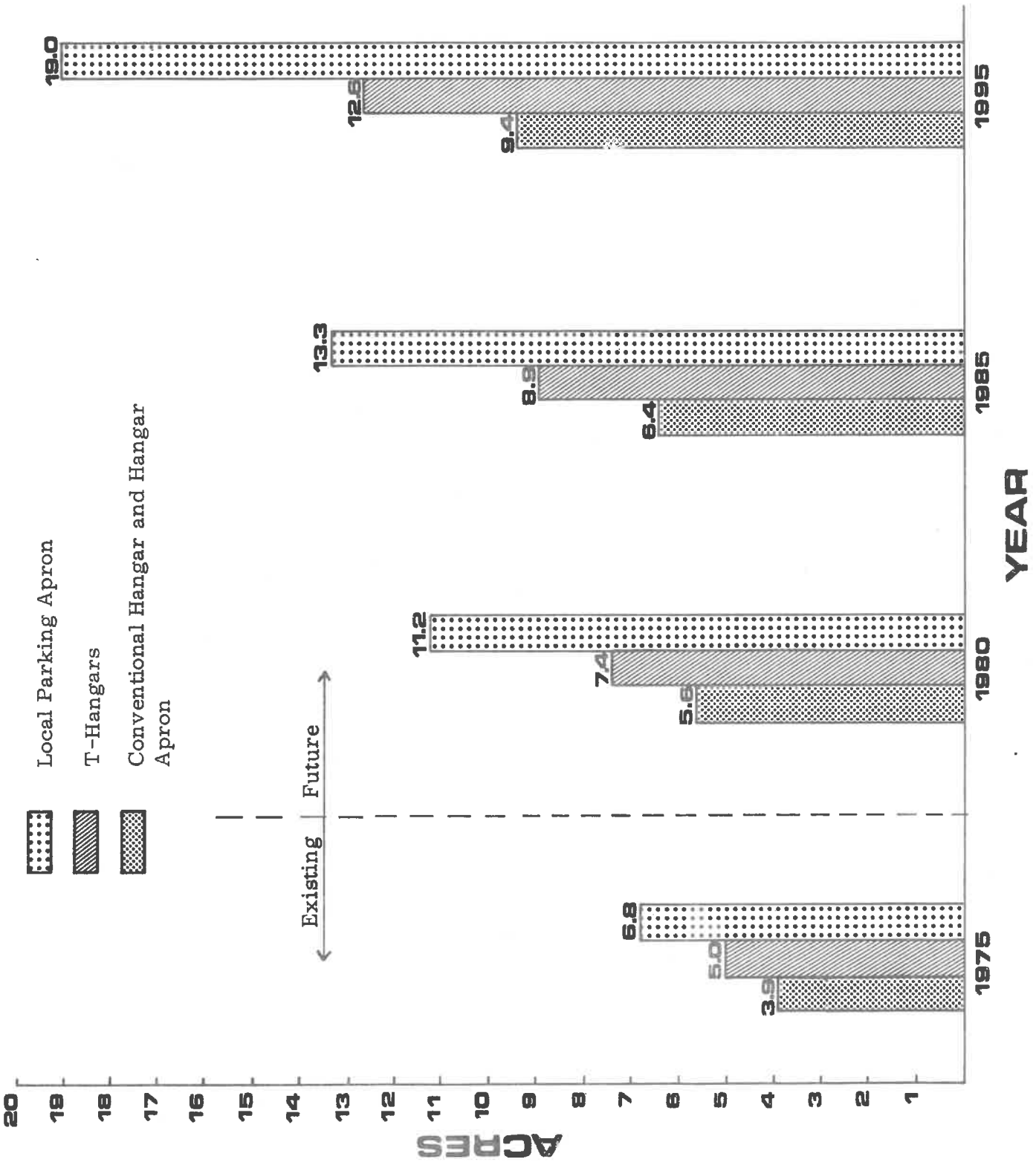


EXHIBIT III-10

Lunken Airport Master Plan

SUMMARY OF FBO FACILITY REQUIREMENTS

Category	Existing	Requirement 1980	1985	1990	1995
Conventional Hangar & Apron Area	3.9	5.6	6.4	7.8	9.4
T-Hangar Area	5.0	7.4	8.9	10.6	12.6
Local Parking Apron	6.8	11.2	13.3	15.9	19.0
FBO Office and Storage	.3	.4	.5	.6	.8

* Fuel Storage Requirements have been omitted. If the airport develops as it has in the past, space requirements for fuel storage will be absorbed into other functional areas.

partially offset by the fact that corporate operators are willing to pay for this privilege). This underlying fact led to a need to first determine the characteristics of the "average" corporate facility in terms of size and numbers of based aircraft. Having determined these characteristics, future corporate space requirements were projected. The analysis conducted to arrive at these projections are discussed below.

1. Characteristics of the "Average" Corporate Facility at Lunken

There are currently six (6) corporate operations at Lunken leasing a total of approximately 18 acres (17.5 acres) and basing 19 aircraft. It was assumed, for planning purpose, that the average corporate facility at Lunken in future years will consist of three (3) acres of leased land supporting a fleet of three (3) aircraft. It was further assumed that these areas will be developed by each individual corporation and will include all facilities (auto parking lots, offices, hangar, ramp, etc.) necessary to support the corporate fleet.

2. Projections of Corporate Space Requirements

It was determined previously in this Chapter that existing corporate based aircraft account for approximately eight percent of all based aircraft at Lunken. It should be stressed that in this eight percent are only those aircraft expected to be hangared in private (corporate) hangars. All other corporate aircraft will be hangared with FBOs. This eight percent relationship was employed to project total corporate based aircraft in each of the planning periods. These aircraft were then allocated to corporate lease areas according to the characteristics described in sub-section (1) above. Having determined the total projected number of corporate lease areas in future years, actual acreage requirements were estimated on the basis of 3 acres per lease area (described in sub-section (1) above). The results of these projections are presented in Exhibit III-11.

EXHIBIT III-11

Lunken Airport Master Plan

CORPORATE SPACE REQUIREMENTS

Year (1)	Corporate Based Aircraft (2)	Required Leased Areas (3)	Required Acreage (4)	Existing Acreage (5)	Requirement For Additional Acreage (6)
1975	19	-	-	17.5	-
1980	28	9	27	17.5	9.5
1985	33	11	33	17.5	15.5
1990	39	13	39	17.5	21.5
1995	47	16	48	17.5	30.5

Source: Col. 1 - Current and design years.
Col. 2 - Section 1, of this Chapter.
Col. 3 - Col. 2 divided by 3 aircraft per leased area.
Col. 4 - Col 3 x 3 acres per lease area.
Col. 5 - Inventory of existing facilities.
Col. 6 - Col. 4 - Col. 5.

(3) Public

Public-use facilities at Lunken Airport consist of the public aircraft parking ramp and the terminal building. The demand/capacity analysis for these two public-use facilities is presented in the following paragraphs.

1. Public Aircraft Parking Ramp

The public ramp at Lunken is primarily used for loading and unloading passengers and short term parking for itinerant aircraft. Discussions with Lunken management and FAA Control Tower personnel indicated that during peak periods the ramp is operating at or very near capacity. It was therefore decided (as recommended in FAA advisory circular AC 150/5300-4A) that projections for ramp space requirements be based on empirically derived relationships between itinerant operations and present ramp space usage.

In advisory circular AC 150/5300-4A, the FAA suggests a methodology by which future itinerant parking requirements can be determined from a knowledge of busy day peak month operations. The procedure is listed below:

- Estimate peak month itinerant operations (from historical data this was determined to be ten percent of the annual itinerant operations).
- Estimate average daily itinerant operations for the peak month (peak month traffic/30)
- Assume the busy itinerant day is ten percent more active than the average day
- Assume that parking will be needed for 50 percent of the itinerant aircraft during the busiest day of the peak month (25 percent of the operations).

Historical data were examined to determine the validity of this procedure relative to patterns of itinerant operations at Lunken. It was known from the analysis described in the preceding paragraph that, if valid for Lunken, the FAA methodology, when applied to 1974 data (as a test case), should indicate a need for approximately 46 standard itinerant parking spaces (16,667 usable square yards/360 square yards per standard itinerant space = 46.2 spaces). The test case results indicated a need for 76 standard itinerant parking spaces. Therefore, the FAA methodology was modified to reflect this discrepancy due to patterns of itinerant parking demand peculiar to Lunken by assuming that itinerant parking is needed for only 15 percent of the busy day peak month operations (i.e., approximately 30 percent of the itinerant aircraft).

The modified FAA methodology for determining public-use parking apron requirements was conducted for the demand years of 1980, 1985, 1990 and 1995 at Lunken. The results of this analysis are presented in Exhibit III-12, following this page.

2. Terminal Building

A detailed projection of terminal space requirements was not appropriate at this point in the Master Plan Report because of the nature of the demand/capacity analysis. That is, the purpose of the demand capacity analysis was to identify critical functional areas of the airport for which additional space must be set aside for future development. It was known that:

- The terminal was originally designed to serve scheduled airline service for the Cincinnati area. Even assuming that scheduled third level service is introduced at Lunken, the terminal will be adequate in size to serve the relatively small number of enplaned passengers. It will also be of adequate size to serve the needs of local and itinerant general aviation in the coming years.

EXHIBIT III-12

Lunken Airport Master Plan

REQUIREMENTS FOR PUBLIC-USE
PARKING APRON

Year (1)	Annual GA Itinerant Operations (2)	Busy Day GA Itinerant Operations (3)	Parking Spaces Required (4)	Required Apron Area Sq.Yds. (Acres) (5)	Existing Apron Area Sq.Yds. (Acres) (6)	Requirement For Additional Area Acres (7)
1975	-	-	-	- -	16,667 (3.4)	-
1980	127,887	469	70	25,200 (5.2)	16,667 (3.4)	1.8
1985	152,421	559	84	30,240 (6.2)	16,667 (3.4)	2.8
1990	181,796	667	100	36,000 (7.4)	16,667 (3.4)	4.0
1995	217,093	796	119	42,840 (8.9)	16,667 (3.4)	5.5

Source:
- Col. 1 - Current and design years.
- Col. 2 - Chapter II, Forecasts of Aviation Demand.
- Col. 3 - (Col. 2 x .10)/30) x 1.1.
- Col. 4 - Col. 3 x .15 .
- Col. 5 - Col. 4 x 360 sq. yds. per A/C.
- Col. 6 - Inventory of existing facilities.
- Col. 7 - Col. 5 - Col. 6 .

- If third level service is not introduced, the size of the terminal will not be a limiting factor in general aviation growth.

Therefore, it was concluded that there is no requirement for additional space to be allocated for future terminal development. The question of adequacy of the existing terminal (in terms of services provided and state of repair) is addressed in later sections of the master plan report.

(4) Ground Access

Ground access to Lunken Airport consists of Wilmer Avenue between Kellogg and Beechmont, and Airport Road between Eastern Avenue and Wilmer. The estimated capacity of Wilmer Avenue and Airport Road is 40,000 and 15,000 movements per day, respectively. These were compared to forecasts provided by OKI 1/ which predict fewer than 5,000 average movements per day in 1990. Therefore, during the planning years, there will be no requirement for additional access capacity to Lunken.

(5) Parking

The demand/capacity analysis conducted for parking facilities was divided into the functional areas of Terminal and FBO (corporate parking was taken into account in the corporate area analysis).

Results of the analysis are discussed below.

1/ Ohio-Kentucky-Indiana Regional Planning Authority.

1. Terminal Area

Parking facilities are provided in the area of the terminal for airport employees, FAA employees, visitors, passengers, and patrons of the businesses located within Lunken Terminal. As presented in Inventory of Existing Facilities, the capacity of the terminal parking lots is approximately 104 spaces. Through conversations with airport management and on-site investigations, it was determined that the present demand for parking in the terminal area is approximately 56 spaces during peak periods.

A requirement for additional parking facilities in the terminal area is not anticipated during the planning years unless charter activity is reinitiated, at which time parking facilities should be provided on an "as needed" basis. The areas adjacent the existing lot are more than adequate for this purpose.

2. FBO Area

The methodology employed to project the demand for FBO parking involved relating peak hour operations to peak hour pilots and passengers (who were assumed to park in near-FBO lots). Peak hour pilots and passengers were, in turn, related to peak hour parking requirements. The complete methodology is outlined below.

- Assume that 50 percent of the forecast peak hour operations are touch and go (reference Appendix A) and further that the majority of touch and go traffic at Lunken originates there. Then to arrive at operations devoid of touch and go traffic, multiply the operations forecast by 50 percent.

- Extrapolating from the graph presented in AC 150/5300-4A (which indicates that peak hour pilots and passengers = 9/5 (peak hour operation + 4) determine peak hour passengers and pilots.

- Assume a requirement of 1.2 parking spaces per peak hour pilot and passenger (reference "Airport Capacity Analysis - A Systems Approach," by John P. Zaniewski).

The results of this analysis are presented in Exhibit III-13, and indicate no overall requirement by 1995. It should be stressed that this implies only that parking spaces will be adequate throughout the design years in number, not necessarily in location. For example, even though overall parking is more than adequate for today's needs, some individual FBOs have inadequate parking facilities. The problems associated with a reallocation of available space for parking facilities will be addressed in later sections of the master plan report.

Exhibit III-14 depicts the accumulative gross area requirements to satisfy the constrained aviation demand for each terminal area component through the twenty year planning period. The required areas are provided solely to identify the approximate gross requirement for each component and to indicate the timing of additional development. It is noted that the gross areas depicted may be altered slightly in subsequent development of terminal area concepts as a result of applying engineering and architectural techniques to the design of functional terminal facilities.

EXHIBIT III-13

Lunken Airport Master Plan

FBO PARKING REQUIREMENTS

Year	Peak Hour Operations*	Peak Hour Operations**	Pilots and Passengers	Parking Space Requirement	Existing Parking Spaces	Requirement For Additional Parking Spaces
(1)	(2)	(3)	(4)	(5)	(6)	(7)
1980	190	95	175	210	433	-
1985	196	98	180	216	433	-
1990	199	100	184	221	433	-
1995	259	130	238	287	433	-

Source: Col. 1 - Design years.
Col. 2 - Forecast of Aviation Demand.
Col. 3 - Col. 2 less 50 percent touch and go operations.
Col. 4 - 9/5 (Col. 3) + 4 per AC 150/5300-4B.
Col. 5 - Col. 4 x 1.2 parking spaces per peak hour pilot and passengers.
Col. 6 - Inventory of existing facilities.
Col. 7 - Col. 5 - Col. 6.

* Including 50 percent touch and go operations.
** Excluding touch and go operations.

EXHIBIT III-14

Lunken Airport Master Plan

EXISTING AND REQUIRED TERMINAL AREA
FACILITIES REQUIRED BY PLANNING PERIOD

Component	Existing Area	Total Required By 1975-1980	1981-1985	1986-1995
I. FBO				
1. Conv. Hangars				
. Area (SF)	83,400 1/	121,625	142,475	152,900
. No. Bldgs.	8 1/	10	11	12
. Apron (SY)	9,643	13,513	15,830	16,989
2. T-Hangars				
. Area (SF)	70,720 2/	105,040	125,840	133,120
. Stalls	68 2/	101	121	128
. No. Bldgs.	4 (8) units 6 (6) units	12 (8) units 1 (6) units	14 (8) units 2 (6) units	16 (8) units
3. Tiedowns				
. Area (SY)	32,994	54,000	64,500	68,700
. Spaces	121	180	215	229
II. PUBLIC RAMP				
. Area (SY)	16,667	25,200	30,240	32,106
III. AUTO PARKING				
. Spaces	433	210	216	219
IV. CORP. AREA				
. Areas	6	9	11	12
. Area (acres)	17.5	26.5	32.5	35.5

1/ 2 conv. hangars each 8,750 S.F. (total 17,500 S.F.) are to be demolished.
2/ 2 - 6 unit T-hangars (12,480 S.F.) to be demolished.

CHAPTER IV

ALTERNATIVE DEVELOPMENT PLANS

CHAPTER IV

ALTERNATIVE DEVELOPMENT PLANS

Chapter III of this report indicated that, by 1995, air traffic demand levels at Lunken Airport will exceed the airport's existing capacity in several operational areas. This chapter identifies the reasonable alternative development plans that could be implemented in an attempt to satisfy these aviation demand requirements.

It must be recognized, however, that certain constraints exist on both the landside and airfield segments of Lunken Airport, which will inhibit the growth of traffic to the unconstrained forecast levels.

1. DEFINITION OF CONSTRAINTS TO DEVELOPMENT

In Chapter I of this report, it was noted that in 1947 air carrier operations moved to Greater Cincinnati Airport, rather than remain at Lunken Airport. The primary consideration influencing this decision was that the geographic location of Lunken prevented it from growing to a size which could satisfy future air carrier demands. These same conditions which prevented its growth and development as an air carrier airport constrain its growth and development as a general aviation airport. These conditions may be categorized as:

. Physical Constraints

. Environmental Constraints

(1) Physical Constraints

Lunken Airport is bordered on all sides either by hills or rivers and levees. The acquisition of additional land within these boundaries for airport expansion is simply not possible. The following paragraphs briefly describe the limitations imposed by each of these physical features.

1. Hills

Mt. Lookout, Mt. Washington, and Ft. Thomas are each very near the airport and approximately 400 feet higher in elevation. These hills limit the runway orientations available by establishing only a few valleys for aircraft arrivals and departures. For example, the position and direction of runway 2R-20L was dictated by the location of these hills. Runway 2R-20L is a precision instrument runway for which a 50:1 clear zone approach slope is required. The valley between Mt. Lookout and Mt. Washington allowed the implementation of a precision approach to runway end 20L. All other runway ends (except 2R) require steeper approach slopes which do not permit precision approaches.

The position of these hills combined with prevailing wind directions make certain runway positions and directions impractical. Application of the Code of Federal Aviation Regulations, Part 77, Objects Affecting Navigable Airspace, indicated that reorientation of the existing runways by a few degrees or displacement of the runways by a few hundred feet either to the right or left in some cases would introduce significant hazards to air navigation.

2. Rivers

Lunken Airport is bounded on the west and southwest by the Ohio River and on the east and southeast by the Little Miami River. The airport is built on land previously in the flood plain of these rivers. A levee surrounding the airport on all but the northwest side prevents flooding of the airport surface from these rivers except under extreme conditions. While the levee protects against flooding it also restricts future land development beyond its borders. The section of levee along Airport Road could conceivably be relocated to a position adjacent to Kellogg Road, but only at a large cost.

Therefore, due to physical constraints, it is practical only to consider expansion of the airport within the existing airport property boundaries, except toward the northeast within Lunken Playfield. Airport development on Lunken Playfield was not considered in this study, as explained in the next paragraph. The existing runway orientations were established based on these physical features -- any reorientation would be impractical, both fiscally and aeronautically.

(2) Environmental Constraints

The primary environmental constraint to airport land acquisition and expansion is Lunken Playfield. Lunken Playfield is situated northeast of and contiguous to the airport on land owned by the airport and leased to the Cincinnati Recreation Commission. The Playfield has been devoted to park and recreation activities (golf, tennis,

softball, etc.). Despite the fact that this land is airport property and extremely desirable for landside development, its long term recreational uses have established it as a permanent community facility. Discussions with airport management and city officials indicated that acquisition and development of any portion of this playfield for aviation related uses would be met with harsh community opposition.

Due to the above constraints, Lunken's growth is limited to the existing airport land envelope. Therefore, the following development alternatives are directed toward attaining maximum use of this land.

2. IDENTIFICATION OF DEVELOPMENT ALTERNATIVES

Because future development at Lunken must make use of existing airport property, neither airfield nor landside considerations were the sole determinant in developing the alternatives. Considerable attention to the interaction and mutual development of the two was necessary to develop viable alternative development plans with a balance between airfield and landside facilities.

The following is a brief description of six reasonable alternatives evaluated to meet the future needs of Lunken Airport. It should be noted that the alternatives do not constitute detailed development plans. Their purpose was only to identify the feasibility of a particular concept. Once the preferred alternative was determined, detailed plans were developed.

The estimated development cost included in the following sections includes only those major development items necessary for evaluation and comparative purposes; also it does not include fees for engineering and contingency which normally run 25 percent of the total cost.

(1) Alternative 1

Alternative 1, the "do-nothing" alternative, retains the existing airfield configuration with minor qualitative improvements, such as runway and taxiway overlays, occuring over the 20 year design period. Landside developments would occur until the capacity of the landside facilities were equivalent to airside capacity or approximately 320,000 operations. Landside developments would be accommodated by; (1) redevelopment of existing areas which do not now make maximum use of the land and, (2) development of a new area within the existing land envelope. This new development area is in the southeast corner of the airport at the end of runway 2R. Exhibit IV-1 shows the intended development of landside facilities associated with Alternative 1. The estimated total development cost is $2,787,300.

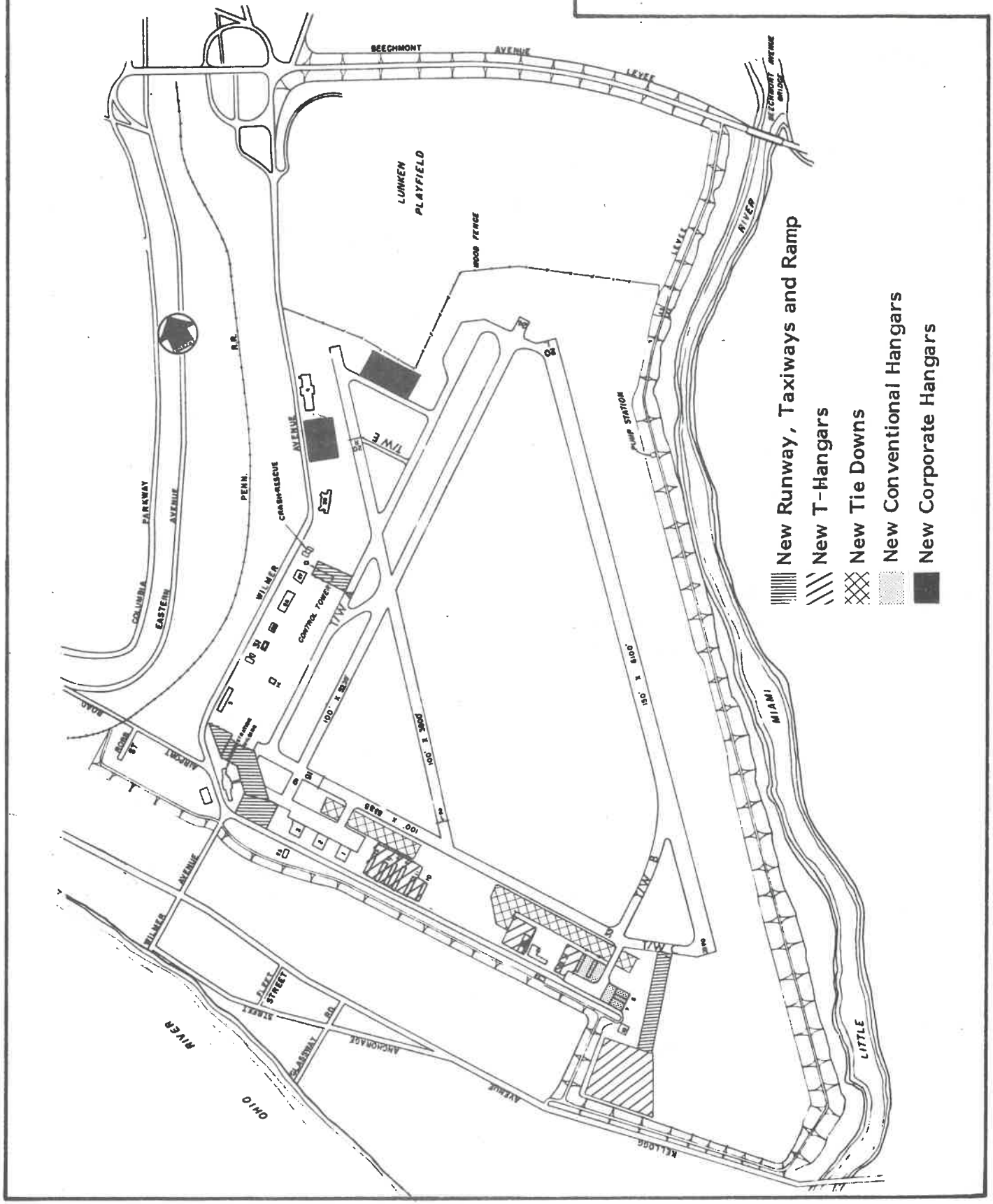
(2) Alternative 2

The second alternative for development at Lunken is to add a full parallel taxiway for Runway 2R/20L. In addition, a taxiway

EXHIBIT IV-1

Lunken Airport Master Plan

ALTERNATIVE #1 SCHEMATIC DIAGRAM



stub connector is proposed from the middle of the parallel taxiway to the intersection of 2L/20R with 6/24. The addition of a full parallel taxiway for 2R/20L, with appropriate exits, would enable the runway to operate at maximum capability. This would increase overall airfield capacity to 345,000 operations. This addition of a parallel taxiway for runway 2R/20L is considered very necessary to Lunken's growth and is therefore included in all subsequent alternatives. A conceptual sketch of the second alternative is presented in Exhibit IV-2. The estimated total development cost is $4,362,100.

(3) Alternative 3

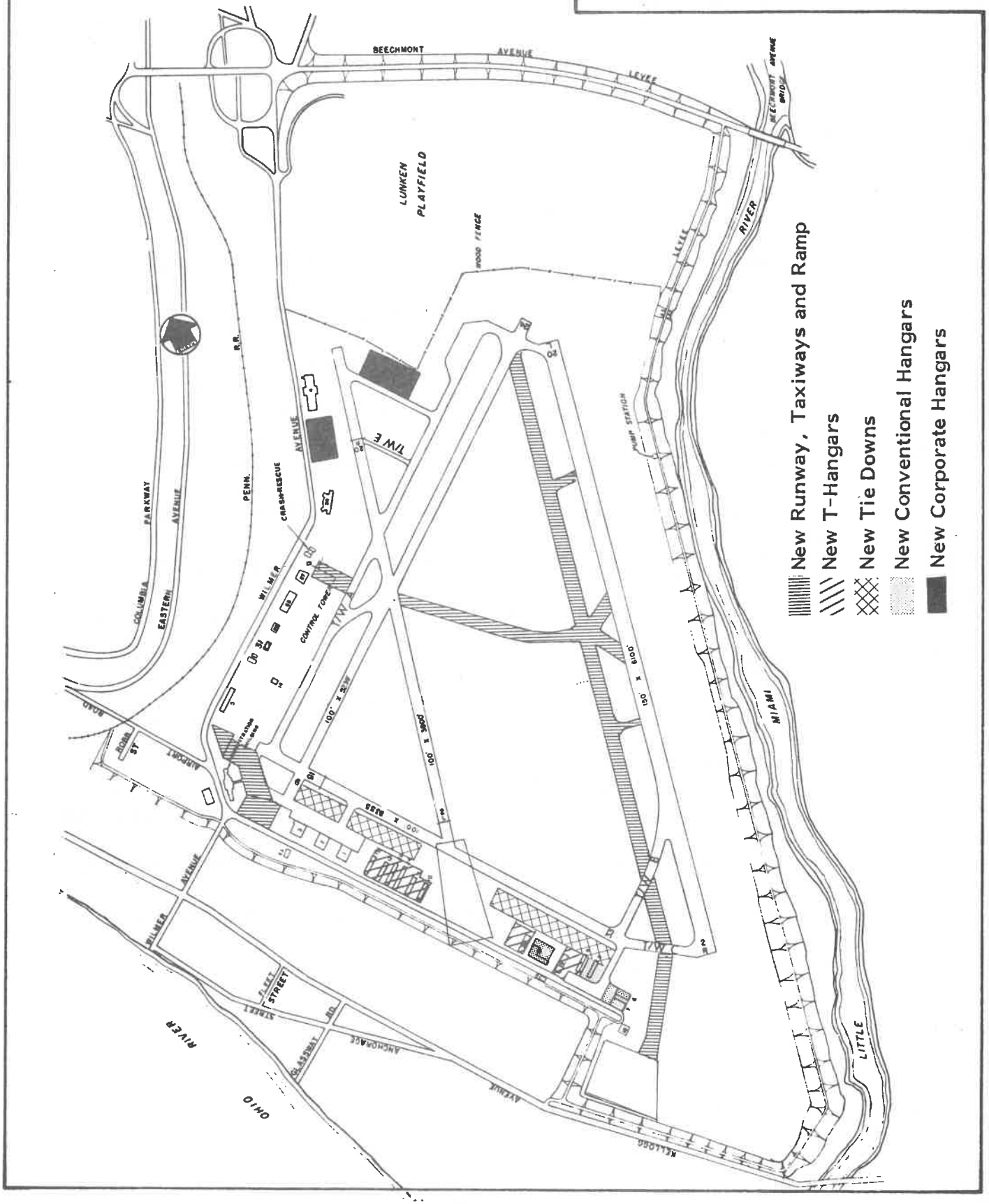
Alternative 3 includes the same concepts as the second alternative but relocates runway 2L/20R approximately 200 feet to the northeast. By relocating 2L/20R and positioning the new 20R threshold at taxiway D (adjacent to the Proctor & Gamble hangar), two major landside improvements may be realized:

- Development of the land between P & G and the Lindair hangar will not be constrained by the 300 foot building limit line as it is today.
- Development of the land along Airport Road, between Maier Aviation and Tri State Aviation is possible. This land is currently undeveloped due to the 2L clear zone. However, with a relocated 2L/20R (with 20R threshold at taxiway D) it is possible to have a 3,800 foot utility runway with 2L clear zone contained to the northeast of the runway 15/33 aircraft parking limit line (125 feet southwest of runway 15/33).

EXHIBIT IV-2

Lunken Airport Master Plan

ALTERNATIVE #2 SCHEMATIC DIAGRAM



This alternative is shown conceptually in Exhibit IV-3. The capacity of Alternative 3 is 345,000 annual operations. The estimated total development cost is $4,906,100.

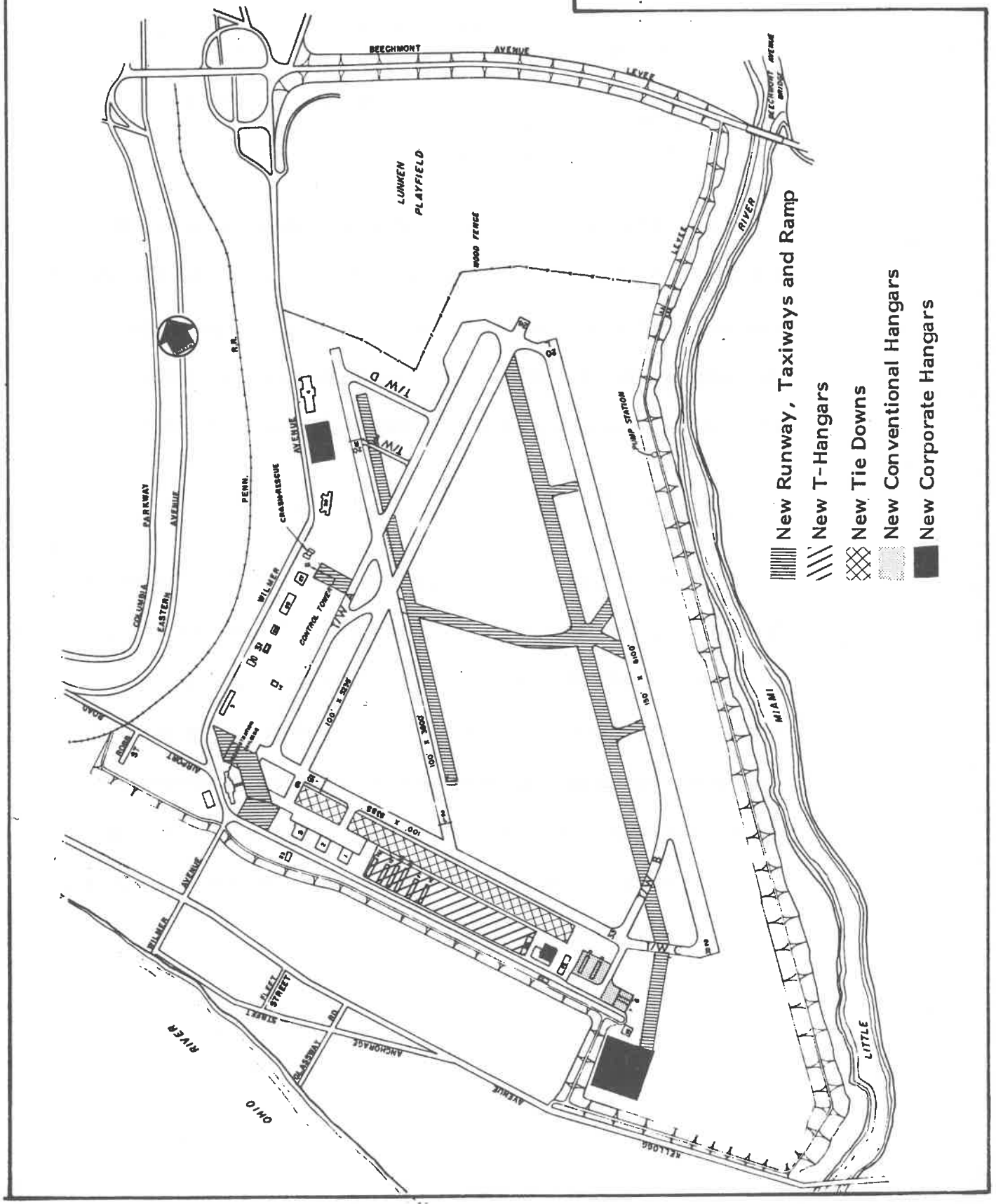
(4) Alternative 4

As previously stated, development at Lunken must make maximum use of existing airport property. Alternative 3 was the first alternative shown which included a major change to the existing facility for the purpose of maximizing use of available land. Alternatives 4, 5 and 6 also include provisions for maximizing the utility of available airport land; however, each of these alternatives dictates that runway 15/33 be decommissioned and used as a taxiway. Analysis of all available meteorological data indicates that this runway is only necessary approximately 3% annually. Although the decommissioning of 15/33 would inconvenience users during conditions of high winds from the northwest, this inconvenience must be carefully weighed against the benefits from the additional land which could be used for aircraft parking, etc. if 15/33 were decommissioned as a runway. Additional land would be available because parked aircraft need not be as far from an active taxiway as from an active runway.

EXHIBIT IV-3

Lunken Airport Master Plan

ALTERNATIVE #3 SCHEMATIC DIAGRAM



Specifically, Alternative 4 involves the following actions:

- The closure of runway 15-33 and its transformation into a taxiway
- Construction of a full parallel taxiway to runway 2R-20L and the construction of additional exit taxiways for that runway

The additional landside and airside capacity provided by this alternative compliment each other providing capability for 340,000 annual operations. Exhibit IV-4 shows conceptually the landside development opportunities provided by implementation of this alternative. The estimated total development cost is $4,271,320.

(5) Alternative 5

Alternative 5, is similar to Alternative 4. However, instead of transforming runway 15-33 into a taxiway it is utilized as a ramp or apron area with facility development occuring right up to the edge of the concrete. Taxiway access to the other runways would be required and a new taxiway would be constructed approximately 250 feet northeast and parallel to the existing runway 15-33. The airside capacity of Alternative 5 would be equivalent to Alternative 4 at 340,000 annual operations.

EXHIBIT IV-4

Lunken Airport Master Plan

ALTERNATIVE #4 SCHEMATIC DIAGRAM

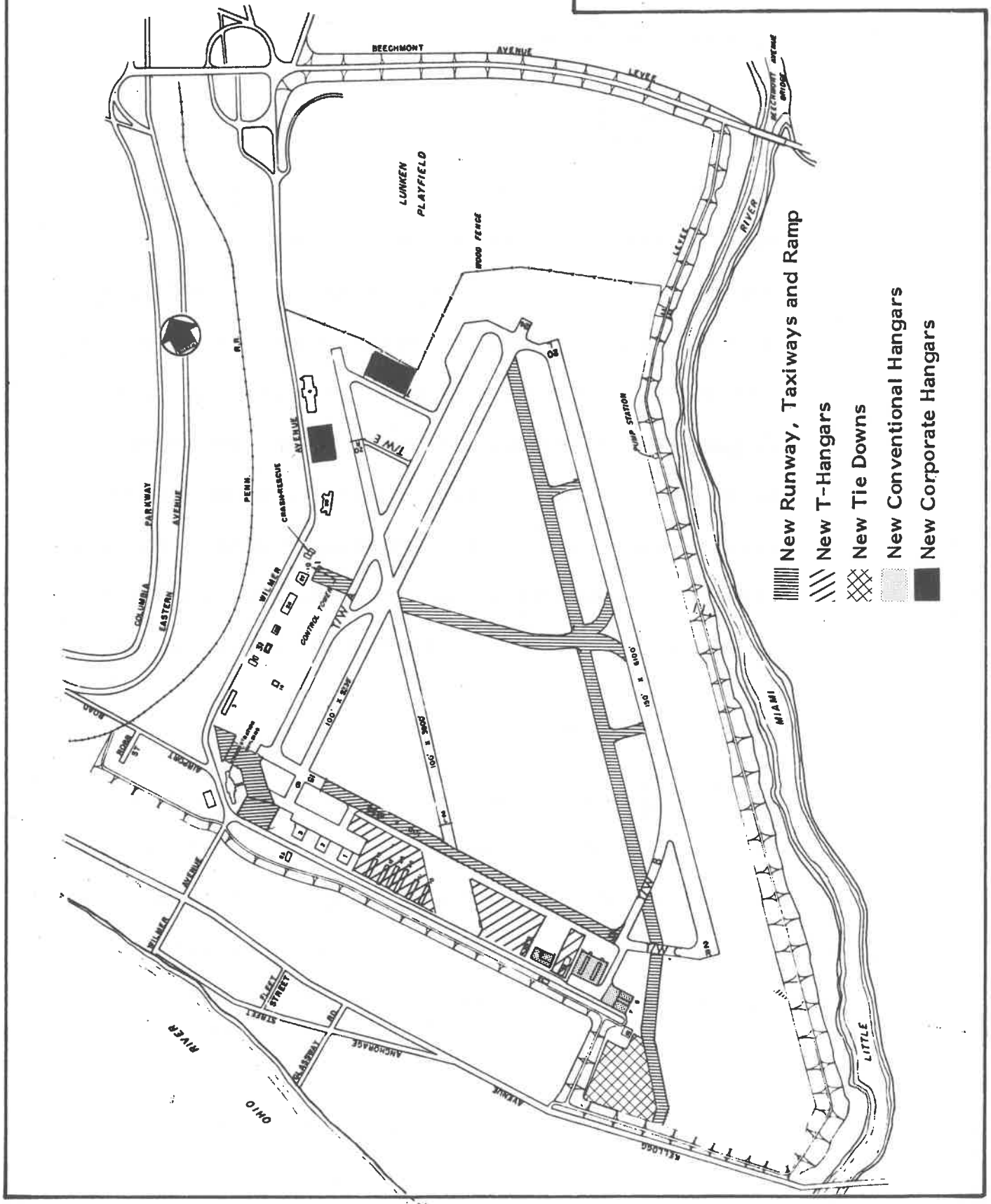


Exhibit IV-5 schematically depicts this airfield configuration and its associated landside development. The estimated total development cost is $4,811,320.

(6) Alternative 6

Alternative 6 is identical to Alternative 2 with the exception of an additional runway. The new runway would be 75 feet wide, 4,000 feet long and located approximately 700 feet east and parallel to existing runway 6-24. Exhibit IV-6 shows the alignment of the proposed new runway and associated taxiways. Also shown are the associated landside development areas. Of the many possibilities considered for the location of a new runway, the 6-24 direction and the location shown in Exhibit IV-6 was the only feasible possibility. The addition of this runway would increase the airfield capacity to 352,000 annual operations. The estimated total development cost is $5,252,080.

3. EVALUATION OF ALTERNATIVES

The approach to the evaluation of the six alternatives is an analysis of how well each alternative accommodates the forecast of aviation demand and the options each preserves for future development versus the cost of developing each alternative. It was recognized earlier that aircraft operational demands will exceed the airfield capacities of the alternatives and

EXHIBIT IV-5

Lunken Airport Master Plan

ALTERNATIVE #5 SCHEMATIC DIAGRAM

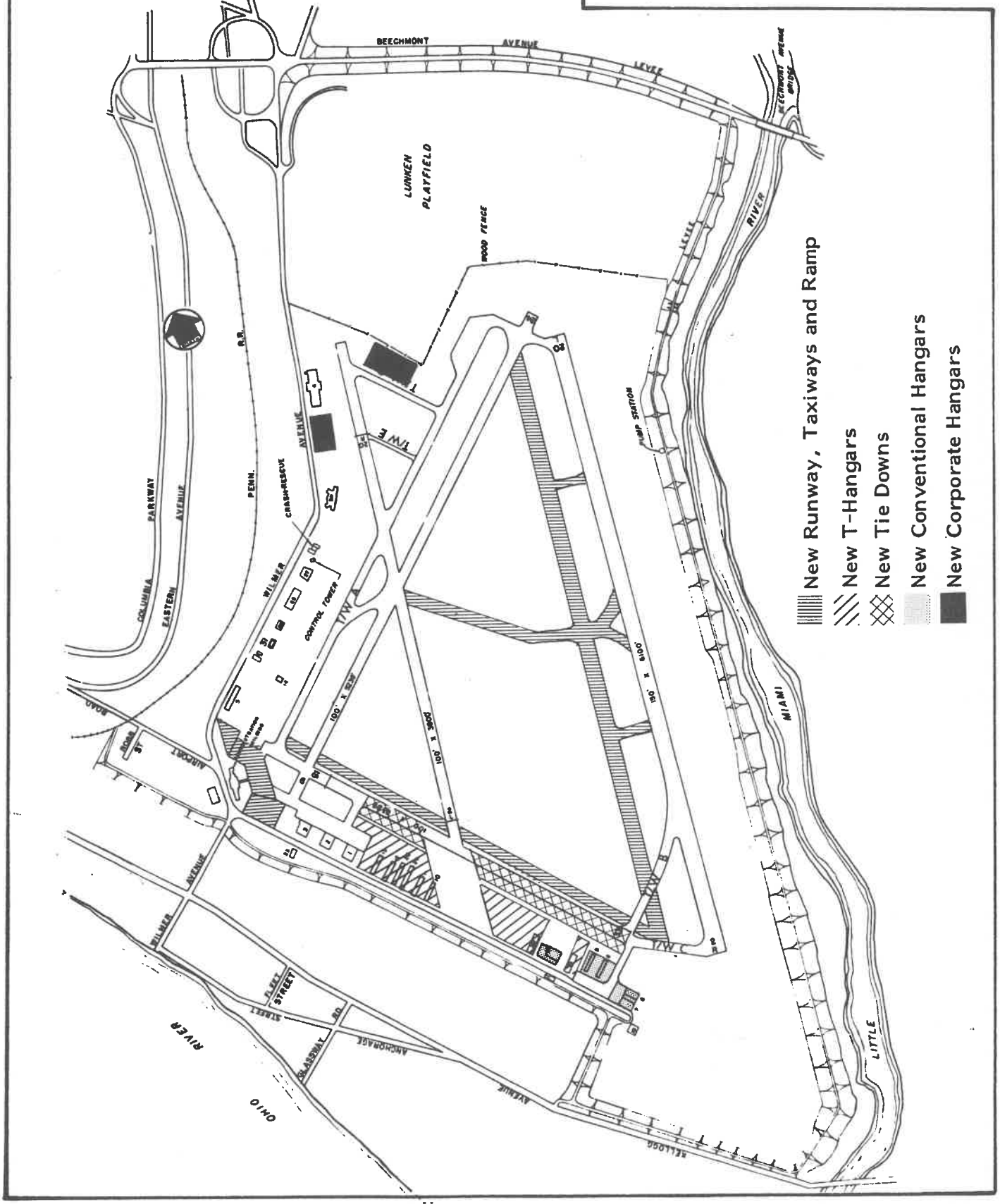
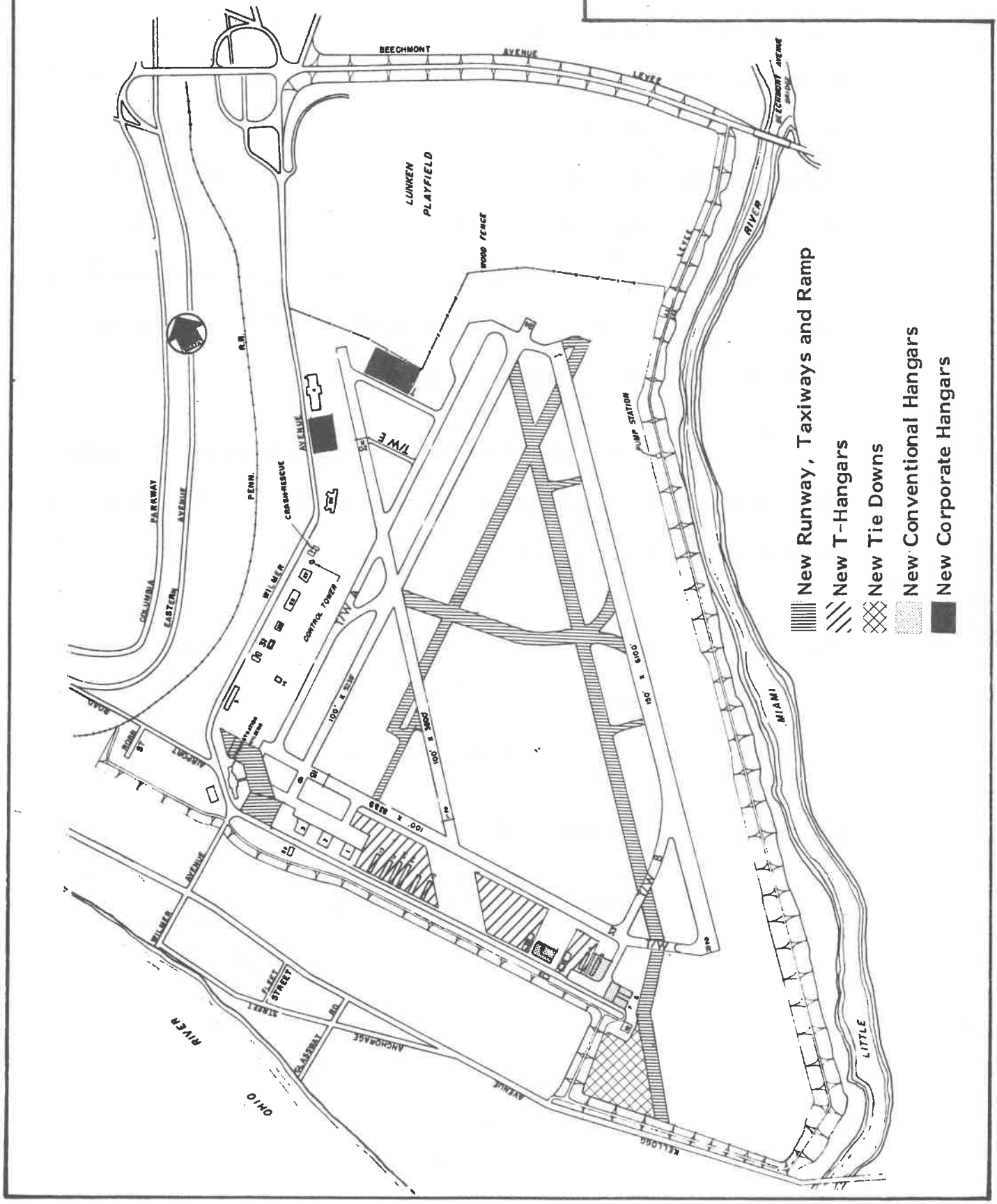


EXHIBIT IV-6

Lunken Airport Master Plan

ALTERNATIVE #6 SCHEMATIC DIAGRAM



that the land envelope at Lunken Airport requires careful structuring for maximum use. The evaluation process consisted of enumerating the quantitative and qualitative aspects of each plan, especially in regard to capacity, land development and cost, and deciding which plan provides the greatest overall benefits at the lowest cost. Environmentally the alternative plans are considered to be equivalent based on their capacities and the volumes of operations to be performed. The environmental analysis was therefore considered inconsequential in the evaluation of alternatives and is presented only for the preferred alternative in Chapter VI.

The following sections briefly outline the advantages and disadvantages of each alternative and other quantitative and qualitative information used to select the preferred alternative.

(1) Alternative 1

1. Advantages

- No action results in little controversy
- Least cost alternative

2. Disadvantages

- No attempt is made to meet the ultimate airside needs of general aviation as presented in the forecast of aviation demand, thereby constraining aviation development even more so than other alternatives.

- The landside facilities expansion is severely restricted and prime development areas are limited. The only major development area remaining is in the southeast corner of the airfield and is not centrally located.

- Runway 2R/20L is not developed to its full capability.

- No undeveloped land remains for contingencies.

(2) Alternative 2

1. Advantages

- The provision of parallel and exit taxiways to runway 2R/20L increases the airfield capacity from 324,000 to 345,000 annual operations thereby responding to the recognized aviation forecast needs and airport saturation is pushed forward from 1985 (with Alternative #1) to about 1990.

- The cost to the City is small compared to the potential benefits of increased capacity and reduced delay.

- 15/33 is preserved as a runway.

2. Disadvantages

- No additional land is available for contingencies.

(3) Alternative 3

1. Advantages

- 2R/20L is developed to its full capability.

- Development of the land between the P & G hangar and Lindair hangars is no longer hindered by the building limit line of existing runway 2L/20R.

- Development of the land between Maier Aviation and Tri State Aviation is possible (corporate or general aviation). This land is potentially the most valuable on airport property because of (1) its location relative

to the runways, (2) its location relative to the existing facilities, and (3) the public desire to locate as close as possible to the administration building (the center of airport activity).

- Some land in the southeast corner of the airfield will be available for contingencies.

- Old runway 2L/20R may serve as a full parallel taxiway for the relocated 2L/20R.

- A tremendous gain in landside planning flexibility is achieved for a relatively small increase in the City's share of capital improvement costs over the other alternatives.

- The flexibility to implement the best features of the other 5 alternatives remains (such as building outward over existing runway 15/33) should the need arise in the future.

- This is the only alternative which makes additional road frontage available.

2. Disadvantages

- Requires an extensive environmental review.

- Does not satisfy the ultimate forecast of unconstrained demand.

- Development of the land adjacent to taxiway D is no longer possible.

- Runway 15-33 would eventually have to be closed.

(4) Alternative 4

1. Advantages

- Additional airplane parking area is gained along 15/33.

- Alternative 4 is the second least expensive alternative.

- Runway end 15 clear zone problems are somewhat alleviated adjacent to the administration building.

2. Disadvantages

- The use of 15/33 as a runway is lost.
- The additional parking area gained along decommissioned 15/33 does not outweigh the loss of its use.
- The overall capacity of the airfield decreases by 5,000 operations over alternatives 2 and 3.

(5) Alternative 5

1. Advantages

- Additional prime land over and above that made available in Alternative 4, is provided. This land is prime because of its relative location to the runway ends and its public preference over utilization of the property in the southeast corner of the airport.
- General aviation T-hangar and tie-down areas may be developed on the land parallel to Airport Road, leaving the southeast corner of the airport for contingencies. The availability of this land allows for more flexible utilization of property for landside development while protecting some valuable development options and providing an allowance of additional land for contingencies. The option and contingencies consist of the availability of buffer areas between developments which do not force a specific fixed base operator into an area which is too small. The optional development of either the southeast corner or the land adjacent to decommissioned runway 15/33 is provided. Also, as it has been noted earlier, corporate facilities tend to be large consumers of land per based aircraft. If the quantity of corporate facilities should grow at a faster rate than anticipated, additional land needed to accommodate them will be available.
- This alternative is capable of making a greater amount of land available for development than any of the other development alternatives.

2. Disadvantages

- The transformation of runway 15/33 into an apron area results in the loss of a crosswind direction and a decrease in capacity of 5,000 annual operations over alternatives 2 and 3.

- There will be some user opposition to the closure of runway 15/33.

(6) Alternative 6

1. Advantages

- With the addition of the new 6R/24L runway, capacity of the airfield system is increased to 352,000 annual operations.

- The transformation of runway 15/33 into a taxiway modifies the location of the building limit line and opens up additional prime land for development.

2. Disadvantages

- The cost to the City of the additional capacity (12,000 annual operations) provided by the proposed development of Alternative 6 over Alternative 5 is estimated at $269,260. This is an extremely high development cost to pay for the modest increase in capacity realized.

- The closure of runway 15/33 and its tranformation into a taxiway results in the loss of a crosswind runway and the capability it provides.

- The additional airfield capacity realized saturates the additional land acreage provided and results in crowded landside development conditions.

4. SELECTION OF THE PREFERRED ALTERNATIVE

The purpose of developing alternatives and comparing their advantages and disadvantages was to select a development program which cost effectively

accommodates the maximum capability of the airport, while providing balanced airside and landside facilities. In addition the selected alternative development program should provide some options and flexibility in responding to future contingencies. Section 3 presented basic quantitative and qualitative data from which Landrum & Brown determined the preferred alternative for Lunken Airport.

Alternative 1 does little to maximize the capability of Lunken Airport. It is a least cost option. It effectively states that the additional increments of airfield capacity provided by the other alternatives are not justified on the basis of cost. Cost alone, however, should not be the deciding factor. Lunken Airport is a community service facility well located to the central business district and the rest of the market area it serves. The question to be answered for the retention or the rejection of this alternative is: "Are the community benefits provided by the other alternatives offset by the additional capital costs incurred for their implementation?" Based on the comparative information presented in Section 3, the analysis of the service area presented in the forecasts and other information relative to the types and location of other airports in the vicinity which could serve general aviation, it is Landrum & Brown's opinion that the community is best served by optimizing development at Lunken Airport. It is not in the best interests of the Cincinnati business and resident population to forego expansion at

Lunken Airport. Moreover, the capital cost to be incurred to develop Lunken will be offset by the community benefits provided. This alternative was therefore rejected on this basis and the remainder of the analysis concentrated on the other alternatives.

Alternative 4 is the same as Alternative 2 except that runway 15/33 would be decommissioned as a runway and used as a taxiway. By using 15/33 as a taxiway, aircraft could park within 75 feet of the taxiway centerline as opposed to 175 feet as required today (an FAA waiver has been obtained allowing aircraft to park within 125 feet of the edge of 15/33). The net gain of 100 feet along the length of runway 15/33 (usable for aircraft parking) is not felt to be sufficient justification for the closure of 15/33. Alternative 4 was therefore rejected.

Alternative 6 was eliminated on the basis of cost effectiveness. An additional runway in the 6/24 direction is estimated to produce a net increase in capacity of only 12,000 annual operations while costing the City $200,000 to $400,000 more than Alternatives 2, 3, or 5.

Alternative 2 was eliminated because Alternative 3 contains all its advantages while forfeiting only the corporate development site adjacent to taxiway D (available with Alternative 2). However, this disadvantage is far outweighed by the additional prime land made available by the removal of the existing 2L clear zone. In addition, Alternative 3 allows part of the

southeast corner of the airport to remain undeveloped for future contingencies (all of the northeast corner is needed in Alternative 2). The incremental City share of Alternative 3 is only approximately $50,000 over Alternative 2.

Alternative 3 was selected as the preferred development alternative over 5. Although its ultimate cost (City share) is approximately $23,000 more than Alternative 5, the potential benefits far outweigh the costs involved. The biggest benefit of Alternative 3 is that it provides the City with the greatest number of future development options. The reasons for selecting Alternative 3 are briefly outlined below.

- Line of sight restrictions from the control tower to runway end 20R are removed.
- Building limit line restrictions to the property between Proctor & Gamble and Lindair are removed.
- The 2L clear zone, preventing development of land between Maier Aviation and Tri-State Aviation, is removed.
- Additional prime land with road frontage is made available for development.
- The City will be in a position to offer prime land to potential corporate or general aviation developers and has an option on their placement (either in the southeast corner or along Airport Road or along Wilmer Avenue).
- The option to decommission runway 15/33 and use it as a taxiway (as in Alternative 4) or to build over it (Alternative 5) still exists when the need for more land should arise in the future.
- The option to build a new runway 6/24 is preserved (although it is considered unnecessary and not cost effective).

- Old runway 2L/20R will serve as an excellent full parallel taxiway for new runway 2L/20R.

- Although the option to develop the land adjacent to taxiway D is lost with Alternative 3, the land is replaced by a larger area, with road frontage, between Tri-State Aviation and Maier Aviation. This land also has ready access to utilities which the land adjacent to taxiway D does not.

CHAPTER V

ENVIRONMENTAL STUDY

CHAPTER V

ENVIRONMENTAL STUDY

The Airport and Airways Development Act of 1970 requires that an investigation of environmental factors which may be affected by airport site selection or site development be made.

An airport is an obvious stimulus to society from the standpoints of economic growth and the services it offers to the public. However, this generation of productivity and employment may be negated by environmental factors if compatibility between an airport and its environs is not achieved. The airport master plan must consider these environmental factors in an attempt to alleviate conditions which contribute to the degradation of the environment.

The purpose of this chapter is to present the assessment of the environmental effects of Lunken Airports' operations and expansion. Specific areas studied included:

- Noise
- Air Quality
- Water
- Solid Waste
- Other
  - Recreational and Park Areas
  - Historic Sites and Unique Areas
  - Aquatic and Marine Life
  - Wildlife and Waterfowl
  - Flora
  - Adjacent Land Use

The following sections present the results of the assessments conducted in each of these areas.

1. NOISE

Noise has become the most critical environmental parameter as far as air service development is concerned. Both the Federal Aviation Administration and the aviation industry are attempting to mitigate the noise problem by minimizing exposure through new technology in the form of quieter engines and procedural requirements for flight operations, and through the achievement of compatible land uses in airport environs. Public response to the noise problem has resulted in the development of several methodologies capable of measuring and suggesting mitigation procedures for community noise impact.

In this study noise contours based on existing and projected 1995 operations and the effects thereof were prepared and analyzed on the basis of the "Composite Noise Rating" (CNR) 1/ technique and "Aircraft Sound Description System" (ASDS).2/

(1) Purpose and Description

The purpose of the analysis was to provide both a subjective and an objective assessment of the noise effects of the projected air traffic demand increase and the proposed airport development program upon the surrounding communities. The assessment was

1/ Bolt, Beranek and Newman, Inc. "Land Use Planning Relating to Aircraft Noise", October, 1964.

2/ Cruz, J.E., "Aircraft Sound Description System," FAA-EQ-73-3, March, 1973.

determined by estimating the number of people, noise sensitive buildings (churches, hospitals, etc.) and acreage outside the airport boundry that would be affected by aircraft noise for existing and 1995 air traffic demand levels, taking into account the proposed development plan to accommodate the 1995 demand levels.

As mentioned earlier two separate methodologies were used to assess the noise effects at Lunken Airport, CNR and ASDS.

The Composite Noise Rating methodology was developed for evaluating public response to aircraft noise, and for developing compatible land uses in airport environs. This methodology involves using noise contours to estimate the noise produced during takeoff, landing and runup operations, and are expressed in terms of maximum perceived noise levels (PNdB). Proper selection of "base contours" is critical and is based on operational information for the airport in question. Corrections are then applied to the perceived noise base contour (PNdB) for number of operations, time of day, etc., to arrive at the composite noise rating (CNR). These contours cover an area in the airport vicinity within which perceived noise levels can be fixed for any site. Community response may then be evaluated, and from the expected response, compatible land use controls can be instituted through zoning restrictions.

The Aircraft Sound Description System was developed for the FAA in an attempt to establish a uniform, practical, technically adequate, objective and understandable method by which to describe aircraft noise exposure. The basic premise of the ASDS concept is straightforward in that the exposure to aircraft noise is described in terms of the total amount of time that sound levels exceed a pre-selected threshold value. As applied to airport area analysis, for any desired location, a noise exposure quantity is specified which states the exposure as "X" minutes of total exposure to sound levels in excess of 85dBA.

(2) Analysis of Existing Noise Exposure

The impact of existing airport related noise upon existing land uses, based on the CNR methodology, is depicted on Exhibit V-1. Exhibit V-2, "Land Use Compatibility Chart for Aircraft Noise", explains the compatibility relationship to CNR values and zones to various land uses around an airport. Exhibit V-3 details the land uses within CNR zones 2 and 3, the more critical of the areas impacted by aircraft noise. As Exhibit V-3 points out, there are 71 residential units and one church that are incompatible land uses with Lunken Airport.

Exhibit V-4 depicts the existing ASDS contour for Lunken Airport. Again, this is the area which receives "X" minutes of total exposure to sound levels in excess of 85dBA during a typical busy day at Lunken Airport.

EXHIBIT V-1

Lunken Airport Master Plan

EXISTING CNR NOISE CONTOUR

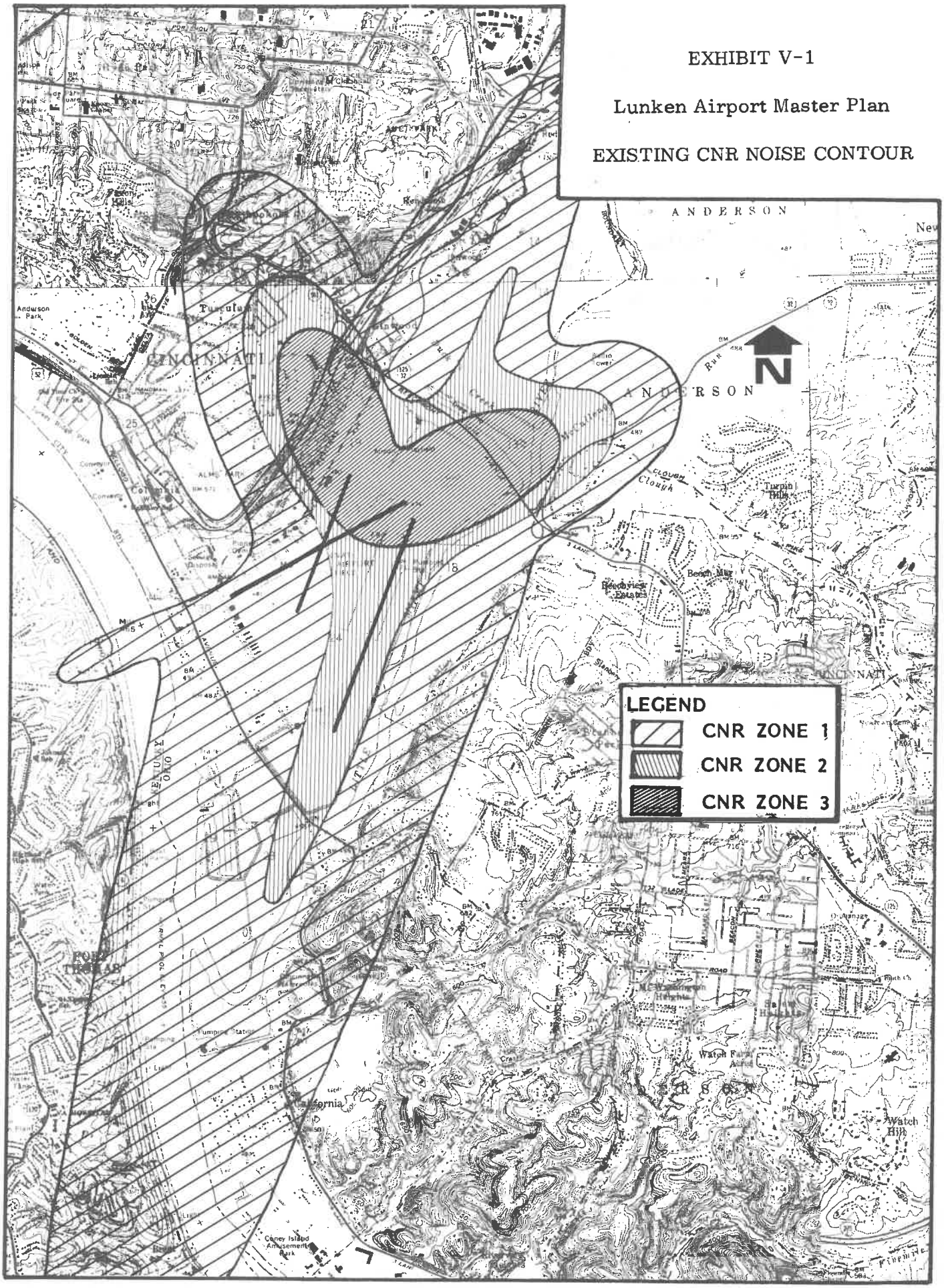


EXHIBIT V-2

Lunken Airport Master Plan

LAND USE COMPATIBILITY CHART FOR AIRCRAFT NOISE

CNR Forecast Zones	Land Use Compatibility								
	Residential	Commercial	Hotel, Motel	Offices, Public, Buildings	Schools, Hospitals, Churches	Theaters, Auditoriums	Outdoor, Amphitheaters, Theaters	Outdoor Recreational (Nonspectator)	Industrial
1	yes	yes	yes	yes	Note (C)	Notes (A) and (C)	Note (A)	yes	yes
2	Note (B)	yes	Note (C)	Note (C)	no	no	no	yes	yes
3	no	Note (C)	no	no	no	no	no	yes	Note (C)

NOTE:

(A) - A detailed noise analysis should be undertaken by qualified personnel for all indoor or outdoor music auditoriums and all outdoor theaters.

(B) - Case history experience indicates that individuals in private residence may complain, perhaps vigorously. Concerted group action is possible. New single-dwelling construction should generally be avoided. For apartment construction, Note (C) applies.

(C) - An analysis of building noise reduction requirements should be made, and needed noise control features should be included in the building design.

Source: Advisory Circular 150/5070-6.
Land Use Planning Relating to Aircraft Noise
Bolt, Beranek, and Newman, Inc. (1965).

EXHIBIT V-3

Lunken Airport Master Plan

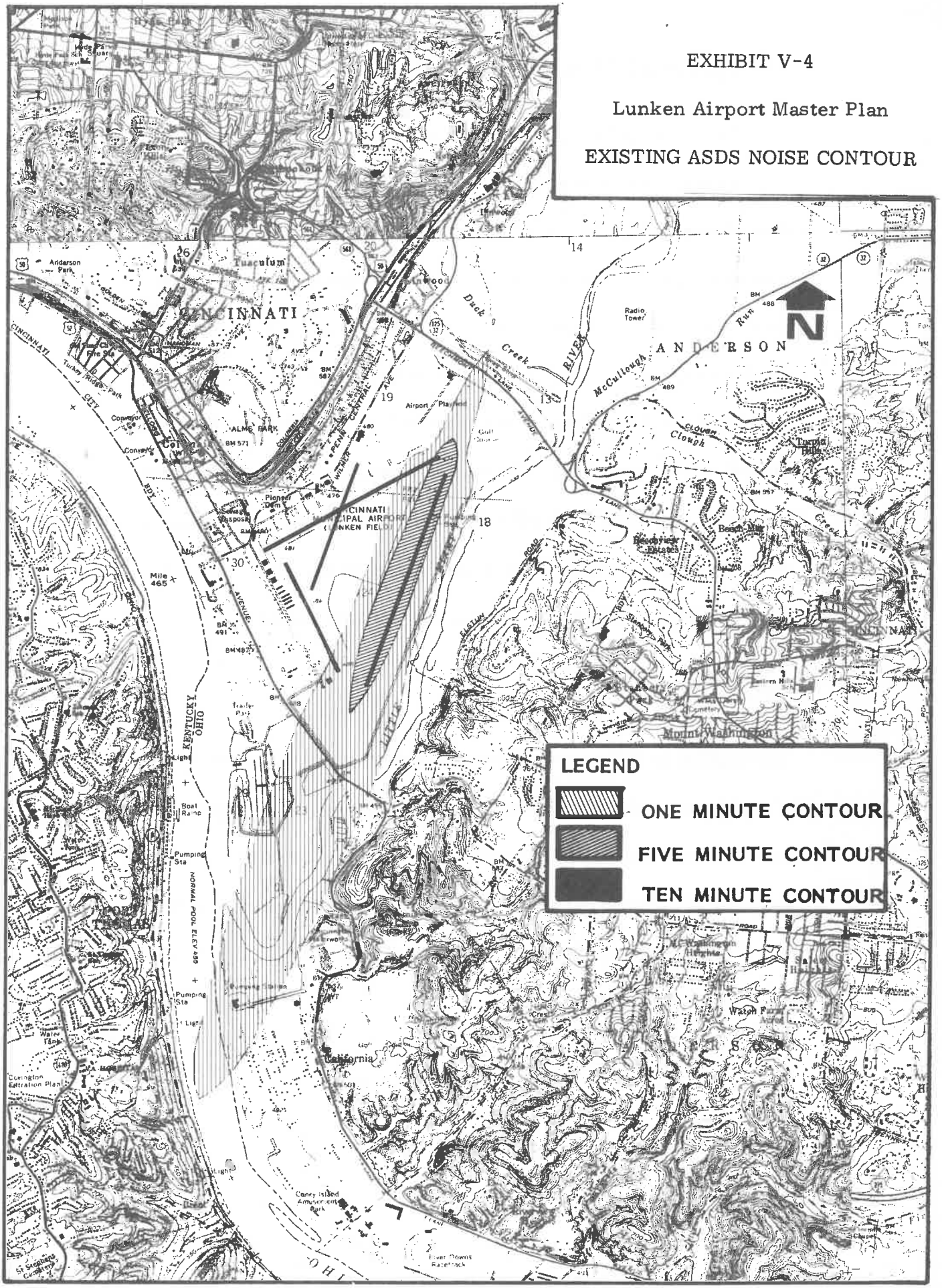
EXISTING LAND USES WITHIN
CNR ZONES 2 AND 3

CNR Zones	Existing Land Uses			
	Residential	Church	Commercial	Industrial
2	57	1	2	3
3	14	0	2	3
Total	71	1	4	6

EXHIBIT V-4

Lunken Airport Master Plan

EXISTING ASDS NOISE CONTOUR



(3) Analysis of Future Noise Impact

The impact of future airport noise, depicted on Exhibit V-5 was determined by overlaying the 1995 CNR contour for the preferred alternative on the existing land use map and applying the criteria expressed on Exhibit V-2. A summation of the existing land uses that will be affected by future airport noise is presented on Exhibit V-6. Comparing Exhibit V-6 to Exhibit V-3, it can be seen that the future land use impact will be significantly less than that of today. Landrum & Brown feels that the reduction in noise impact as shown in the 1995 CNR noise contour will occur as a result of new noise regulations promulgated by the FAA. Exhibit V-7 depicts the 1995 ASDS contour for Lunken Airport.

2. AIR QUALITY

Air quality is a function of various meteorological factors, geographic and topographic constraints, timing and magnitude of pollutant emissions and type and variety of pollutant sources. Pollutant sources to be considered at an airport location generally include: (a) aircraft; (b) ground vehicles; (c) stationary sources (on airport site); (d) stationary sources (off airport site).

EXHIBIT V-5

Lunken Airport Master Plan

1995 CNR NOISE CONTOUR

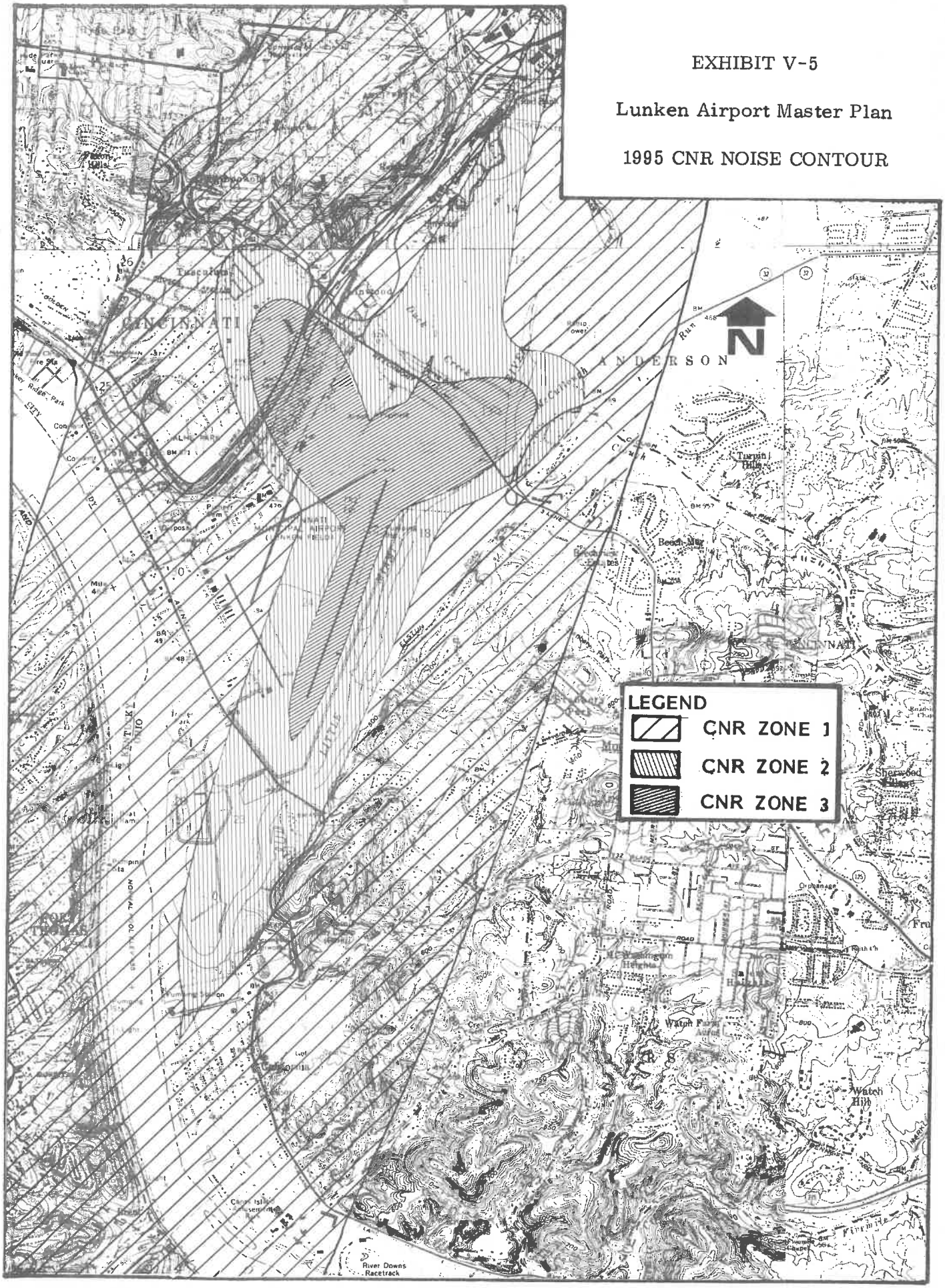


EXHIBIT V-6

Lunken Airport Master Plan

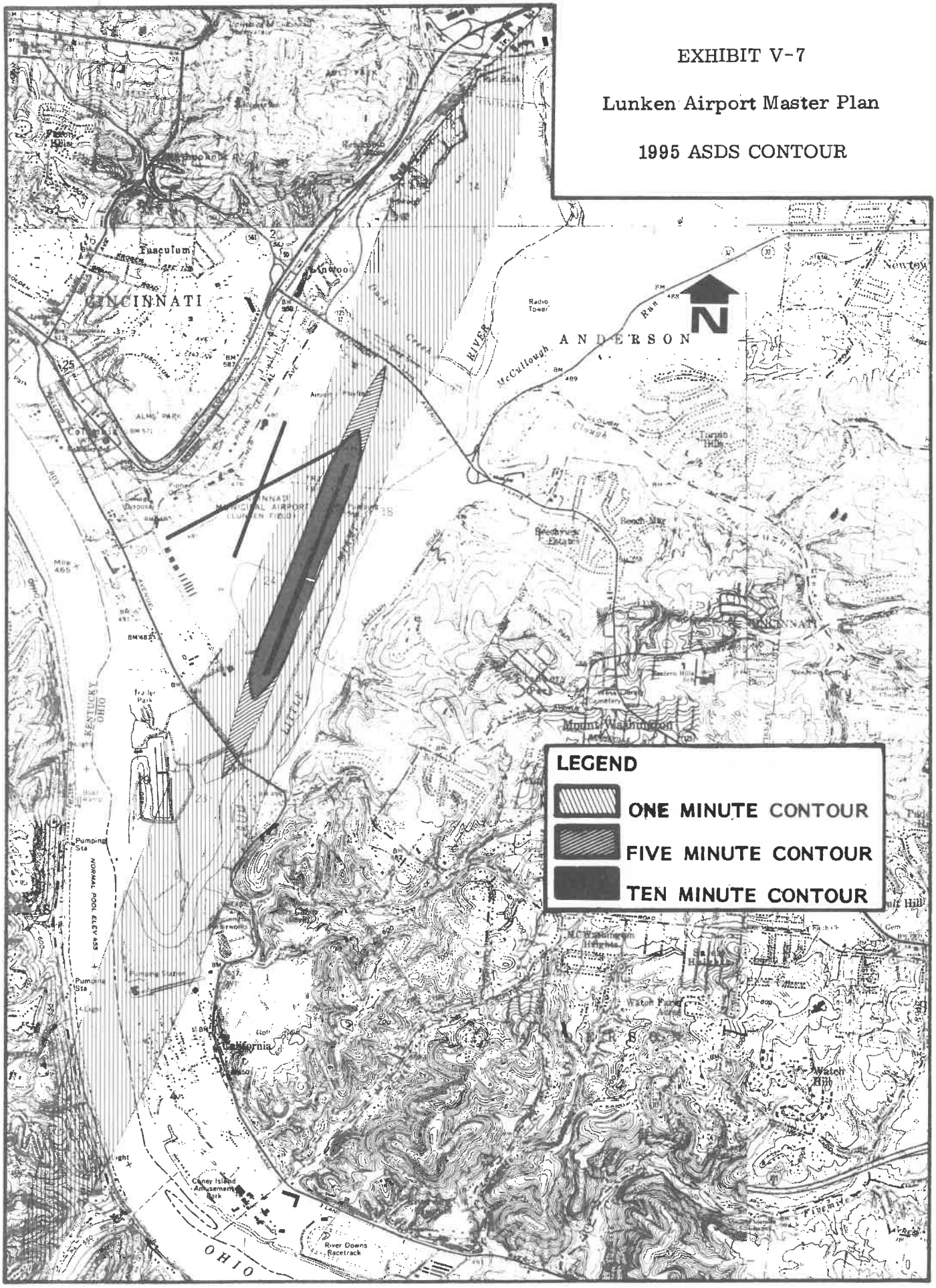
FUTURE LAND USES WITHIN
CNR ZONES 2 AND 3

CNR Zones	Future Land Uses			
	Residential			
	Single-Family	Multi-Family	Industrial	Commercial
2	32	1	0	0
3	23	1	1	1
Total	55	1	1	1

EXHIBIT V-7

Lunken Airport Master Plan

1995 ASDS CONTOUR



At Lunken Airport, meteorological and topographic factors are of minor importance in the air quality "equation", with type and magnitude of pollutant emissions being more significant factors. Measuring emission concentrations, therefore, provides perhaps the best method of determining air quality at Lunken.

In this analysis, emission calculations were performed for aircraft only since no stationary sources of pollution exist at or in the vicinity of the airport and pollutant emissions from the relatively small number of ground vehicles is minimal.

(1) Purpose and Description of the Analysis

The purpose of the analysis was to provide an assessment of the effects of the projected air traffic demand increase and the proposed airport development program upon air quality at the airport and surrounding environs. The assessment was determined by evaluating air quality conditions for existing and 1995 air traffic demand levels, taking into account the proposed development plan to accommodate the 1995 demand levels, then comparing the air quality conditions with national air quality standards.

The methodology used to calculate the various pollutant levels (Enclosed Box Technique) is based upon assumptions stated in the U.S. Environmental Protection Agency Publication, AP-42,

"Compilation of Air Pollutant Emission Factors." The calculation procedure is a summation of the quantities of the particular pollutant generated by the various aircraft classes, divided by an assumed volume. The results of the calculations are then compared against the National Primary Ambient Air Quality Standards as established by the Environmental Protection Agency (EPA) to determine compliance with the standards. This technique is not an exact prediction of present and future pollutant levels, but an estimate of the worst possible condition. The pollutants considered in the air quality evaluation included the following:

- Particulates
- Sulfur Oxides
- Carbon Monoxide
- Hydrocarbons
- Nitrogen Oxides

(2) Analysis of Existing Air Quality Conditions

The analysis of existing air quality at Lunken Airport indicated that the existing level of pollutant emissions are far below the national standards and that the airport is probably not a significant source of air contamination of the surrounding environs. A comparison between existing aircraft pollutant emission levels and the national air quality standards is shown on Exhibit VII-8 .

EXHIBIT V-8

Lunken Airport Master Plan

COMPARISON OF EXISTING EMISSIONS TO NATIONAL AIR QUALITY STANDARDS

Pollutant	Emission Concentrations		National Standards[1]	
	ug/m^3/hr[2]	ppm[3]	ug/m^3/hr[2]	ppm[3]
Particulates	0.100	-	75	-
Sulfur Oxides	0.136	$.05 \times 10^{-3}$	80	0.03
Carbon Monoxide	24.250	.02	40,000	35
Hydrocarbons	1.079	1.62×10^{-3}	160	0.24
Nitrogen Oxides	0.600	0.3×10^{-3}	100	0.05

1/ National Primary Ambient Air Quality Standards of April 30, 1975.
2/ Micrograms per meter cubed per hour.
3/ Parts per million.

Source: Landrum & Brown Analysis.

(3) Analysis of Future Air Quality Conditions

The analysis of potential air quality conditions at Lunken Airport indicated as the analysis of existing conditions did, that the level of pollutant emissions are expected to be far below the national standards. A comparison of the potential aircraft pollutant emission levels for 1995 and the national air quality standards is shown on Exhibit V-9.

3. WATER

Various provisions of the Department of Transportation Act of 1966, the National Environmental Policy Act of 1966 and the Airport and Airway Development Act of 1970 require the protection and enhancement of the natural environment surrounding the nation's airports. One of the most important considerations in this regard is the protection of adjacent natural water bodies and municipal sewage systems from contaminants due to aircraft operation, servicing and maintenance.

Airports have only recently been acknowledged as significant sources of industrial wastes. Spillage of fuels, oils and other volatile solvents associated with normal fueling operations, metal finishing wastes from aircraft maintenance and repair work (including painting and metal work), detergents, grease and oil wastes from aircraft and motor vehicle washing and engine test cell operations are only a sample of the types of wastes which may be introduced into nearby receiving

EXHIBIT V-9

Lunken Airport Master Plan

COMPARISON OF POTENTIAL
1995 EMISSIONS TO NATIONAL
AIR QUALITY STANDARDS

Pollutant	Emission Concentrations		National Standards 1/	
	ug/m^3/hr 2/	ppm 3/	ug/m^3/hr 2/	ppm 3/
Particulates	0.2	-	75	-
Sulfur Oxides	0.3	0.11×10^{-3}	80	0.03
Carbon Monoxide	47.6	.04	40,000	35
Hydrocarbons	2.94	4.41×10^{-3}	160	0.24
Nitrogen Oxides	1.20	0.6×10^{-3}	100	0.05

1/ National Primary Ambient Air Quality Standards of April 30, 1975.
2/ Micrograms per meter cubed per hour.
3/ Parts per million.

waters or waste treatment works. Additional waste loads may be imposed during the winter season because of the use of salts and abrasives on runways and aprons as snow and ice retardants and extensive application of glycol and other petroleum derivatives on aircraft surfaces for de-icing purposes.

This section will discuss freshwater requirements versus available supply, liquid waste versus treatment facilities and hydrology.

(1) Purpose and Description

The purpose of this analysis was to provide an assessment of the effects of increased air traffic demand and proposed airport development programs upon fresh water supply, waste water generation and control and hydrology at the airport and its surrounding environs. The assessment of freshwater supply was accomplished by determining current requirements, including the source of supply then comparing future needs against the available supply. The assessment of wastewater generation and control was accomplished by examining existing methods of wastewater disposal and treatment facilities then comparing future wastewater volumes against available treatment facilities. An assessment of hydrology was accomplished through discussion with City of Cincinnati Engineers in terms of what effect, if any, would the proposed development plan have on the hydrologic cycle of Lunken Airport and its environs.

(2) Water Requirements

Lunken Airport as well as the surrounding community receives all potable water from Cincinnati Water Works. Lunken Airport is not considered to be a major user of freshwater. Cincinnati Water Works indicated that it would be more than able to supply all needed fresh water in the future.

(3) Wastewater

Wastewater at Lunken consists of sanitary waste, industrial waste and storm runoff.

a. Sanitary Waste

Sanitary waste is generally defined as waste generated by the daily activities of people. All sanitary waste is disposed of through a sanitary sewer system which is connected to the Little Miami Sewage Treatment Plant. This facility is currently involved in a $60 million dollar expansion program which will enable secondary treatment of wastewater as well as primary treatment.

The supervisor of the Cincinnati Metropolitan Sewer District, Mr. George Hurtle, indicated that the capacity of the existing facility far exceeds the current load. It is expected that this facility will have more than enough capacity to handle the expected demand over the next 20 years.

b. Industrial Waste

Industrial Waste is associated with routine servicing of aircraft such as refueling, aircraft maintenance or aircraft washing.

Oils, greases, solvents, degreasers, hydraulic fluids and other maintenance wastes are collected and disposed of by private contractors.

c. Surface Runoff and Storm Drainage

Rain falling through the atmosphere tends to pick up many impurities such as engine exhaust emissions and particulate matter. Water, while on the surface, picks up waste fuel, grease, pesticides, and herbicides. Unfortunately, no good data are available on the concentration of contaminants in storm water runoff. Experience in urban street runoff indicates a level of pollution at least as high as sanitary wastes. Some evidence indicates that the quality of storm drainage is at its worst during the first 15 minutes of rainfall when most waste matter is flushed from the surface.

Usually, treatment is not considered for storm drainage because of its low occurrence, high volume character. However, the great majority of surface runoff from the

terminal area apron, runways, taxiways and other paved portions of the airport is collected by a series of storm sewers or drains and gravity fed to the Little Miami River. All new paved areas are expected to be handled in a similar manner.

(4) Hydrology

Hydrology is concerned with the occurrence, circulation and distribution of the natural waters of the earth and their interaction with the environment.

As mentioned in Chapter I, Lunken Airport is bounded on two sides by either the Little Miami or Ohio River. The entire airport area is located in the flood plain area of these rivers. To protect the airport from potential flooding, levees were constructed around three sides of the Airport. These levees were designed to protect the airport from flood peaks that would likely occur only once every 90 years.

In addition to the potential flood hazard, the entire airport area overlies an aquifer. At times, either due to a high water table or river level, water will percolate back to the surface of the airport, saturating the soil. Because of the location of

the airport with respect to the two rivers, there is no feasible way of eliminating this natural phenomena; however it could be alleviated with additional pumps.

Also mentioned earlier is the problem of percolation in the old river bed. This situation is taken care of by a series of pumps, pumping the water back into the Little Miami River. There have been a total of 18 days of flooding since 1964 due to heavy rains and percolation.

The levees and pumps should be adequate for all but the most severe flooding conditions. It is recommended that additional pumps be installed to help alleviate this problem.

4. SOLID WASTE

Aircraft operations produce solid waste from general paper waste, in flight food service (mainly corporate), and from cargo service. Airport tenants operations produce solid waste from restaurant, snack bars and general business operations. In addition, construction material packing and debris are produced by construction operations.

(1) Purpose and Description

The purpose of the analysis was to determine what effect, if any, future operation and airport development would have on solid waste disposal at Lunken Airport. The effect was determined by evaluating existing conditions and comparing them with 1995 conditions.

(2) Existing and Future Conditions

The composition of solid waste generated at the airport consists of paper (newspapers, wrappings, office waste paper, etc.), food waste, cans, bottles, plastics, wood and metal. They are currently consolidated by airport personnel and picked-up and disposed of by private solid waste disposal contractors. This system or arrangement should suffice over the next 20 years.

5. OTHER ENVIRONMENTAL CONSIDERATIONS

In general, when the facilities at an airport are expanded to accommodate rising levels of activity, the most controversial issues associated with such a program relate to its impact on community noise exposure, and air and water quality. However, an airport expansion program may also effect other areas of the environment, such as:

- Recreation and park areas
- Historic sites and areas of unique interest
- Aquatic and marine life
- Wildlife and waterfowl
- Flora
- Adjacent land use

(1) Purpose and Description

The analysis was performed to determine if the projected increase in operations or the alternative airport development

plans would have any effect upon the above areas of environmental concern. The assessment was made through on-site inspections, interviews and analysis of data pertaining to each of the areas of concern.

a. Recreation and Park Areas

Located northeast and contiguous to the airport is Lunken Playfield. Lunken Playfield is owned by the airport and leased to the Cincinnati Recreation Commission. This facility contains 186.813 acres of land and is primarily an outdoor, night-lighted family recreational facility with a variety of recreational activities for all ages. Available activities include golf, tennis, miniature golf, archery, picnicking, softball, football, children's play areas, shuffle board, ping pong, games of skill, hiking, bike riding and badminton. The playfield has existed compatibly with the airport in the past; furthermore, because of its importance as a recreation facility the alternative airport development plans have been configured so as to have little or no effect upon future operations of Lunken Playfield.

b. Historic Sites and Areas of Unique Interest

The Pioneer Memorial Cemetery, located on the northwesterly side of Wilmer Avenue approximately 450 feet north

of Airport Road, between Lunken Airport and Penn Central Railway, is the only historic site in the immediate vicinity of the airport. This cemetery, consisting of 2.22 acres, has some of the first settlers to the Cincinnati area buried there. Memorial Day Ceremonies and a parade are held there annually.

Apparently, this historic site has existed compatibly with the airport in the past; a situation in which we expect to continue in the future.

c. Aquatic and Marine Life

There are no streams, lakes or ponds located on airport property, although the old Little Miami River bed lies within existing Airport boundries and is at times flooded because of its use as a temporary reservoir, therefore no marine or aquatic life exist on airport property.

Located to the east is the Little Miami River and to the south the Ohio River. Some storm runoff and seepage in the old river bed are pumped into the Little Miami River.

d. Wildlife and Waterfowl

Because of the rather large volume of air traffic at Lunken Airport, there is very little wildlife at the airport per se.

Migrating waterfowl will use the old river bed, if it is flooded, as a temporary resting place. There can be as many as several hundred ducks in the reservoir during the spring migration.

e. Flora

There are no rare or endangered vegetation species in the vicinity of the airport. The alternative airport development plans will have a short term effect on vegetation during construction. They can be replaced following construction.

f. Adjacent Land Use

The western part of Lunken Airport is surrounded by steep hillsides or rivers. There are three city parks in the area, Lunken Playfield abutting the airport to the north, Alms and Ault Parks to the west and northwest, respectively, on top of one of the hills overlooking the airport. There are some very fine residential areas in the vicinity of the airport also on top of the hills. The area west of Wilmer Avenue along the airport's western boundry is a railroad right-of-way. There is some commercial development to the west along Wilmer Avenue and to the South along Kellogg.

In general, existing operations do not detrimentally affect any existing residential areas. A more detailed discussion of land use is presented in Chapter VII, "Land Use Plan."

CHAPTER VI

AIRPORT PLANS

CHAPTER VI

AIRPORT PLANS

In Chapter IV, "Alternative Development Plans," six alternative airfield development plans were identified and evaluated, whereby alternative three was selected as the preferred alternative. The six alternative plans were conceptual in nature and their only purpose was to identify the feasibility of a particular concept. This chapter will develop a detailed Airport Layout Plan of the preferred alternative as well as the Terminal Area Plan, the Obstruction Plan, and Runway Approach Profile drawings.

1. CURRENT AND FUTURE NASP CLASSIFICATION

In order to form a basis for developing the ultimate airport layout plan, fundamental issues concerning the role of Lunken Airport within the Federal "National Airport System Plan (NASP)" are addressed.

FAA criteria used when Federal planning and project development funds are involved, initially establish the eligibility of the airport for inclusion in the NASP. If the airport qualifies, its functional role based upon its level of public service within the National Airport System is determined; and finally, its operational role in terms of the dominant and subordinate aeronautical activity is identified and categorized. Each classification is ultimately used to determine the priority of airport projects and the planning and design standards applicable to existing and future airport requirements.

The eligibility of Lunken for entry into the NASP is justified based upon its designation as a reliever airport to Greater Cincinnati Airport.

Having qualified for entry, the airport is then classified by its functional and operational role. The determination of the airport's existing and future functional role is based on a combination of the airport's level of public service and annual operations. The present functional role of the airport was determined to be that of a medium density airport within the secondary airport system (S-2). It is projected to be that of a high density airport within the secondary airport system (S-1) during the twenty-year forecast period.

Lunken Airport currently serves only, and is projected to serve only, general aviation aircraft; therefore, its current and projected operational role is that of a general aviation airport. The design classification associated with the general aviation role, based on criteria contained in FAA Order 5090.3 (NASP), Appendix 16, is that of basic transport and is projected to remain a basic transport-type airport throughout the twenty-year planning period. General aviation-basic transport airports can accomodate all general aviation aircraft up to 60,000 pounds maximum gross weight.

2. AIRPORT DESIGN STANDARDS

The FAA airport design standards applicable to future airport development are depicted on Exhibit VI-1. The standards have been used to evaluate the existing airport configuration and to design future airport improvements in conformance with applicable criteria.

EXHIBIT VI-1

Lunken Airport Master Plan

RECOMMENDED FAA DESIGN STANDARDS
(GENERAL AVIATION)

Item		Runway	2L-20R	2R-20L	6-24
		Approach Category	Visual	Precision	Non-Precision
		Classification	General Utility	Basic Transport	Basic Transport
1.	Runway Length		3,800' 1/	5,600' 1/	5,600' 1/
2.	Width				
	. Runway		75'	150'	100'
	. Taxiway		40'	40'	40'
	. Primary Surface		250'	1,000'	500'
	. R/W Safety Area		150'	500'	300'
3.	Runway Centerline (℄) to				
	. Taxiway ℄		150'-200'	400'	200'
	. Apron Edge		275'	650'	300'
	. Building Restriction Line (BRL)		300'	750'	300'
	. Property Line		250'	750'	300'
4.	Taxiway ℄ to				
	. Airplane Tiedown Area		75'	250'	100'
	. Fixed or Movable Object		50'	200'	75'
	. BRL		-	200'	75'
5.	Safety Area Beyond Runway End		200'	200'	200'
6.	Approach Slope		20:1	50:1	34:1

1/ 100% Fleet @ 60% Useful Load

3. AIRPORT LAYOUT PLAN

The Airport Layout Plan, Exhibit VI-2, depicts the airport as it exists today as well as the recommended facilities required to accomodate the anticipated constrained demand.

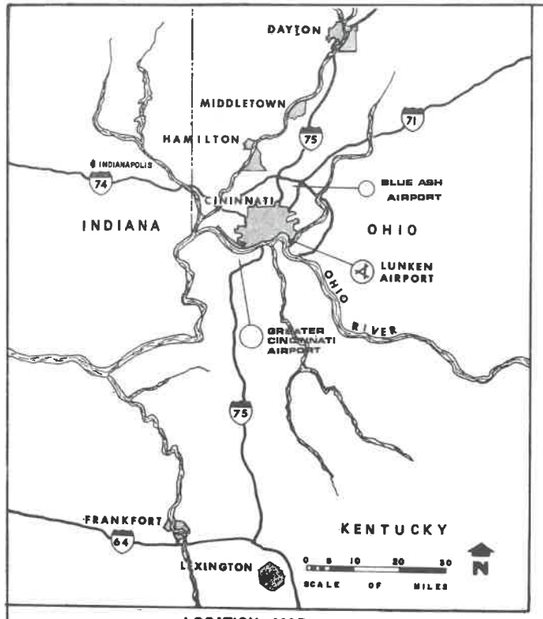
The development of the plan (ALP) was time-phased to conform with the FAA's "National Airport System Plan" (NASP) planning periods as shown below:

Planning Range	Years	Development Period
Short Range	1 - 5	1976 - 1980
Intermediate Range	6 - 10	1981 - 1985
Long Range	11 - 20	1986 - 1995

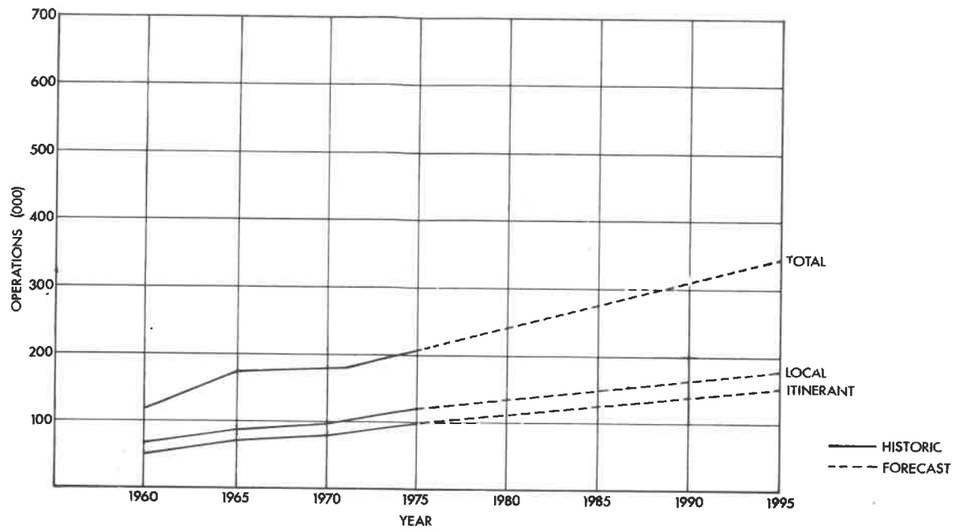
In Chapter II, "Forecast of Aviation Demand", an increase in helicopter activity was forecast. Although the CH-47 Chinook was identified as the critical helicopter for design purposes, control tower personnel and the airport manager mentioned the need to separate helicopters with skids, i.e., UH-1H Huey, that need to hover to taxi, from light fixed wing, single engine training aircraft. AC 150/5390-1A, "Helicopter Design Guide", was used to provide design guidance. The location was established to insure compatibility both with training activity and parked small aircraft.

The major items of the plan discussed in Chapter III, "Demand/Capacity Analysis and Determination of Facility Requirement" and in Chapter IV, "Alternative Development Plans," which have been incorporated in the Airport Layout Plan, are summarized below by phased development period.

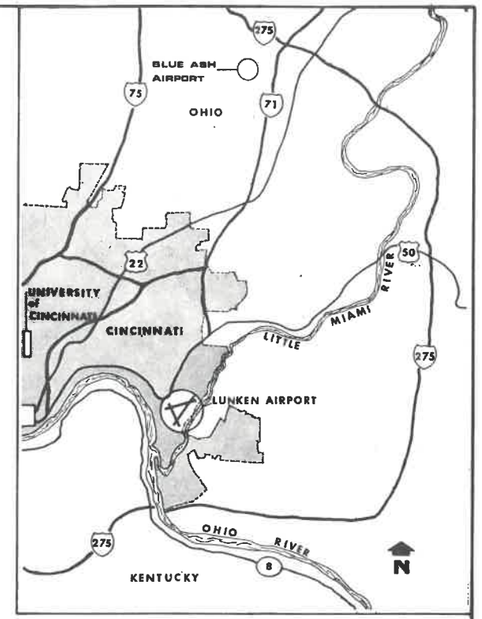
EXHIBIT VI-2



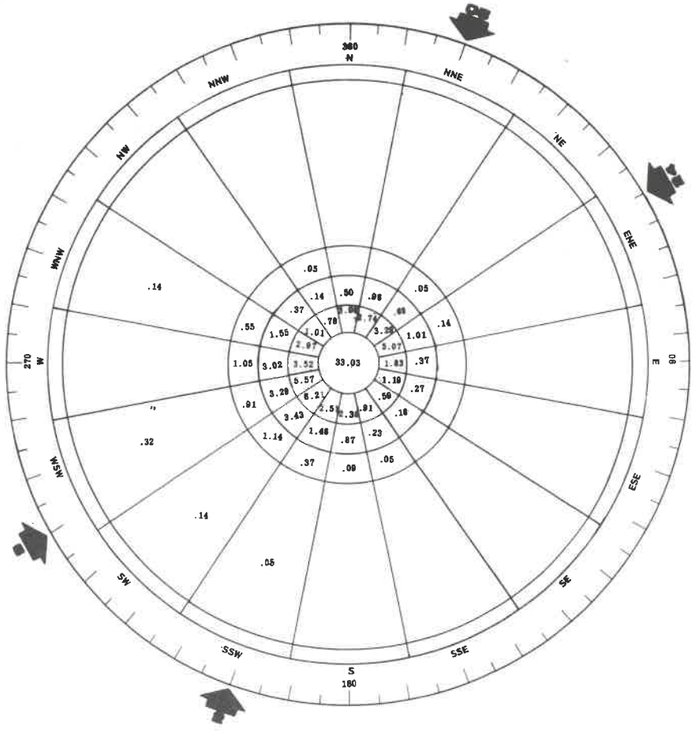
LOCATION MAP



FORECAST OF AIRCRAFT OPERATIONS

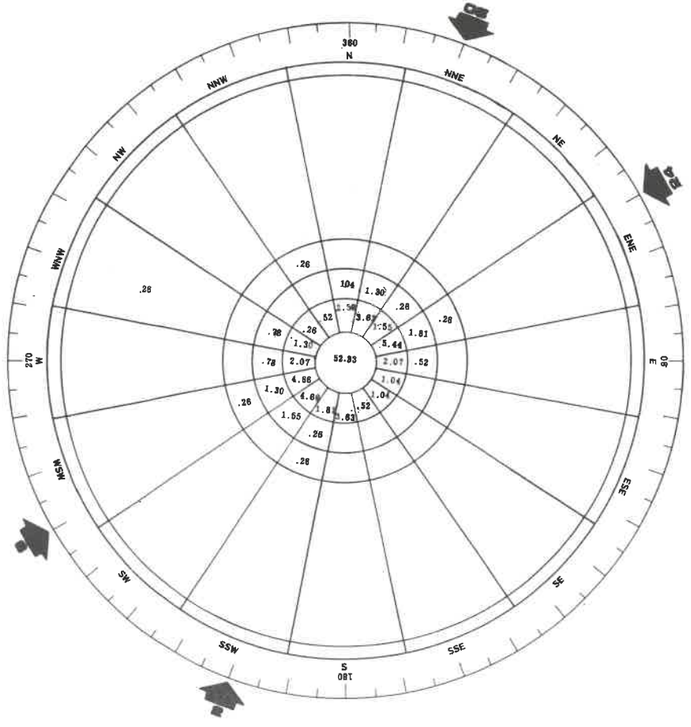


VICINITY MAP



ALL WEATHER WIND ROSE

SOURCE: National Climatic Center, U.S. Department of Commerce, Asheville, North Carolina
From Lunken Airport
PERIOD: January thru December, 1974



IFR WIND ROSE

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LUNKEN AIRPORT
CINCINNATI, OHIO

DATA SHEET

SHEET 2 OF 8

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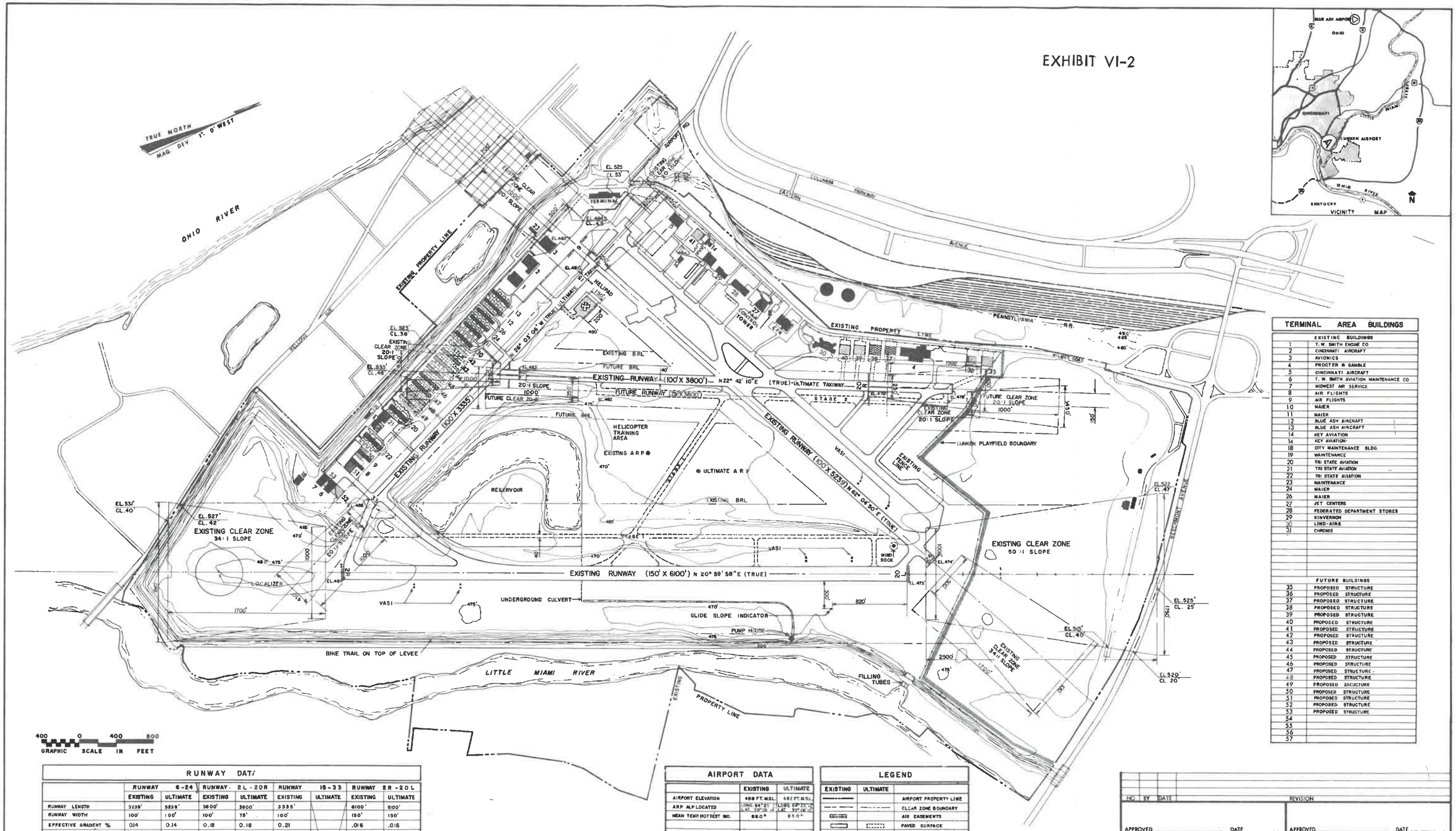
EXHIBIT VI-2



TERMINAL AREA BUILDINGS	
	EXISTING BUILDINGS
1	T. W. SMITH ENGINE CO
2	CINCINNATI AIRCRAFT
3	AVIONICS
4	PROCTER & GAMBLE
5	CINCINNATI AIRCRAFT
6	T. W. SMITH AVIATION MAINTENANCE CO
7	MIDWEST AIR SERVICE
8	AIR FLIGHTS
9	AIR FLIGHTS
10	MAIER
11	MAIER
12	BLUE ASH AIRCRAFT
13	BLUE ASH AIRCRAFT
14	KEY AVIATION
14	KEY AVIATION
18	CITY MAINTENANCE BLDG.
19	MAINTENANCE
20	TRI STATE AVIATION
21	TRI STATE AVIATION
22	TRI STATE AVIATION
23	MAINTENANCE
24	MAIER
26	MAIER
27	JET CENTERS
28	FEDERATED DEPARTMENT STORES
29	KINVERNON
30	LIND-AIRE
31	CHROMS
	FUTURE BUILDINGS
35	PROPOSED STRUCTURE
36	PROPOSED STRUCTURE
37	PROPOSED STRUCTURE
38	PROPOSED STRUCTURE
39	PROPOSED STRUCTURE
40	PROPOSED STRUCTURE
41	PROPOSED STRUCTURE
42	PROPOSED STRUCTURE
43	PROPOSED STRUCTURE
44	PROPOSED STRUCTURE
45	PROPOSED STRUCTURE
46	PROPOSED STRUCTURE
47	PROPOSED STRUCTURE
48	PROPOSED STRUCTURE
49	PROPOSED STRUCTURE
50	PROPOSED STRUCTURE
51	PROPOSED STRUCTURE
52	PROPOSED STRUCTURE
53	PROPOSED STRUCTURE
54	
55	
56	
57	

RUNWAY DATA

	RUNWAY 6-24		RUNWAY 2L-20R		RUNWAY 15-33		RUNWAY 2R-20L	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE	EXISTING	ULTIMATE
RUNWAY LENGTH	5239'	5239'	3600'	3800'	3335'		6100'	6100'
RUNWAY WIDTH	100'	100'	100'	75'	100'		150'	150'
EFFECTIVE GRADIENT %	0.14	0.14	0.18	0.18	0.21		.016	.016
INTRUMENT RUNWAY	N.P.I.	N.P.I.	VISUAL	VISUAL	VISUAL		P.I.	P.I.
PAVEMENT STRENGTH	75,000DG	60,000DG+	36,000SW.	12,500SW.	36,000SW.		75,000DG	60,000DG
APPROACH SURFACE	6-20 20:1 24-34:1	6-20 20:1 24-34:1	20:1	20:1	20:1		28-34:1 20:1-50:1	28-34:1 20:1-50:1
RUNWAY LIGHTING	MIRL	MIRL	MIRL	MIRL			HIRL	HIRL
RUNWAY MARKING	N.P.I.	N.P.I.	BASIC	BASIC	BASIC		P.I.	P.I.
NAVIGATIONAL AIDS	—	24-VASI	—	—	—		ILS,VASI	ILS, VASI
% WIND COVERAGE (13 MPH)	96.59	96.59	91.67	91.67	85.48		91.67	91.67
TAXIWAY LIGHTING	MITL	MITL	—	MITL	MITL			MITL
RUNWAY CATEGORIES	N.P.I.	N.P.I.	VISUAL	VISUAL	VISUAL		P.I.	P.I.
OPERTATIONAL ROLE (NASP)	B.T.	B.T.	G.U.	G.U.	G.U.		B.T.	B.T.

AIRPORT DATA

	EXISTING	ULTIMATE
AIRPORT ELEVATION	488 FT. M.S.L.	482 FT. M.S.L.
ARP ALP LOCATED	LONG. 84°25' LAT. 39°06.4'	LONG. 84°25'12" LAT. 39°06.0'
MEAN TEMP. HOTTEST MO.	88.0°	88.0°

LEGEND

EXISTING	ULTIMATE	
		AIRPORT PROPERTY LINE
		CLEAR ZONE BOUNDARY
		AIR EASEMENTS
		PAVED SURFACE
		PAVED ROADS
		BUILDING RESTRICTION LINE
		FENCE LINE
		STRUCTURES STAGE 1
		STRUCTURES STAGE 2
		STRUCTURES STAGE 3

The preparation of this document was financed in part through a planning grant from the Federal Aviation Administration as provided under Section 13 of the Airport and Airway Development Act of 1970. The contents of this report reflect the views of Landrum & Brown who is responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this report by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with Public Laws 91-190, 91-258, and/or 90-495.

NO	BY	DATE	REVISION

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LUNKEN AIRPORT
CINCINNATI, OHIO

AIRPORT LAYOUT PLAN

SHEET 1 OF 8

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. Short Range Development Period (1976-1980)

- Overlay Runway 6-24 and install drainage system
- Construct a parallel taxiway to runway 2R-20L including medium intensity taxiway lights
- Construct a taxiway connecting parallel taxiway 2R-20L and the crash, fire and rescue facility
- Construct a helipad
- Terminal area development (see "Terminal Area Plan" this chapter)

. Intermediate Range Development (1981-1985)

- Construct new runway 2L-20R, 3,800 feet by 75 feet
- Relocate MIRL from old 2L-20R to new 2L-20R
- Terminal area development (see "Terminal Area Plan" this chapter)

. Long Range Development (1986-1995)

- Terminal area development (see "Terminal Area Plan" this chapter)

4. TERMINAL AREA PLAN

The Terminal Area Plan was developed from data contained in the Demand/Capacity section of Chapter III. The objective for developing the

plan was to satisfy the area requirements for each terminal area component by achieving an acceptable balance between user convenience, operational efficiency, facility investment and the aesthetic quality of the airport.

Analysis of all existing terminal area facilities indicated that most facilities are in good condition. Two conventional and two T-Hangar buildings are in rather poor condition. It is recommended that these buildings be demolished and new buildings constructed as replacements. Hangar 3, leased to Avionics, and one maintenance building are located within the primary surface and clear zone for runway 6-24. Both of these structures violate FAA's location criteria and are potential obstructions to air navigation. It is recommended that both buildings be either removed or relocated.

Inasmuch as the analysis of terminal area did not indicate a need to develop alternative terminal area plans, the most favorable method of expanding the existing terminal area to satisfy the forecast of aviation demand was identified. The recommended expansion of the terminal area as shown in the "Terminal Area Plan" Exhibit VI-3, generally satisfied the gross area requirements determined in Chapter III.

It is noted that while the development of the Airport Layout Plan (ALP) is based upon critical aircraft requirements and safety considerations, the

EXHIBIT VI-3

TERMINAL AREA BUILDINGS	
	EXISTING BUILDINGS
1	T. W. SMITH ENGINE CO.
2	CINCINNATI AIRCRAFT
3	AVIONICS
4	PROCTER & GAMBLE
5	CINCINNATI AIRCRAFT
6	T. W. SMITH AVIATION
7	MIDWEST AIR SERVICE
8	AIR FLIGHTS
9	AIR FLIGHTS
10	MAIER
11	MAIER
12	BLUE ASH AIRCRAFT
13	BLUE ASH AIRCRAFT
14	KEY AVIATION
14	KEY AVIATION
18	CITY MAINTENANCE BLDG.
19	MAINTENANCE
20	TRI STATE AVIATION
21	TRI STATE AVIATION
22	TRI STATE AVIATION
23	MAINTENANCE
24	MAIER
26	MAIER
27	JET CENTERS
28	FEDERATED DEPARTMENT STORES
29	KINVERNON
30	LIND-AIRE
31	CHROMIS
	FUTURE BUILDINGS
35	PROPOSED STRUCTURE
36	PROPOSED STRUCTURE
37	PROPOSED STRUCTURE
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43	PROPOSED STRUCTURE
44	PROPOSED STRUCTURE
45	PROPOSED STRUCTURE
46	PROPOSED STRUCTURE
47	PROPOSED STRUCTURE
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49	PROPOSED STRUCTURE
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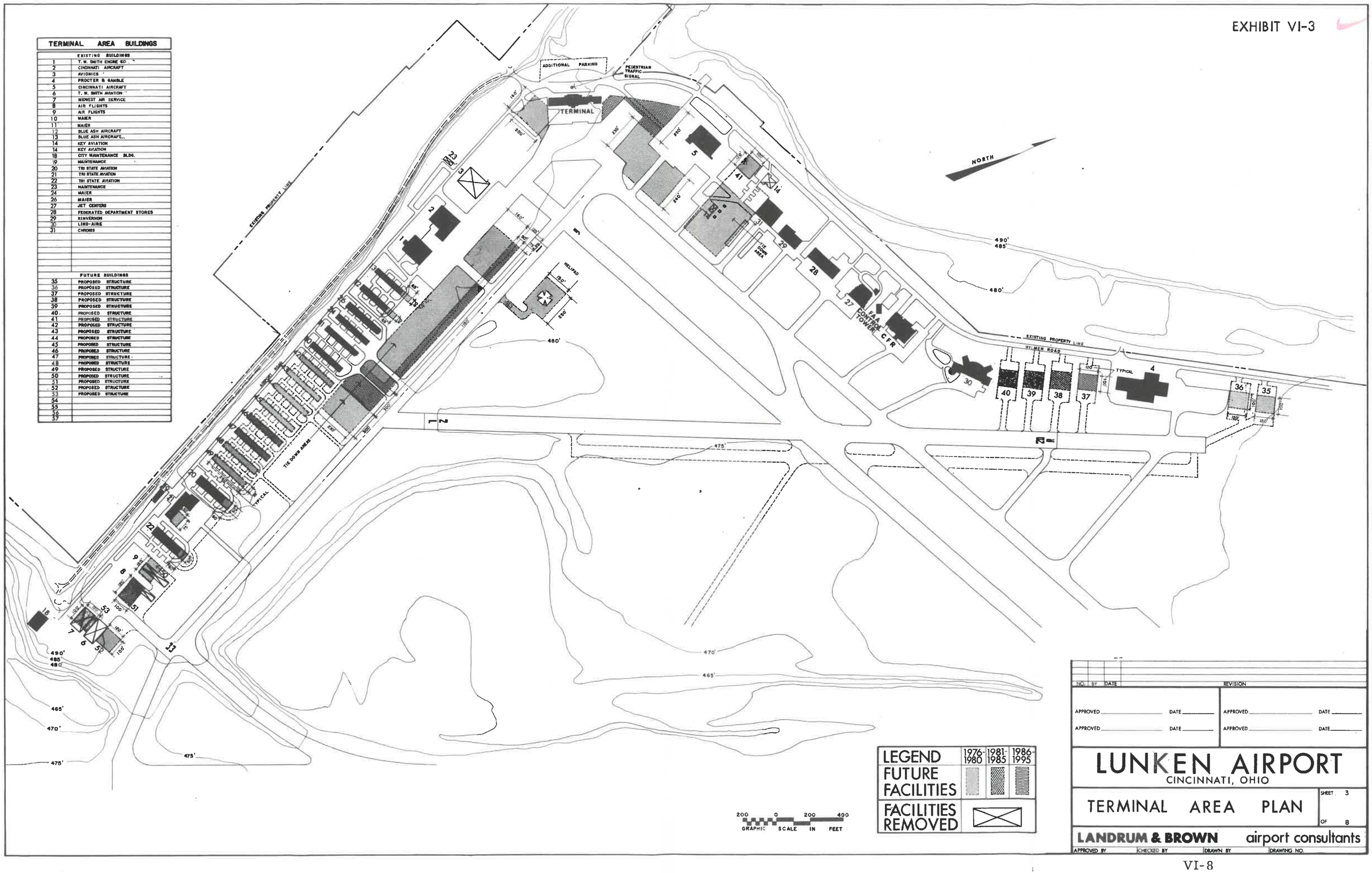

LEGEND	1976-1980	1981-1985	1986-1995
FUTURE FACILITIES			
FACILITIES REMOVED			

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LUNKEN AIRPORT
CINCINNATI, OHIO

TERMINAL AREA PLAN

SHEET 3 OF 8

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development of the terminal area is predicated upon forecast space requirements and the City of Cincinnati's desire to enhance the airport's image by providing sufficient terminal facilities to satisfy increased airport activity.

The phased expansion of the terminal area can be accomplished with a minimum of disruption to routine airport operations. The Terminal Area Plan illustrates the phasing and location of all proposed terminal area development.

The major items of the Terminal Area Plan as determined by the Master Plan Study are described below by phased development periods:

. Short Range Development (1976-1980)

- Three conventional hangars and two T-hangars are to be demolished
- Construct three conventional type hangars
- Construct three, eight unit T-hangar buildings
- Pave additional transient ramp
- Overlay Airport Road
- Enlarge tiedown area

. Intermediate Range Development (1981-1985)

- Construct one conventional hangar
- Construct two, eight unit T-hangar buildings
- Pave additional transient ramp
- Enlarge tiedown area
- Install pedestrian traffic signal

. Long Range Development (1986-1995)

- Construct two conventional hangars
- Construct four, eight unit T-hangar buildings
- Pave additional transient ramp
- Enlarge tiedown area

5. AIRPORT OBSTRUCTION PLANS

The objective of this section is to identify and locate any natural growth, terrain or permanent or temporary object in the vicinity of Lunken Airport which may constitute a potential hazard to the safe and efficient use of navigable airspace and to recommend a plan to help alleviate the problem. The standards used herein are defined in the Federal Aviation Regulations, Volume XI, Part 77 "Objects Affecting Navigable Airspace," currently in effect. The plan, Exhibit VI-4, has been prepared depicting the airport's ultimate development plan.

OBSTRUCTIONS			
NO.	DESCRIPTION	ELEV.	DESCRIPTION
1	ROD ON STACK	670'	
2	FLAGPOLE	900'	
3	ANT. ON BLDG.	717'	
4	TREE	568'	TO BE REMOVED
5	"	574'	" " "
6	"	555'	" " "
7	ANT. ON HANGAR	518'	HANGAR TO BE REMOVED
8	HEDGE ROW	488'	TO BE REMOVED
9	POLE	504'	OBST. LTD.
10	TREE	551'	TO BE REMOVED
11	"	564'	" " "
12	"	931'	" " "
13	ANT. ON TANK	1036'	OBST. LTD.
14	TREE	895'	TO BE REMOVED
15	"	576'	" " "
16	"	521'	" " "
17	TERRAIN	840'	
18	"	840'	
19	"	750'	
20	TREE	505'	TO BE REMOVED
21	"	550'	" " "
22	ANT. ON AIRPORT BEACON ON TANK	991'	
23	TERRAIN	750'	
24	WINDSOCK	498'	
25	BUILDING	815'	TO BE LIGHTED
26	TREES & HOUSES	790'	TO BE LIGHTED
27	" " "	810'	" " "
28	WATER TANK	1026'	" " "
29	TREES & HOUSES	800'	" " "
30	TREES & HOUSES	630'	" " "

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LUNKEN AIRPORT
CINCINNATI, OHIO

OBSTRUCTION PLAN

SHEET 4 OF 8

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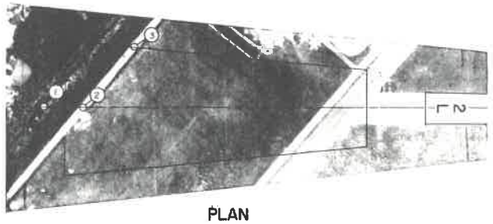
Three general recommendations are presented below which result from the evaluation of the ultimate airport layout plan and construction of its corresponding FAR Part 77 "Imaginary Surfaces."

- All clear zones depicted on the ALP should be cleared of all trees, structures or other incompatible objects that penetrate the FAR Part 77 surface.

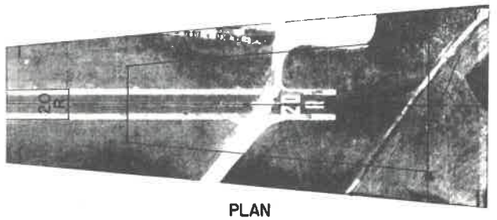
- All trees or structures identified on the Approach and Clear Zone Plan as obstructions should be removed or topped. In addition, adequate measures should be taken by the Airport Authority to prevent any future man-made structures and/or natural objects from penetrating the imaginary surfaces depicted on Exhibit VI-4.

- Obstruction lights should be placed on nearby terrain which penetrates the imaginary surfaces or on land which lies less than ten feet under the height limitations of the imaginary surface. In these instances, easement rights or fee purchase of land necessary for the installation and operation of obstruction lights should be considered by the Airport Authority. Exhibit VI-4 depicts the lighting recommendations.

Exhibits VI-5, 6 and 7 show the plan view of the approach surface and extended runway centerline profile of each existing and proposed runway. The plan view shows the topography and location of any obstruction that exists. The profile shows existing terrain, approach surface slope and a clear glide angle where obstructions exist.



PLAN



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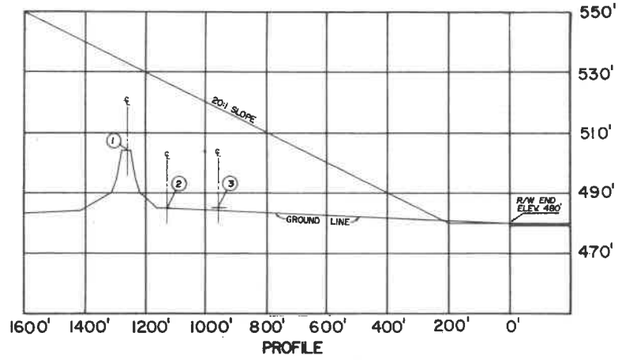
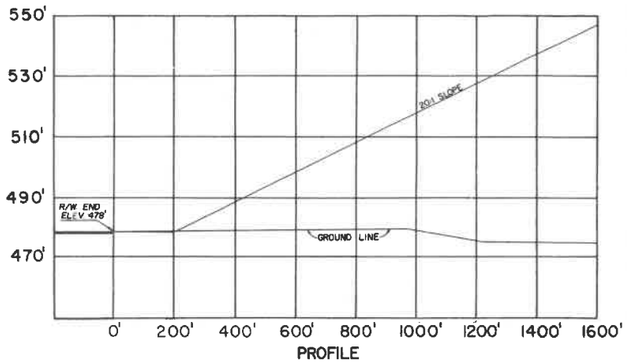


PROFILE

NO.	DESCRIPTION	TOP ELEV.	FEET ABOVE RW SLOPE	REMARKS
1	LEVEE	504'	—	
2	℄ AIRPORT ROAD	485'	—	
3	℄ AIRPORT ROAD	485'	—	



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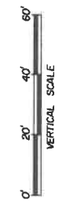

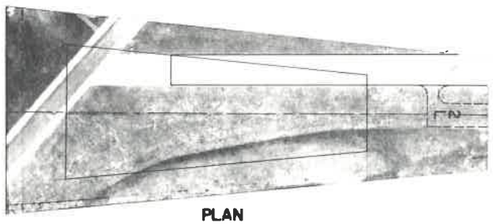

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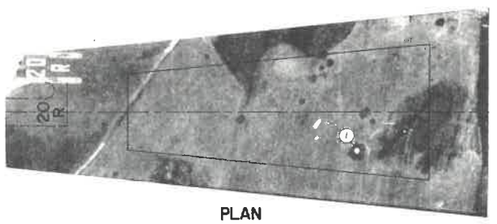

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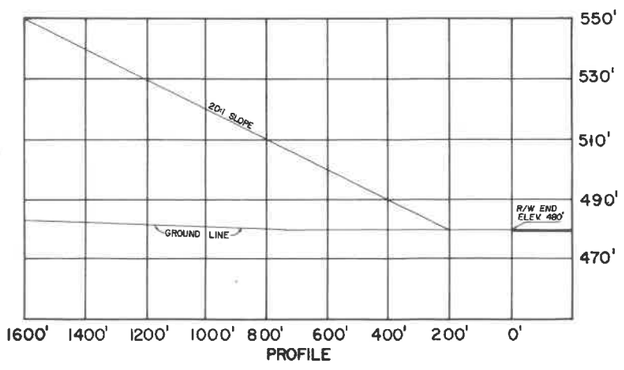
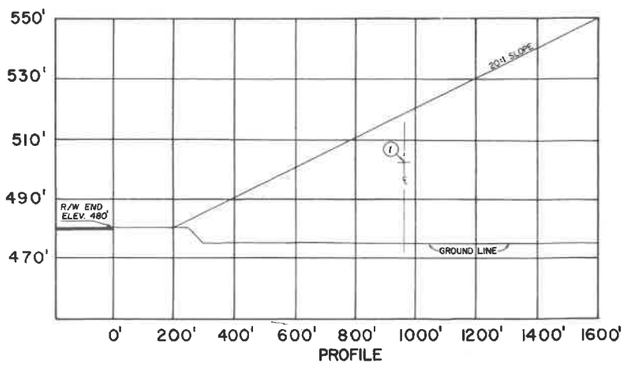


PROFILE

NO.	DESCRIPTION	TOP ELEV	FEET ABOVE RW SLOPE	REMARKS
1	TREE	502'	—	



PROFILE

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LUNKEN AIRPORT

CINCINNATI, OHIO

CLEAR ZONE PLANS & PROFILES
RUNWAYS 2L-20R & FUT. 2L-20R

SHEET 5 OF 8

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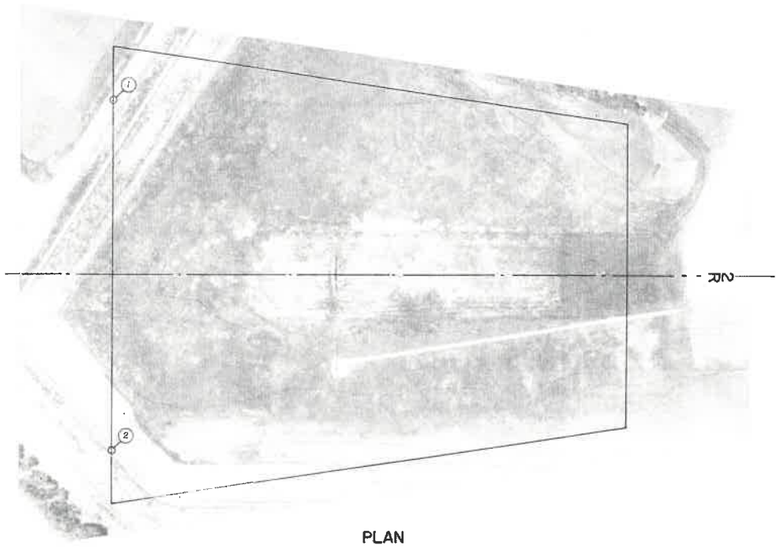

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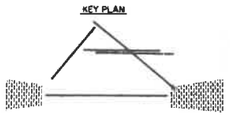

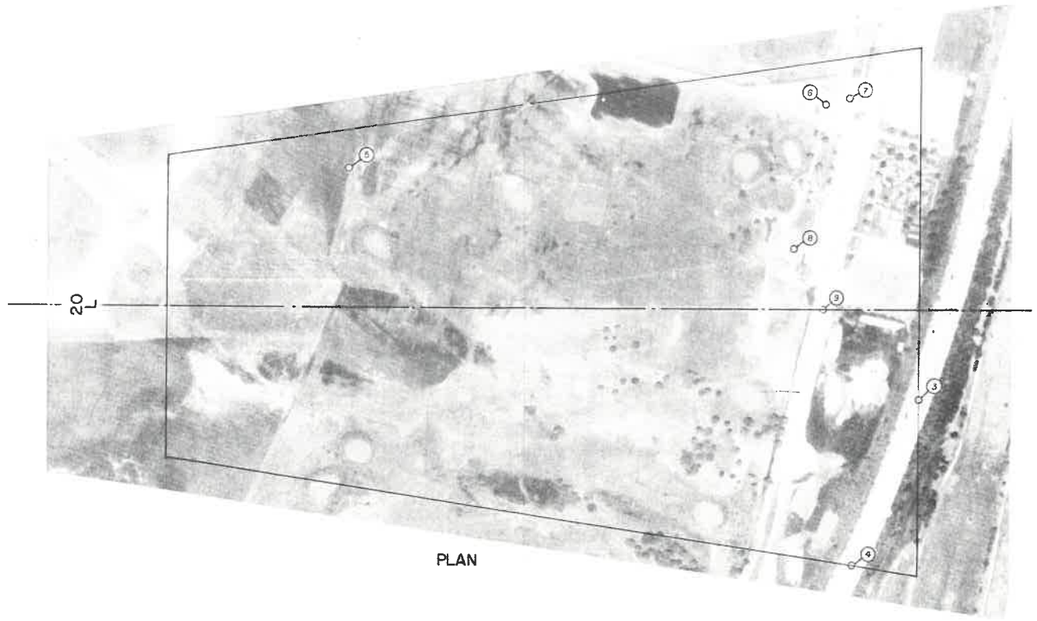

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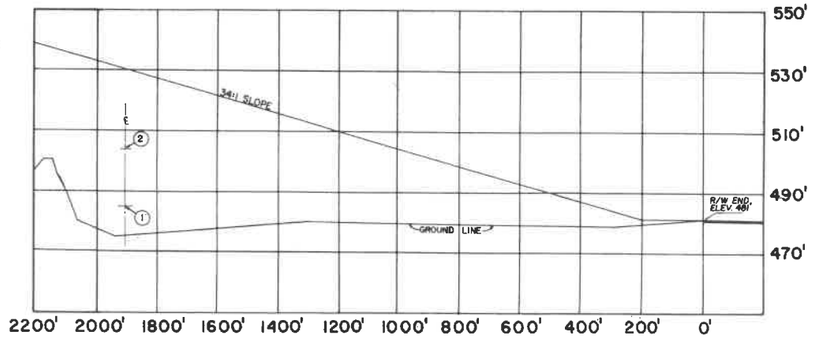
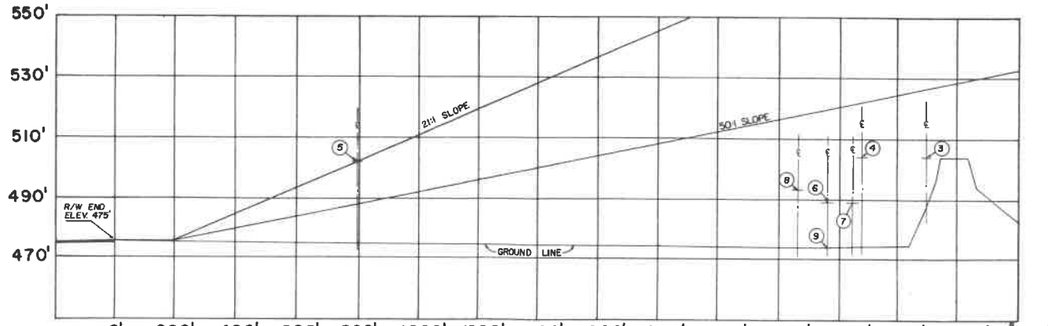
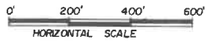


PROFILE

NO.	DESCRIPTION	TOP EL.EV.	FEET ABOVE APP. SLOPE	REMARKS
1	℄ U.S. 52	485'	—	
2	LEVEE	504	—	
3	℄ S.R. 32 & 125	504	—	
4	℄ S.R. 32 & 125	504	—	
5	TREE	502	14	TO BE REMOVED
6	BUILDING	489	—	
7	BUILDING	493	—	
8	℄ ROAD	474	—	



PROFILE



NO	BY	DATE	REVISION

APPROVED _____ DATE _____
APPROVED _____ DATE _____

_____ DATE _____
_____ DATE _____

LUNKEN AIRPORT
CINCINNATI, OHIO

CLEAR ZONE PLANS & PROFILES RUNWAY 2R - 20L

SHEET 6 OF 8

LANDRUM & BROWN airport consultants

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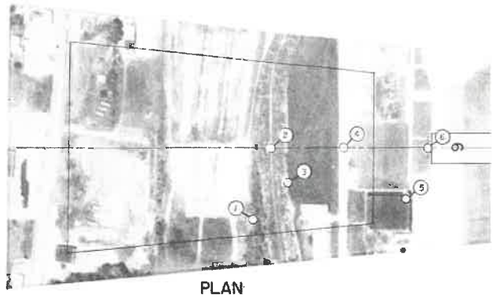
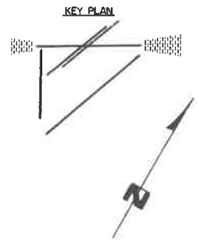
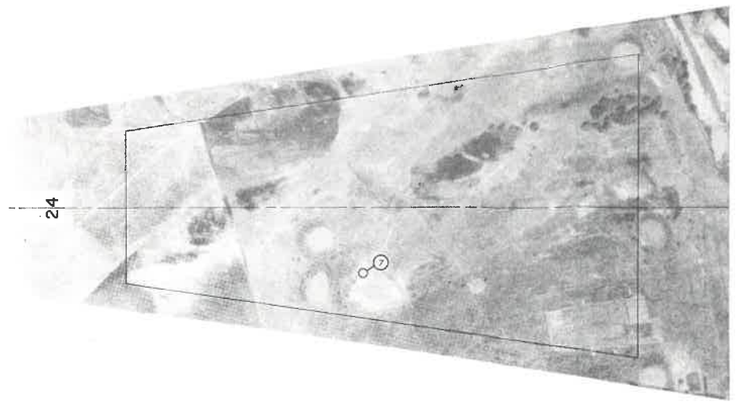
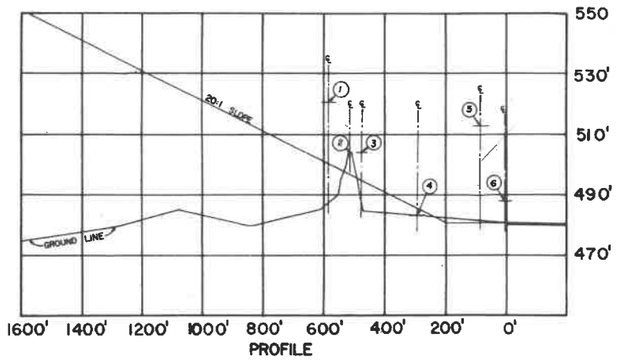
EXHIBIT VI-7



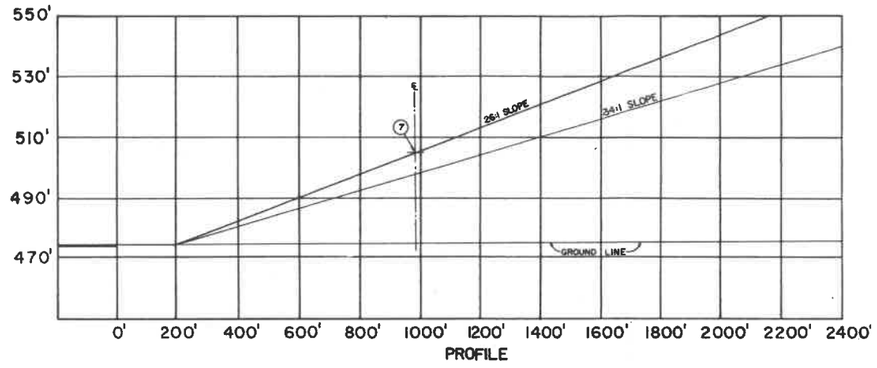
PLAN

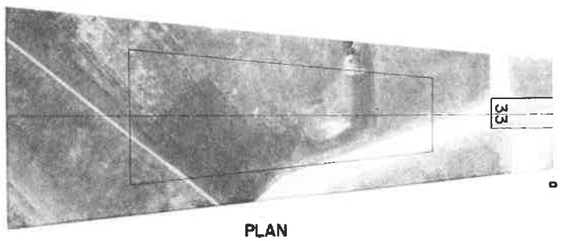


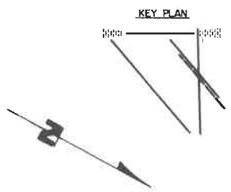


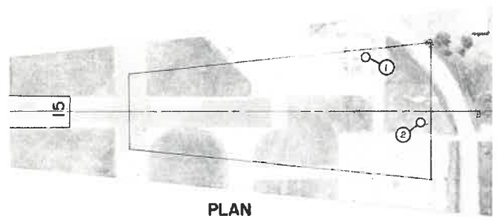


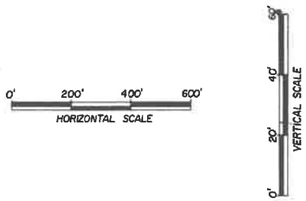
NO.	DESCRIPTION	TOP ELEV.	FEET ABOVE 20:1 SLOPE	REMARKS
1	TREE	521'	20'	TO BE REMOVED
2	℄ LEVEE	504'	7'	
3	POLE	504'	9'	
4	℄ AIRPORT ROAD	483'	—	
5	ANTENNA ON HANGAR	513'	32'	HANGAR TO BE REMOVED
6	HEDGE ROW	488'	6'	TO BE REMOVED
7	TREE	505'	7'	TO BE REMOVED

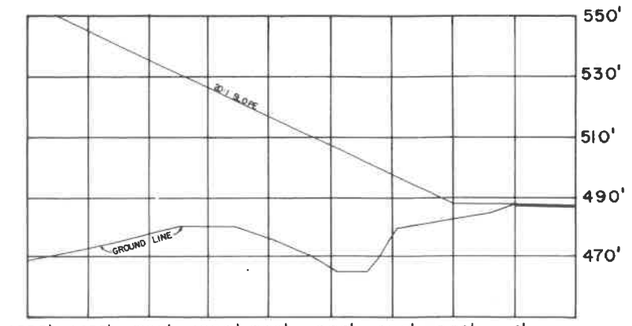




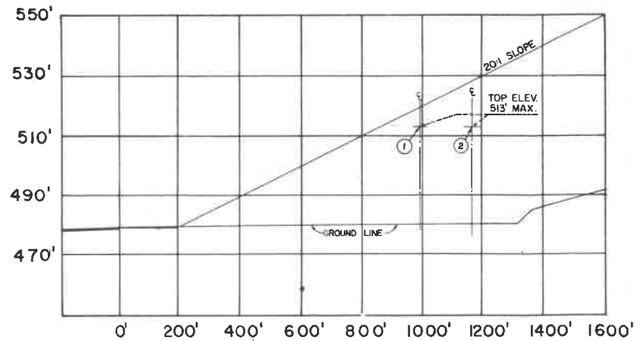








NO.	DESCRIPTION	TOP ELEV.	FEET ABOVE 20:1 SLOPE	REMARKS
1	PARKED AIRCRAFT	513'	—	MAX. TOP ELEV.
2	PARKED AIRCRAFT	513'	—	" " "



NO.	BY	DATE	REVISION

APPROVED _____ DATE _____
APPROVED _____ DATE _____

DATE _____
DATE _____

LUNKEN AIRPORT
CINCINNATI, OHIO

CLEAR ZONE PLANS & PROFILES RUNWAY 15-33 & 6-24

SHEET 7 OF 8

LANDRUM & BROWN airport consultants

APPROVED BY | CHECKED BY | DRAWN BY | DRAWING NO.

6. Estimated Capital Improvement Costs

Exhibits VI- 8, 9 and 10 depict estimated airport improvement cost for each of the three development periods previously discussed. All costs were estimated on the basis of 1975 dollars, and as far as possible, are judged to represent a reasonable indication of the capital expenditure required for the development of the Lunken Airport, as identified on the airport layout plan and the terminal area plan.

The total cost of each category of construction other than land and acquisition was increased by 25 percent to represent associated engineering and contingency cost.

In summary, the "Short Range" (1975-1980) capital improvement costs were estimated at $4,901,600, the "Intermediate Range" (1981-1985) at $1,374,100 and the "Long Range" (1986-1996) at $1,101,100, for a total twenty year improvement cost of $7,626,800.

EXHIBIT VI-8

Lunken Airport Master Plan

ESTIMATED AIRPORT DEVELOPMENT COSTS
(Stage 1 - 1975-1980)

Item	Unit	Unit Cost	Quantity ($000)	Cost ($000)
Airfield Paving [1/]				
1. Reconstruct Runway 6-24 (Includes drainage system)	SY	$25.09	58.2	$1,460.0
2. Construct Parallel Taxiway 2R-20L	SY	30.00	33.3	999.0
3. Construct Connecting Taxiway	SY	30.00	8.4	252.0
Airfield Lighting & Marking				
1. MITL for Parallel Taxiway 2R-20L	LS	LS	LS	46.3
Terminal Area				
1. Conventional Hangars				
. Three Buildings	SF	9.00	37.5	337.5
. Hangar Pavement	SY	20.00	4.2	84.0
. Hangar Ramp	SY	20.00	4.2	84.0
. Hangar Taxiway	SY	20.00	2.1	42.0
2. T-Hangars				
. 24 Stalls	SF	4.40	25.0	110.0
. Hangar Pavement	SY	15.00	2.8	42.0
. Lead-in Taxiway	SY	15.00	0.9	13.5
. Access Taxiways	SY	15.00	0.5	7.5
3. Tiedown Area	SY	5.00	8.1	40.5
4. Transient Ramp	SY	20.00	2.85	57.0
5. Overlay Airport Road including drainage	LS	LS	LS	200.0
6. Heliport	SY	15.00	4.4	66.0
7. Install Auxiliary Pumping Station	LS	LS	LS	80.0
8. Installation of Obstruction Lights	LS	LS	LS	200.0
Subtotal				4,121.3
25% E&C				1,030.3
TOTAL COST				$5,151.6

1/ Includes site prep and drainage.

EXHIBIT VI-9

Lunken Airport Master Plan

ESTIMATED AIRPORT DEVELOPMENT COSTS
(Stage II - 1981-1985)

Item	Unit	Unit Cost	Quantity ($000)	Cost ($000)
Airfield Paving				
1. Construct New Runway 2L-20R	SY	$20.00	31.7	$ 634.0
Airfield Lighting & Marking				
1. Relocate MIRL Runway 2L-20R	LS	LS	LS	40.0
2. Visual Runway marking	LF	0.95	3.8	3.6
Terminal Area				
1. Conventional Hangars				
. One Building	SF	9.00	12.5	112.5
. Hangar Pavement	SY	20.00	1.4	28.0
. Hangar Ramp	SY	20.00	4.2	28.0
. Hangar Taxiway	SY	20.00	0.7	14.0
2. T-Hangar				
. 16 Stalls	SF	4.40	16.64	73.2
. Hangar Pavement	SY	15.00	1.8	27.0
. Lead-in Taxiways	SY	15.00	0.6	9.0
. Access Taxiway	SY	15.00	0.5	7.5
3. Tiedown Area	SY	5.00	8.1	40.5
4. Transient Ramp	SY	20.00	3.60	72.0
Miscellaneous				
1. Pedestrian Traffic Signal	LS	LS	LS	10.0
Subtotal				1,099.3
25% E&C				274.8
TOTAL COST				$1,374.1

EXHIBIT VI-10

Lunken Airport Master Plan

ESTIMATED AIRPORT DEVELOPMENT COSTT
(Stage III - 1986-1995)

Item	Unit	Unit Cost	Quantity ($000)	Cost ($000)
Terminal Area				
1. Conventional Hangars				
. Two Buildings	SF	$ 9.00	25.0	$ 225.0
. Hangar Pavement	SY	20.00	2.8	56.0
. Hangar Ramp	SY	20.00	8.4	56.0
. Hangar Taxiway	SY	20.00	1.4	28.0
2. T-Hangars				
. 32 Stalls	SF	4.40	33.3	146.5
. Hangar Pavement	SY	15.00	3.7	54.0
. Lead-in Taxiways	SY	15.00	1.2	18.0
3. Tiedown Areas	SY	5.00	16.2	81.0
4. Transient Ramp	SY	20.00	9.86	197.0
5. Access Taxiways	SY	15.00	1.3	19.5
Subtotal				880.9
25% E&C				220.2
TOTAL COST				$1,101.1
GRANT TOTAL STAGES I, II & III				$7,626.8

CHAPTER VII

LAND USE PLAN

CHAPTER VII

LAND USE PLAN

The objective of the land use plan was to determine the impact of proposed developments at Lunken Airport within the comprehensive framework of surrounding communities and to generally define the major uses of land on and adjacent to airport property.

Planning for the future use of land within the airport boundary will assure availability of sufficient acreage to meet the aviation oriented functions of the airport. In addition, planning for the land deemed in excess of that required to meet the aviation function of the airport can provide a basis upon which appropriate airport officials can maxmize airport financial returns by effective management of non-aviation related land.

Beyond the airport boundary, careful consideration must be given to adjacent land uses in order to insure that the local planning agencies are fully aware of the long-range impact of the airport and are able to take the necessary steps to harmoniously integrate the airport into the urban environment.

Of primary concern to this land use study for Lunken Airport and its environs was the development of a plan adequate to accommodate the projected aviation activities in the most efficient manner possible. The planning for the remainder of the airport property and the recommended use of adjacent airport land areas was based upon the forecast of local needs in terms of addi-

tional land required to meet the demands for residential, commercial, and industrial growth in the area. The distribution of future land requirements was made according to various criteria including noise compatibility, community objectives, existing planning efforts, and land use characteristics.

The procedures employed in the study included:

- Identification of existing land uses on and in the vicinity of the airport.
- Identification of land use impacts associated with aircraft generated noise.
- Analysis of future land use plans in the area of the airport.
- Interpretation of existing zoning in the area of the airport.
- A statement of methods of controlling land use with special reference to airports.
- Allocation of land requirements in accordance with airport requirements, land suitability, and compatibility with existing land uses.

1. EXISTING LAND USE

Lunken Airport is located approximately five miles east of Cincinnati's Central Business District and borders the southeastern portions of the City's urbanized area. Exhibit VII-1 illustrates existing land uses in the vicinity of Lunken. Concentrations of residential use lie to the north and west of the airport in the City of Cincinnati and to the southeast in the suburbs of Mt.

Exhibit VII-2, "Land Use Compatibility Chart for Aircraft Noise," explains the compatibility relationship of CNR values and zones to various land uses around an airport. As noted in the exhibit, few land uses are compatible with the level of aircraft noise generated in CNR zone 3. Only outdoor recreational activities and acoustically treated commercial or industrial areas should exist in this innermost zone. Within CNR zone 2 commercial and industrial activities are considered compatible land uses and office or public buildings and hotel or motel facilities can withstand aircraft noise impacts of noise control features are included in their building design. Residential uses should generally be avoided within zone 2, especially single family dwellings without sound-proofing provisions. Beyond zone 2 only those structures very sensitive to aircraft noise such as schools, hospitals or theaters, need be protected by noise control features.

The impact of existing noise levels on surrounding land uses is depicted in Exhibit VII-3. As prevsiouly noted in Chapter V, approximately 37 schools, 9 health care facilities, and 71 residential dwellings are presently impacted by aircraft noise. Locations of those schools and health care facilities impacted by aircraft noise are indicated in Exhibit VII-3. Both these types of community facilities, however, fall within the zone of least noise impact.

The distribution of existing land uses within the more critical noise areas, CNR zones 2 and 3, is given in Exhibit VII-4. Airport property or vacant land occupies the greater portion of land within the most severely noise impacted area, CNR zone 3. A residential area to the west of the airport along Columbia Parkway is also within this critical noise zone.

EXHIBIT VII-2

Lunken Airport

LAND USE COMPATIBILITY
CHART FOR AIRCRAFT NOISE

CNR Forecast Zones	Land Use Compatibility								
	Residential	Commercial	Hotel/ Motel	Office Buildings Buildings	Schools, Hospitals, Churches	Theaters Auditoriums	Outdoor Amphitheaters, Theaters	Outdoor Recreational (Nonspectator)	Industrial
1	Yes	Yes	Yes	Yes	Note (C)	Note (A)	Note (A)	Yes	Yes
2	Note (B)	Yes	Note (C)	Note (C)	No	No	No	Yes	Yes
3	No	Note (C)	No	No	No	No	No	Yes	Note (C)

Note (A) A detailed noise analysis should be undertaken by qualified personnel for all indoor or outdoor music auditoriums and all outdoor theaters.

(B) Case history experience indicates that individuals in private residence may complain, perhaps vigorously. Concerted group action is possible. New single-dwelling construction should generally be avoided. For apartment construction, Note (C) applies.

(C) An analysis of building noise reduction requirements should be made, and needed noise control features should be included in the building design.

Source: Advisory Circular 150/5070-6. Land Use Planning Relating to Aircraft Noise - Bolt, Beranek, & Newman, Inc. (1965).


CINCINNATI
LUNKEN AIRPORT
OHIO RIVER
READING ROAD
VICTORY PARKWAY
MADISON ROAD
AVENUE
LEGEND
SINGLE FAMILY
MULTI-FAMILY
INDUSTRIAL
COMMERCIAL
INSTITUTIONAL
RECREATIONAL
VACANT-AGRICULTURAL
TRANSPORTATION
SCHOOLS
HISTORIC SITE
HEALTH FACILITY
PARKS

Index to Historic Sites

Map Code Number	Description
1	Adena Village Site, occupied between 1,000 BC and 500 BC.
2	Ebersole Village Site, occupied between 900 AD and 1650 AD
3	Burial mound overlooking river, date unknown
4	Celeron de Blainville's campsite, 1749 AD
5	Stites and Gano's Blockhouse, Built 1788 AD
6	Columbia, built about 1788
7	Cincinnati, Georgetown, and Portsmount narrow gauge railroad (right-of-way) built 1877
8	Flinn's Ford
9	Wichersham's Floating Mill
10	Presbyterian and Fulton Cemeteries
11	Pioneer Memorial Cemetery

Source: Cincinnati Planning Commission Land Use Plan for the River Area, November, 1972, pg. 16.

Index to Open Space/Recreational Facilities

Map Code Number	Name	Ownership	Total Area (Acres)	Facilities*
1	Little Duck Creek Park	Cincinnati	2.27	undeveloped
2	Bramble Park	Cincinnati	10.25	BD,PE,P
3	Bramble Playground	Cincinnati Bd. of Education	5.21	BD,PE,PF
4	Baker Playfield	Mariemont	2.0	BD,PF
5	Dale Park	Mariemont	2.0	G.A.
6	Mariemont Tennis Courts	Mariemont	1.0	TC
7	Allotment Gardens Play Area	Mariemont	1.0	PE,PF
8	Dogwood Park	Mariemont	19.0	BD,HT,PF
9	Mariemont Green Space	Mariemont	17.0	G.A.
10	Mariemont Pool	Mariemont	1.0	S
11	Fairfax Community Park	Fairfax	3.0	BD,PE,PF,P,S
12	Ault Park	Cincinnati	223	CA,GA,HT,N PE,P,SO
13	Linwood Field	Cincinnati	7.33	BD,PE,PF,P
14	Linwood Play Area	Cincinnati	.41	PE
15	Airport Playlot	Cincinnati	.07	PE
16	Airport Playfield	Cincinnati	187	AG,BD,BT,G, PE,PE
17	Little Miami Riverfront	Cincinnati	12.7	undeveloped

Index to Open Space/Recreational Facilities
(Continued)

Map Code Number	Name	Ownership	Total Area (Acres)	Facilities*
18	Turpin Hills Swim Club	Private	4.0	S
19	Stanbury Park	Cincinnati	79.0	BD,CA,HT, NE,PE,PF,P
20	Alms Memorial Park	Cincinnati	94	BD,HT,PE,P
21	Memorial Pioneer Cemetery	Cincinnati	2	HB
22	Queen City Control Line Field	Cincinnati	2	---
23	Queen City Harbor	Private	1.0	BL
24	California Golf Course and Nature Preserve	Cincinnati	332	G,N,P
25	California Ball Ground	Cincinnati	2.8	BD,PF
26	California Yacht Club	Private	7.0	BL,B,F
27	Miami Beach	Private	NA	BL
28	Four Seasons Marina	Private	32	B,BF,S
29	Adams Marina	Private	6.0	BL
30	Yacht Haven	Private	4.0	BL
31	Jewell's Yacht Club	Private	NA	BL
32	North Park	Ft. Thomas	14.5	BD,PE,PF,P
33	Ft. Thomas Parkways	Ft. Thomas	4.7	SO
34	Aqua Ramp	Private	3.8	BL,P
35	Highland Hills Park	Ft. Thomas	77.5	HT,PE,P
36	Ft. Thomas Swim Club	Private	4.0	S

Index to Open Space/Recreational Facilities
(Continued)

Map Code Number	Name	Ownership	Total Area (Acres)	Facilities*
37	Storr's Park	Private	10.0	BD,PE,PF
38	Vernon Lake Swim Club	Private	.2	S
39	Ft. Thomas Military Reservation	U.S.Government	NA	---
40	South Park	Ft. Thomas	46.6	PE,P
41	Unnamed Park	Ft. Thomas	2.5	BD,PF
42	Highland Country Club	Private	64.1	G.S.
43	Winkler Playfield	Ft. Thomas	6.1	BD,PF
44	Campbell County Y.M.C.A.	Private	1.6	---

* AG - Archery/Gun Club
BD - Ball Diamond
BL - Boat Launch
B - Boating
BT - Bicycle Trail
CA - Cultural Activities
F - Fishing
G - Golf
B/A - Garden/Arboretum
HB - Historic Building
HT - Hiking Trail
N - Nature Education
P - Picnic Area
PE - Play Equipment
PF - Play Field
RT - Riding Trail
S - Swiming Pool
SO - Scenic Overlook
TC - Tennis Courts

Source: Ohio-Kentucky-Indiana Regional Planning Commission, Open Space Plan, May, 1973.

Washington, Mt. Washington Heights and Stanbury Park. Existing land in the immediate vicinity of Lunken Airport is, however, largely utilized for open space, recreational, and agricultural purposes or is left vacant.

Situated in the Little Miami River Valley, Lunken Airport lies at the beginning of a large open space corridor which extends northeast along the river for more than 100 miles. Most of the valley is in a flood plain area and is presently undeveloped. The only major land uses in the valley area are those protected by flood levees. In addition to Lunken Airport, these include the Little Miami Sewage Treatment Plant and portions of the California Water Treatment Plant. Penn Central also maintains a large railroad yard facility, Undercliff Yard, adjacent to the western boundary of the airport.

The wide range of recreational activities and the scenic qualities of this area are considered unique to Cincinnati. The Ohio Department of Natural Resources has designated the lower eleven miles of the Little Miami River to be included under the protection of the Ohio Scenic Rivers Act. A number of recreational facilities are located in the vicinity of Lunken Airport and are designated in Exhibit VII-1. Alms Memorial Park, located to the west of the airport, has 94 acres of park area for hiking, field activities, and picnics. Directly southeast of the airport is the California Golf Course and Nature Preserve which offers over 330 acres for golfing, nature studies, and picnicing. There is also a 187 acre park located on airport property. Lunken Playfield is primarily an outdoor family recreational facility and provides a variety of recreational activities for all ages.

As indicated in Exhibit VII-1, this area is also well endowed with significant historical and archeological sites. Pioneer Memorial Cemetery has commemorative monuments to Benjamin Stites, one of the pioneer settlers in this area, and a monument in honor of the original settlers of the village of Columbia. It is reported that the first recipient of a purple heart, Sgt. William Brown, is buried in this cemetery.

2. AIRCRAFT NOISE

A general description of the techniques used in the analysis of airport related aircraft is presented in Chapter V "Environmental Study." Of the methods available to project the extent of land areas affected by airport noise, the Composite Noise Rating (CNR) technique was selected and adopted for use in this study. This method more adequately defines the noise generated by general aviation aircraft of the type projected to operate into and out of Lunken Airport.

The Composite Noise Rating (CNR) represents a method of predicting the level of annoyance and the probability of community complaint associated with a particular level of air traffic into or out of the airport. Experience during the past decade has shown a definite correlation between responses predicted by this method and the actual reaction of people living in a particular noise zone. The CNR values derived for this study are a composite index reflecting the number of take-offs and landings, the type of aircraft, and the occurrence of both daylight and night operations.


CINCINNATI
LUNKEN AIRPORT
RIVER
OHIO
EXISTING CNR 2&3
READING ROAD
VICTORY PARKWAY
MADISON ROAD
BEECHMONT AVENUE
LITTLE MIAMI
LEGEND
SINGLE FAMILY
MULTI-FAMILY
INDUSTRIAL
COMMERCIAL
INSTITUTIONAL
RECREATIONAL
VACANT-AGRICULTURAL
TRANSPORTATION
SCHOOLS
HISTORIC SITE
HEALTH FACILITY
PARKS

Index to Educational Facilities

Map Code Number	Name	Location	Public/ Private
1	Bramble Elementary School	4324 Homer Cincinnati, Ohio	Public
2	Eastern Hills Elementary School	6421 Corbly Cincinnati, Ohio	Public
3	Lincoln Elementary School	455 Delta Cincinnati, Ohio	Public
4	McKinley Elementary School	3905 Eastern Cincinnati, Ohio	Public
5	Kilgour Elementary School	1339 Herschel Cincinnati, Ohio	Public
6	Mt. Washington Elementary School	1730 Mears Cincinnati, Ohio	Public
7	Eastwood Elementary School	5030 Duck Creek Cincinnati, Ohio	Public
8	Madisonville Elementary School	4837 Ward Cincinnati, Ohio	Public
9	Silverton Elementary School	6829 Stewart Cincinnati, Ohio	Public
10	Burton Elementary School	876 Glenwood Cincinnati, Ohio	Public
11	Eastern Hills Junior High School	6421 Corbly Cincinnati, Ohio	Public
12	Peoples Junior High School	3030 Erie Cincinnati, Ohio	Public
13	Lyon Junior High School	5051 Anderson Cincinnati, Ohio	Public
14	Guardian Angels Elementary School	6539 Beechmont Cincinnati, Ohio	Public

Index of Educational Facilities
(Continued)

Map Code Number	Name	Location	Public/ Private
15	St. Ursula Villa Elementary School	3660 Vinyard Place Cincinnati, Ohio	Private
16	Hillsdale-Lotspeich	5400 Red Bank Cincinnati, Ohio	Private
17	St. Anthony Elementary School	6104 Desmond Cincinnati, Ohio	Private
18	St. Margaret of Cortona Elementary School	4100 Simpson Cincinnati, Ohio	Private
19	St. John Vianney Elementary School	6942 Windward Cincinnati	Private
20	McNicholas High School	6532 Beechmont Cincinnati, Ohio	Private
21	Johnson Elementary School	Cliffwood & North Ft. Thomas Ft. Thomas, Ky.	Public
22	Ruth Moyer Elementary School	219 Highland Ft. Thomas, Ky.	Public
23	Highlands High School	2300 Memorial Pkwy. Ft. Thomas, Ky.	Public
24	St. Catherine of Sienna Elementary School	23 Rossford Ft. Thomas, Ky.	Private
25	St. Thomas Elementary School	E. Villa & S.Ft.Thomas Ft. Thomas, Ky.	Private
26	St. Thomas High School	428 S. Ft. Thomas Ft. Thomas, Ky.	Private
27	Camargo Elementary School	6711 Miami Madeira, Ohio	Public
28	Miami Hills Elementary School	7840 Thomas Madeira, Ohio	Public

Index to Educational Facilities
(Continued)

Map Code Number	Name	Location	Public/ Private
29	W.M. Sellman Elementary School	6612 Miami Madeira, Ohio	Public
30	Madeira High School	Loanns Drive Madeira, Ohio	Public
31	St. Gertrude Elementary School	6551 Miami Madeira, Ohio	Private
32	Dale Park Elementary School	Chestnut Avenue Mariemont, Ohio	Public
33	Fairfax Elementary School	Southern Avenue Fairfax, Ohio	Public
34	Middle School	Plainville & Wooster Mariemont, Ohio	Public
35	Mariemont High School	3812 Pocahontas Mariemont, Ohio	Public
36	Concord Elementary School	8401 Montgomery Kenwood, Ohio	Public
37	All Saints Elementary School	8939 Montgomery Kenwood, Ohio	Public

Index to Health Care Facilities

Map Code Number	Facility
1	Madisonville Clinic
2	Memorial Clinic Group
3	Columbia Baptist Clinic
4	East End Community Health Center
5	Newtown Health Clinic
6	V.A. Hospital
7	St. Joseph's Orphanage
8	Kenton County Infirmary
9	St. Luke's Hospital

EXHIBIT VII-4

Lunken Airport

DISTRIBUTION OF EXISTING
LAND USE WITHIN
CNR ZONES 2 and 3

	CNR ZONE 3		CNR ZONE 2	
USE	ACRES	PERCENT	ACRES	PERCENT
Single Family Residential	7.00	6%	28.50	4%
Multi-Family Residential	-	-	-	-
Industrial	-	-	19.28	3
Commercial	-	-	35.81	5
Institutional	-	-	-	-
Recreation/Open Space	-	-	376.49	52
Transportation/Utilities*	54.18	43	120.23	17
Vacant/Agricultural	65.19	51	140.49	19
TOTAL	126.37	100%	720.80	100%

* Includes Lunken Airport, approximately 1,084 acres.

Although CNR zone 2 encompasses a larger residential area than zone 3, the distribution of existing land use is dominated by vacant, open space, and transportation-related uses. Those noise impacted residential areas within zone 2 include dwelling units in Fairfax and Signal Hills as well as increased proportions of dwelling units to the west.

While incompatible land uses within the noise impacted area can be identified, the present state of land development is not severely incompatible with airport operations. The overwhelming percentage of land uses compatible with aircraft noise is demonstrated in Exhibit VII-4. In zone 3, 73 percent of all land uses are compatible and are in either open space, recreation, transportation, utility, agricultural or vacant use. Ninety-six percent of the land uses in zone 2 are considered compatible and include commercial and industrial uses in addition to transportation, recreation, open space, agricultural or public utility uses. This beneficial situation is a result of the airports location in the valley of the Little Miami River and the arrangement of flight operations over the undeveloped portions of the valley area.

3. FUTURE LAND USES

In order to estimate future effects of aircraft noise it was necessary to identify the distribution of new land use development in the vicinity of Lunken Airport. Local zoning ordinances, established land use plans, and development proposals are indicators of future land use distributions and were used to estimate the impact of future aircraft noise on surrounding areas.

The unique scenic and recreational qualities of land in the vicinity of Lunken Airport has prompted local planning agencies to take a special interest in the development of this area. The Regional Development Plan released by the Ohio-Kentucky-Indiana Regional Planning Commission in 1971, recommends that a special conservation district be formed along the entire course of the Little Miami River and that funding be secured for the acquisition and development of recreational lands. The Little Miami River has also been the subject of studies conducted by the Ohio Department of Natural Resources and the Cincinnati Planning Commission. In 1972 the Cincinnati Planning Commission prepared a plan for the southernmost five and one-half miles of the Little Miami River recommending that the entire valley area between the River and the Columbia Parkway corridor be developed for recreational and semi-public land uses.

The Columbia Parkway Corridor "C" is identified as a potential site for a limited access freeway by the 1971 Regional Transportation Plan. The proposed improvement is designated directly westof Lunken extending from Martin Drive to Fairfax. The construction of a highway on this site is however, a controversial matter and recent actions have been taken to halt the improvement.

All land in the vicinity of Lunken Airport falls under the jurisdiction of either a municipal or county zoning authority. Except for small areas to the north and east of Lunken Airport, the greater part of the area is zoned by the City of Cincinnati. The remaining areas are under the authority of the Hamilton County Zoning Commission.

As a summary of these two zoning ordinances, Exhibit VII-5 allocates the classifications of each into seven basic districts: single family residential, multi-family residential, office, commercial, industrial, planned or special. Using the seven basic districts, Exhibit VII-6 portrays the present zoning of land around Lunken Airport.

Zoning practices, a principal tool for controlling land development, reflect a community's present land use aspirations. The majority of land adjoining the airport is zoned for recreation/residential riverfront-related uses, RF-1, which indicates the City's intentions to preserve valley areas for recreational use. 1/ The airport is also zoned RF-1 and is a permitted use in this district. Areas to the west of the airport along Wilmer Avenue and the south along Airport Road are zoned for industry. Zoning for either industrial or recreational development may be considered as permitting compatible uses in noise impact areas. Beyond the immediate vicinity of the airport, however, are some areas which are within the future noise impact zone. These residentially zoned areas represent additional land use conflicts in the future if new single-dwelling construction continues to be permitted.

4. METHODS OF LAND USE CONTROL

While prior discussions have centered on zoning powers and community planning activities, a number of development controls can be utilized to eliminate incompatible land uses, to promote the location of compatible uses in the

1/ Due to a 65 foot flood stage limitation on residential use, dwelling units are not permitted in this flood prone area at an elevation of less than 498' MSL.

EXHIBIT VII-5

Lunken Airport
Master Plan

COMPARATIVE
ZONING CLASSIFICATION
Page 1 of 2

Basic District	City of Cincinnati				Hamilton County			
	Use	District	Height	Minimum Lot Area	Use	District	Height	Minimum Lot Area
SINGLE FAMILY RESIDENTIAL	Single-Family	R-1A	35	20,000	Single-Family	A-A	35	1 Acre
	Single-Family	R-1	35	10,000	Single-Family	A	35	20,000
	Single-Family	R-2	35	6,000	Single-Family	A-2	35	14,000
					Single-Family	B	35	10,500
					Single-Family	B-2	35	7,500
					Single-Family	C	35	6,000
MULTI-FAMILY RESIDENTIAL	Two-Family	R-3	35	5,000	Multi-Family	D	45	3,000
	Multi-Family	R-4	45	5,000				
	Multi-Family	R-5	a	5,000				
	Multi-Family	R-6	a	5,000				
	Multi-Family	R-7	a	5,000				
OFFICE	Suburban Office	O-1A	a		Office	0	45	
	Suburban Office	O-1	a					
	Downtown Office	O-2	e					
COMMERCIAL	Neighborhood Business	B-1	30					
	Community Business	B-2	85					
	Retail Wholesale Business	B-3	85		Retail Business	E	45	
	General Business	B-4	85					
	Core Central Business	C-1	d					
	Frame Central Business	C-2	e					

EXHIBIT VII-5

Lunken Airport
Master Plan

COMPARATIVE
ZONING CLASSIFICATION
Page 2 of 2

Basic District	City of Cincinnati				Hamilton County			
	Use	District	Height	Minimum Lot Area	Use	District	Height	Minimum Lot Area
INDUSTRIAL	Neighborhood Manufact.	M-1	35	10,000	Light Industrial	F	75	
	Intermediate-Manufact.	M-2	f					
	Heavy Manufact.	M-3	f		Heavy Industrial	G	75	
SPECIAL	Residence View	R-V	a	5,000	Mobile Home Park	MHP		10 Acres 7 Unit/Net Acre
	Riverfront Rec. Resid.	RF-1	h		Flood Plain	H	35	20,000
	Riverfront Comm. Indust.	RF-2	f	10,000				
	Meat Packing	MP	f					
PLANNED	Experimental Overlay District	E-OV			Community Unit Plan	CUP		
	Transition Zone	R-T			Planned Multi-Family	DD		
					Planned Office District	OO		
					Planned Retail Business	EE		
					Planned Light Industrial	FF		
					Planned Heavy Industrial	GG		

a. two times distance from building line to center of street
d. floor area ratio 9.0
e. floor area ratio 7.0
f. none, except within 100' of an R zone
h. 35' above 65' flood elevation

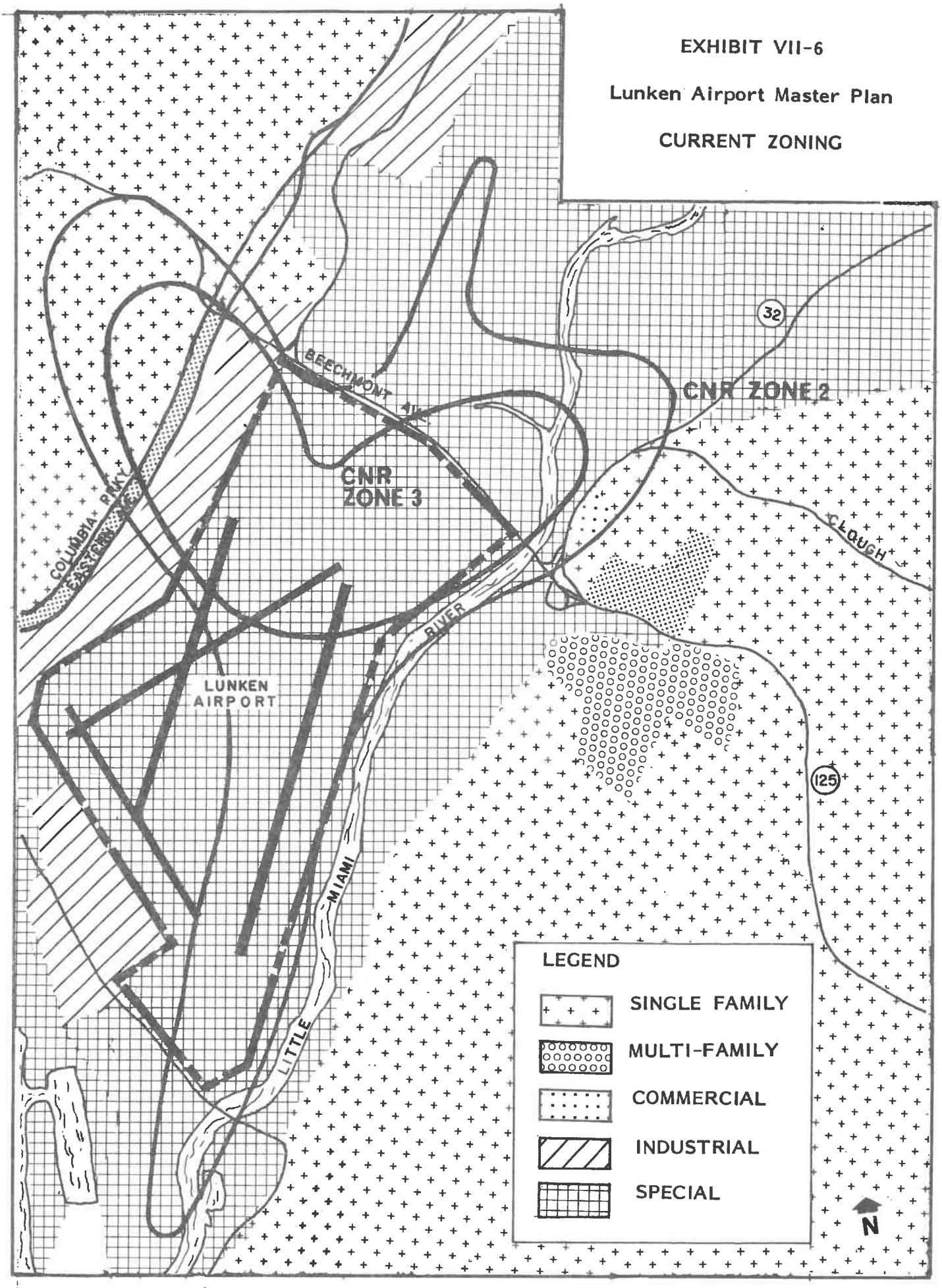


EXHIBIT VII-6
Lunken Airport Master Plan
CURRENT ZONING
BEECHMONT AVE.
CNR ZONE 2
CNR ZONE 3
COLUMBIA PKWY.
EASTERN AVE.
LUNKEN AIRPORT
LITTLE MIAMI RIVER
CLOUGH
32
125
LEGEND
SINGLE FAMILY
MULTI-FAMILY
COMMERCIAL
INDUSTRIAL
SPECIAL
N

airport's vicinity, or to prevent the erection of height hazards. Eight methods of controlling land development are outlined below. The effectiveness of each control to promote compatible land uses is discussed and pertinent financial and political limitations are noted.

(1) Land Acquisition

Although very expensive, land acquisition is the most thorough method by which incompatible land uses can be eliminated and height-obstructions prevented. This method can also aid in the development of compatible land uses by providing suitable utilities, suitable services, or other public uses appropriate in an airport impact area, e.g., forest preserves, water reservoirs, sewer treatment facilities. The location of these facilities, however, should be carefully planned and coordinated with other public agencies.

(2) Advanced Land Acquisition for Resale

Often called land banking, advance land acquisition can insure compatible use of developed land through lease or resale with land use controls. For example, in situations where lands are already subdivided for residential use or contain a number of small commercial parcels, public acquisition can be used to assemble land and reduce obstacles to commercial development. Advance land acquisition has the added benefit of being able to return to the public some of the value generated by the proximity of the land to the airport. Certain costs are incurred

during this process such as interest, other opportunity costs of capital, taxes foregone and administrative costs. While quite benefitical, advanced acquisition for resale is seldom use by airports. Local governments and real estate interests frequently object to public bodies entering the development field.

(3) Development Right Purchase

Instead of outright land acquisition, it is possible for a public agency to purchase the development rights for areas where little development has occurred. Retaining these rights enables the airport to limit the land from a more intensive use and to decide which uses should be put on a particular piece of property. In this manner sensitive uses can be eliminated or effectively controlled.

(4) Easements

Acquiring an easement grants the airport a limited right in land owned by others. Avigation easements are usually purchased in approach zones and empower the airport to restrict incompatible height obstructions and to maintain the right of airspace. This method has been used in the past to control height obstructions around Lunken Airport.

While often used by airports to restrict incompatible height obstructions, easement purchase is only a limited solution to controlling land development. An easement does not offer an airport protection from noise complaints and inverse condemnation proceedings. It is possible, however, to execute an easement in exchange for the cost of adding acoustical sound-proofing insulation to buildings housing noise sensitive activities.

(5) Preferential Taxing

Similar to easements, reducing assessments on property in the impact area can be used to mitigate noise complaints and provide compensation to affected property owners. Preferential taxing can also be used to entice compatible development near the airport site. Tax advantages can be coordinated into a market service strategy designed to promote commercial and industrial location within the impact areas. Other various of preferential taxing can be used to encourage undeveloped land to remain in agricultural or open space use. It is important to note that tax incentives do not prevent incompatible development. Moreover, tax reductions are not always a primary location factor for most firms seeking new locations and local taxing bodies may have strong opposition to this type of approach.

(6) Zoning

Zoning is the most well known method of land use control and is a logical alternative to regulating land uses when it is not economically

feasible to acquire height hazard or noise impacted areas. Zoning around airports is traditionally used to regulate the height of structures within approach zones. Recent actions taken in Minnesota and California, however, illustrate that an airport's zoning power can be extended to the right to zone for safety and noise purposes.

Although Lunken Airport has taken no action to restrictively zone the height of structures in approach areas, airport zoning regulations for height purposes are authorized under Ohio legislation. Section 4563.03 of the State of Ohio Aviation Laws authorizes the establishment of airport zoning boards for the purposes of enforcing zoning regulations in airport hazard areas. An airport hazard area is defined as any area of land adjacent to an airport which has been declared to be an airport hazard area by the Ohio Division of Aviation in connection with an airport approach plan recommended by a zoning board. Those hazards which can be regulated include "any structure or object of natural growth or use of land which obstructs the airspace required for the flight of aircraft in landing or taking off or is otherwise hazardous to such landing or taking off of aircraft". It should be noted that Section 4563.09 prohibits the interference of zoning regulations with the continuance of a non-conforming use, i.e., hazards existing prior to the adaption of a zoning ordinance cannot be required to move or be modified.

Zoning is also a practical solution for encouraging compatible land uses in areas impacted by aircraft noise. Zoning may be used to preserve existing compatible uses, prevent change to incompatible uses, and to promote compatible uses where no dominant use is yet established. This regulatory tool, however, has little power to require existing incompatible uses to conform, although some courts have upheld conformance through amortization.

The use of zoning to arrange compatible uses around airports does have limitations and is often criticized. Several zoning jurisdictions are usually involved in the impact area of an airport without any method of coordinated land use planning. Opposition from local zoning bodies can be expected in any attempt to create an area-wide zoning authority. Furthermore, zoning is governed by constitutional limitations. Zoning to compatible uses around airports must not be such that it constitutes a "taking" of land, in which case compensation must be paid. A "taking" is made by either restricting uses on property in high demand for other uses or by zoning to a high value use for which there is no demand. Courts are unlikely to uphold zoning away from a predominant or accepted use if owners object. Recent judgements are tending to condone land use restrictions if reflected in a comprehensive plan, particularly a state or regional plan, and if the reasons for restriction are well-supported and clear.

(7) Subdivision Regulations

Subdivision regulations are second in importance only to zoning as a land use regulation and are a method of insuring compliance with city planning and zoning. While subdivision regulations have no affect on existing development, they can be used to regulate intended uses prior to the development process or during resubdivision. When granting approval for divisions, it is possible for the planning commissions to: require parcel sizes suitable for commerical or industrial development; require plans to be in conformance with comprehensive planning; acquire deed restrictions on subdivided lands in noise impact areas or require notice to local approving bodies of noise sources affecting the land to be subdivided.

Assuming the existence of a comprehensive plan, it is entirely feasible to time subdivision application approval with the planning of public improvements. For example, the provision of utilities, street, and other public services could be withheld until noise criteria are met.

(8) Building Codes

The use of building codes does not promote compatible development or eliminate incompatible uses but can protect sensitive areas from the full effect of aircraft noise. Acoustical sound-proofing provisions for intended construction within the noise area may be incorporated into a

building code. In this manner, anyone unable to meet the new requirements is ineligible to receive a building permit. The use of this method depends upon state enabling legislation. Requiring various construction methods in different areas based on noise contours is not permitted in most enabling legislation for building codes or zoning.

Although the foregoing sections have outlined a number of potential land development controls, no single method should be relied upon to promote compatible land uses in the Airport's vicinity. It is rather recommended that a combination of land use controls be utilized to regulate the height and location of future land uses.

Land acquisition and avigation easements are best utilized for controlling the height of structures in clear zone areas. These two methods have been used effectively by Lunken Airport authorities in the past. Except for the northeast corner of the clear zone to 20L, the clear zones of existing runway relocation are sufficiently protected.

In order to regulate the height of structures in runway approach zones, it is suggested that steps be taken to implement airport zoning regulations for height purposes. Such action is authorized by State enabling legislation and it is in the best interests of the airport that the integrity of its airspace be adequately protected in the future.

Aside from zoning against height obstructions, the zoning of land to promote compatible development within aircraft noise impact areas is not authorized

by State legislation. The zoning of land uses beyond the airport boundary is strictly under the authority of either the City of Cincinnati or Hamilton County. The following section suggests a land use plan for the purpose of promoting compatible development in noise impact areas. This plan should be distributed to both Cincinnati and Hamilton County authorities. These two jurisdictions should be encouraged to reflect the plan in their future planning activities and to enact zoning changes in favor of compatible land use development.

5. RECOMMENDED LAND USE PLAN

The recommended land use plan considers aviation-related improvements at Lunken Airport as well as future development characteristics of land in the airport's vicinity. The allocation of future land uses both on and off the airport site are made on the basis of:

- Projected airport needs and requirements,
- Land suitability for development,
- Compatibility of land use activities with aircraft noise, and
- Established community plans and development proposals.

Exhibit VII-7 illustrates both recommended generalized improvements to Lunken Airport as well as suggested development patterns for those areas which will be impacted by airport operations in the future.

The type and location of facility improvements at Lunken Airport are thoroughly discussed in Chapter VI. Generally, it is recommended that the

existing arrangement of on-airport land uses be continued in the future. The present location of corporate facilities along Wilmer Avenue is designated to receive six new private facility developments. Additional public facilities should be located with current public uses along Airport Road. Suggested airfield improvements include a proposed helicopter pad, the conversion of runway 15-33 into a taxiway, and the relocation of runway 2L-20R.

The number of aircraft operations at Lunken Airport are forecast to increase from the present average of 200,000 per year to approximately 345,000 per year in 1993. In spite of this increase, however, a significant decrease is expected in the impact of aircraft generated noise. This reduction in noise impact is based on an anticipated increase in the use of new aircraft types with quieter engine design as well as compliance with new Federal regulations, i.e., FAR Part 36, regarding aircraft noise emissions.

While the impact of aircraft noise is forecast to decrease by 1995, effects of aircraft generated noise will still extend into areas surrounding the airport. Those areas which will be substantially impacted are indicated by the CNR zone 2 and CNR zone 3 designations in Exhibit VII-7. It is within these areas that careful consideration should be given to planning for land uses compatible with aircraft noise.

The land use plan allocates a substantial amount of recreational development to the north and east of the airport along the Little Miami River. Recreational activities are compatible with aircraft noise and also protect the fragile environmental conditions of the valley area. Preservation of these areas for recreational use is not unique to this plan, and both the City of Cincinnati and OKI have expressed a desire to preserve the valley for recreational activities.

The allocation of industrial transportation-related, and public utility land uses within the planning area is based on existing land use patterns and local zoning classifications. Industrial, utility and transportation areas presently adjoin the western and southern boundaries of the airport and are zoned accordingly by the City of Cincinnati. Such uses are compatible with airport operations and can exist harmoniously in noise impact areas.

While some residential areas are indicated on the Land Use Plan, residential dwellings should not be considered as being compatible with aircraft noise. These areas have already developed into residential use and are quite likely to remain in residential use within the time frame of this plan. It is recommended, however, that additional dwelling unit construction be avoided or be permitted only if adequate sound-proofing insulation is provided.

The location of schools, churches, hospitals, cultural centers, and other types of activities very sensitive to aircraft noise is a special concern of the Land Use Plan. It is strongly recommended that these facility types not be per-

mitted within CNR zones 2 or 3. Within the impact area of CNR zone 1, such uses should be permitted only if noise control features are incorporated as part of building design.

CHAPTER VIII

FINANCIAL PLAN AND FEASIBILITY ANALYSIS

CHAPTER VIII

FINANCIAL PLAN AND FEASIBILITY ANALYSIS

This chapter describes the methods used to analyze the financial feasibility of the proposed master plan program for Lunken Airport. It presents historic airport expenses and revenues, the capital costs associated with the development program, forecasts of airport expenses and revenues, and a cash flow forecast.

1. HISTORIC EXPENSES

To provide a basis for forecasting airport expenses, an analysis was made of the recent historic expenses at Lunken Airport. Between 1970 and 1974 total expenses at Lunken Airport have increased from $263,000 to $293,000 as shown on Exhibit VIII-1.

For analytical purposes, historic expenses were segregated into the following components:

- Administrative Expenses
- Operating Expenses
- Non-operating Expenses

(1) Administrative Expenses

Included in this category are administrative salaries and fringe benefits, liability insurance, security service, taxes, telephone and a general fund charge. The City does not charge the airport fund for the fire, crash, and rescue services it provides the airport.

EXHIBIT VIII-1

Lunken Airport Master Plan

HISTORIC REVENUES AND EXPENSES

	Year Ending December 31				
	1970	1971	1972	1973	1974
Operating Revenues:					
Rents	$109,200	$129,900	$144,600	$152,300	$161,800
Operations	100,600	99,700	100,700	112,100	98,700
Miscellaneous	4,700	5,500	1,000	2,700	5,000
Total Operating Revenues	$214,500	$235,100	$246,300	$267,100	$265,500
Operating Expenses:					
Salaries	$ 93,000	$ 92,100	$101,000	$106,400	$118,500
Employee Benefits	13,500	13,300	18,600	18,800	23,100
Maintenance and Repair	31,000	14,200	20,400	10,100	20,300
Utilities	26,200	26,000	26,300	27,900	31,800
Equipment Rental	7,100	7,900	7,300	6,700	8,700
Engineering Services	3,000	500	800	- 0 -	- 0 -
Telephone	700	800	900	1,100	1,000
General Administration	7,800	15,900	17,000	14,800	16,700
Real Property Tax	23,400	17,400	15,000	15,100	15,400
Insurance Liability	4,400	4,200	4,200	4,200	2,600
Miscellaneous	100	-0-	100	200	600
Bad Debt Expense	-0-	6,600	100	-0-	1,600
Total Operating Expenses	$210,200	$198,900	$211,700	$205,300	$240,300
Net Operating Profit	$ 4,300	$ 36,200	$ 36,900*	$ 61,800	$ 25,200
Total Debt Charges	$ 53,000	$ 52,400	$ 52,400	$ 52,400	$ 52,800
Total Profit or (Loss)	$(48,700)	$(16,200)	$(15,500)	$ 9,400	$(27,600)
Subsidy From General Fund	- 0 -	- 0 -	- 0 -	$ 12,000	$ 48,000

* Includes $2,300 recovery of bad debt.

Total administrative expenses are estimated to be about $107,400 in 1975. This amount is comprised of the following:

- Salaries and fringe benefits for the airports' superintendent, administrator and secretary -- $37,600.
- The Hamilton County real estate taxes on the airport owned buildings -- $15,500.
- Telephone expense -- $1,100.
- Contractual security services -- $9,900.
- The airports' allocated charge for the City's administrative expenses -- $5,700. This allocation is made to the airport based on its total salary expense.
- Non-recurring professional services for the master plan and rates and charges study -- $37,600.

(2) Operating Expenses

Included as operating expenses are all maintenance, custodial, utility, materials, and supplies expenses related to the operation of the airport. The $196,300 estimated operating expenses for 1975 are comprised of the following:

- Wages and fringe benefits for the airport's four custodial employees -- $45,000.
- Wages and fringe benefits for the airport's five full-time and two seasonal maintenance employees -- $77,000.
- Total airport utility expenses, including reimbursable utility expenses -- $45,000.
- Rental of City owned vehicles -- $9,500.
- All other operating expenses -- $19,800.

(3) Non-Operating Expenses

Although capital expenditures are non-operating expenses, Lunken Airport is designated as an operating fund of the City of Cincinnati and, as such, capital improvements are not charged to the airport, but to a separate capital improvements fund.

Runway 2R-20L, which was opened for use on January 14, 1965, was constructed with funds derived from the sale of Lunken Airport Revenue Bonds. These bonds are not general obligations of the City of Cincinnati but are secured by and payable from the revenues of Lunken Airport. Therefore, the debt service related to the bonds is included as an airport expense. The debt service schedule and reserve fund payments are presented as Exhibit VIII-2 on the next page.

2. HISTORIC REVENUES

In order to develop a basis for forecasting total net revenues at Lunken, historic total revenues have been analyzed. For analytical purposes they have been divided into the following sources:

- Terminal and Tower Revenues
- Land and Hangar Revenues
- Fuel Flowage Revenues
- Commission Revenues
- Utility Reimbursement Revenues
- Other Revenues

EXHIBIT VIII-2

Lunken Airport Master Plan

EXISTING DEBT SERVICE SCHEDULE

Year	Principal	Interest	Total Debt Service Requirement	Debt Service Reserve	Total Debt Service and Reserve
1975	$29,000	$22,420	$51,420	$2,580	$54,000
1976	30,000	21,240	51,240	2,560	53,800
1977	32,000	20,000	52,000	2,600	54,600
1978	33,000	18,700	51,700	2,580	54,280
1979	34,000	17,360	51,360	2,560	53,920
1980	35,000	15,980	50,980	2,540	53,520
1981	36,000	14,560	50,560	2,530	53,080
1982	38,000	13,080	51,080	2,560	53,640
1983	39,000	11,540	50,540	2,520	53,060
1984	41,000	9,940	50,940	2,540	53,480
1985	42,000	8,280	50,280	2,520	52,800
1986	44,000	6,560	50,560	2,520	53,080
1987	46,000	4,760	50,760	2,540	53,300
1988	47,000	2,900	49,900	2,500	52,400
1989	49,000	980	49,980	2,500	52,480

Total airport revenues for the period 1970 through 1974 appear in Exhibit VIII-1.

(1) Terminal and Tower Revenues

Rental of space in the terminal building will account for about $32,600 in 1975. Terminal building tenants include the FAA Flight Service Station, a fixed base operator, tenants renting office space, and a restaurant. In addition to the $32,600 in rental revenue, about $14,000 will be realized from a percentage commission on sales of the restaurant.

Rental of the control tower to the FAA amounts to about $15,200 per year. In addition to space rented in association with traffic control, the FAA also houses its Airways Facilities Office in the tower building. This office maintains the tower equipment and navaids.

(2) Hangar and Land Revenue

Rental of the airport owned hangar buildings will produce about $54,000 in 1975, while land rental to the airport's fixed base operators and corporate tenants will amount to about $30,000. Currently all but about 124,000 square feet of rentable land is revenue producing.

(3) Fuel Flowage Revenue

Airport tenants authorized to pump fuel pay the airport $.03 per gallon pumped. This charge is made to all tenants, including

corporate tenants who pump fuel for their own use, but do not sell it. In 1974 about 2,460,000 gallons of fuel were pumped at the airport, producing about $74,000 in airport revenue, making it the airport's largest single source of revenue.

(4) Commission Revenues

Fixed base operator commissions are based on a percentage of the operator's total gross sales, excluding commercial aviation fuel sales. The percentage commission paid to the airport is 2% of gross sales. In 1974 this source of revenue amounted to about $23,000.

(5) Utility Reimbursement Revenues

The airport charges, without profit, the cost of utilities used by its tenants. About 55% of the airport's total utility expense is recovered in the form of utility reimbursement revenues.

(6) Other Revenues

Included in this category are revenues from such sources as pay telephone commissions, income on investments, landing fees, permit fees and tax support.

Landing fees are currently charged for commercial flights only. Because of the limited commercial activity at Lunken, landing fees are not a significant revenue source.

Permits authorizing various commercial activities such as airplane sales and flying lessons, are issued at Lunken Airport. These permits, which are actually minimums for the percentage of sales revenues, amounted to about $3,600 in 1974.

Interest income earned from investment of funds in the Construction Fund and Debt Service Reserve Fund amounted to about $8,000 in 1974.

Exhibit VIII-1 indicates that the airport's operating revenues have been sufficient to meet operating expenses during the period 1970-1974. However, when debt service and reserve payments are included, the airport has operated at a deficit four out of the last five years. Furthermore, if depreciation on the airport's assets and a charge for return on its investment, which are legitimate airport expenses, were also included the deficit would be much greater. The airport does not include these last two items as expenses.

The City of Cincinnati has contributed tax support to the airport. In 1974, the City subsidized the airport with $48,000. Because the amount of the City's subsidy is determined during the preparation of the annual budget and because it takes into consideration the amount of airport's unappropriated surplus from prior years budgets, it can be greater or less than the total annual deficit.

3. CAPITAL PROGRAM

The facilities development program for Lunken Airport is summarized in Exhibit VIII-3. The estimated cost of the entire capital program in 1975 dollars is $7,626,800. When a seven percent per year allowance for the impact of inflation is applied to each item in the development program, up to the mid-year of the stage in which the item is planned, total development costs through 1995 are estimated to be $11,739,100. The local share of this total is estimated at $5,304,200. The local share of the capital program costs were computed with the assumption that the future FAA financial assistance programs will be continued with the same eligibility priorities and levels of participation as the ADAP program which expired June 30, 1975.

It is the intention of the City to fund major capital improvements at Lunken Field from revenue sources other than the operating fund of the airport. Therefore, the financial impact of the capital program of the master plan is addressed here only in terms of its effect on the operating revenues and expenses of the airport.

4. FUTURE EXPENSES

Total airport expenses were projected through 1995 based on actual recent expenses and anticipated additional expenses resulting from implementation of the development program and inflationary cost increases.

EXHIBIT VIII-3

Lunken Airport Master Plan

ESTIMATED AIRPORT DEVELOPMENT COSTS

Development Item	Total Cost (in 1975 Dollars)	Projected Costs		
		Total	Local	FAA
Stage I - 1975-1980				
Reconstruct Runway 6-24	$1,825,000	$2,244,800	$ 561,200	$1,683,600
Construct Parallel Taxiway 2R-20L	1,248,800	1,536,000	384,000	1,152,000
Construct Connecting Taxiway	315,000	387,500	96,900	290,600
Lighting for Parallel Taxiway 2R-20L	57,900	71,200	17,800	53,400
Conventional Hangars	526,900	648,100	648,100	- 0 -
Conventional Hangar Ramp and Taxiway	157,500	193,700	48,400	145,300
T-Hangars	190,000	233,700	233,700	- 0 -
T-Hangars Access Taxiways	9,400	11,600	2,900	8,700
T-Hangar Lead-in Taxiways	16,800	20,700	20,700	- 0 -
Tie-Down Area	50,600	62,200	15,500	46,700
Transient Ramp	71,200	87,600	21,900	65,700
Helipad	82,500	101,500	25,400	76,100
Overlay Airport Road	250,000	307,500	76,900	230,600
Auxiliary Pumping Station	100,000	123,000	30,800	92,200
Obstruction Lights	250,000	307,500	76,900	230,600
Total Stage I	$5,151,600	$6,336,600	$2,261,100	$4,075,500
Stage II - 1981-1985				
Relocation of Runway 2L-20R	$ 792,500	$1,363,100	$ 340,800	$1,022,300
Relocate Lighting 2L-20R	50,000	86,000	21,500	64,500
Visual Marking Runway 2L-20R	4,500	7,800	1,900	5,900
Conventional Hangars	175,600	302,000	302,000	- 0 -
Conventional Hangar Ramp and Taxiway	52,500	90,300	22,600	67,700
T-Hangars	125,300	215,500	215,500	- 0 -
T-Hangar Access Taxiway	9,400	16,200	16,200	- 0 -
T-Hangar Lead-in Taxiway	11,200	19,300	4,800	14,500
Tie-Down Area	50,600	87,000	21,700	65,300
Transient Ramp	90,000	154,800	38,700	116,100
Pedestrian Traffic Signal	12,500	21,500	5,400	16,100
Total Stage II	$1,374,100	$2,363,500	$ 991,100	$1,372,400

EXHIBIT VIII-3

Lunken Airport Master Plan

ESTIMATED AIRPORT DEVELOPMENT COSTS

Development Item	Total Cost (in 1975 Dollars)	Projected Costs		
		Total	Local	FAA
Stage III - 1986-1995				
Conventional Hangars	$ 351,300	$ 969,600	$ 969,600	$ - 0 -
Conventional Hangar Ramp and Taxiway	105,000	289,800	72,400	217,400
T-Hangars	250,500	691,400	691,400	- 0 -
T-Hangar Access Taxiway	24,400	67,300	16,800	50,500
T-Hangar Lead-in Taxiway	22,500	62,100	62,100	- 0 -
Tie-Down Area	101,200	279,300	69,800	209,500
Transient Ramp	246,200	679,500	169,900	509,600
Total Stage III	$1,101,100	$3,039,000	$2,052,000	$ 987,000
Grand Total	$7,626,800	$11,739,100	$5,304,200	$6,434,900

(1) Economic Influences

Economic conditions have influenced expenses at Lunken Airport. The impact of inflation on the costs of goods and services and the cost of labor account for some of the increases in historic expenses at the airport. In order to give consideration to future inflationary trends, increases in the Consumer Price Index and wages paid to the employees of the City of Cincinnati were used to estimate the effect these factors have had on historic expenses.

Although the proposed expansion program is long-term in nature, the long-term historic average annual increase in wages and goods and services appeared to be too low for forecasting purposes in light of current inflationary rates. Therefore, to give effect to the impact of recent rates of inflation, the expense forecast for the period 1976-1995 was divided into two parts: 1976 through 1980; and 1981 through 1995.

1. 1976 - 1980

The Consumer Price Index through June of 1975, for all items for the Cincinnati Standard Metropolitan Statistical Area (SMSA), was used to determine the annual increase in the costs of goods and services. Because the latest five year average was considered too high, the median between the five and ten years averages was used as an annual increase factor for the cost of materials and supplies. Therefore, for forecast purposes, expenses at the airport related to the costs of goods and services were increased at an annual rate of 6.2% for the period 1976-1980.

Based on recent wage increases for employees of the City and current wage negotiations, the annual rate of increase used for wage and salary expenses was: 1976-10%; 1977-8%; 1978 through 1980-7%. These factors were applied to all salary expenses, fringe benefits, security service expenses and the general fund expense.

2. 1981 - 1995

The ten year average annual increase in the Consumer Price Index for the Cincinnati SMSA was used to forecast the costs of goods and services at the airport for the period 1981-1985. The factor used was 5.5% per year.

Based on the last ten years average annual increase in wages paid to the employees of the City and on the increase factor used in forecasting goods and services expenses, the rate of increase used in forecasting wage and salary expenses for the period 1981-1995 was 6.0% per year.

Debt service expense was taken from the debt service schedule. Deposits to the Debt Service Reserve Fund, which are computed at 5 percent of the debt service payment, are also included in the expense forecast.

(2) Capital Program

It is expected that the capital program will have a relatively minor effect on future operating expenses. Most of the airport's operating expenses are of a fixed nature and will be relatively insensitive to increases in the size of the airport's facilities as developed in the master plan. For instance, wages, fringe benefits, security, taxes, equipment rental, and general fund expenses cur-

rently comprise about 75% of the airport's total operating expenses. It is anticipated that the capital improvements presented in the master plan will not substantially increase these expenses. Some improvements, such as the overlay of runway 6-24 and the overlay of Airport Road could reduce operating expenses in the near term by restoring aging facilities which are more costly to maintain than new facilities.

Also, it is assumed that new conventional and T-hangars constructed by the airport will be transferred to the FBOs for management. Because the FBOs will be responsible for the operating and maintenance expenses of the hangars, no estimate of airport expenses were made relative to the hangars.

Exhibit VIII-4 presents the forecast of expenses.

5. FUTURE REVENUES

Forecasts of revenues have been made by revenue source and reflect the influence of two primary factors. They are:

- the effect of inflation on the price of goods, services and fees charged airport users directly by the airport and on-airport tenant sales upon which airport commission revenue is derived.
- the effect of anticipated increases in revenue generating activity on the airport.

EXHIBIT VIII-4

Lunken Airport Master Plan

FORECAST OF EXPENSES

	1976	1980	1985	1990	1995
Salaries	$161,500	$197,700	$264,500	$353,900	$473,500
Employee Benefits	29,600	36,200	48,400	64,800	86,700
General Fund Charge	6,900	8,500	11,400	15,300	20,500
Security Service	10,900	14,400	19,300	25,800	34,500
Utilities	47,600	60,500	78,700	102,300	133,000
Equipment Rental	10,200	13,000	16,900	22,000	28,600
Taxes	15,500	15,500	15,500	15,500	15,500
Other	42,800	1/ 54,400	70,700	91,900	119,500
Total Operating Expenses	$325,000	$400,200	$525,400	$691,500	$911,800
Debt Service	51,200	51,000	50,300	0	0
Total Expenses	$376,200	$451,200	$575,700	$691,500	$911,800

1/ Includes $16,400 for equipment purchases.

Therefore, except in cases where lease limitations were a limiting factor, revenue sources were first forecast to increase at 6.2% a year up to 1980 and at 5.5% a year from 1981 to 1995 to reflect the impact of inflation. These are the same rates of increase that were used in forecasting materials and supplies expenses. Then, revenue sources related to operations and based aircraft were increased in relationship to increases in these elements.

(1) Terminal and Tower Revenue

The master plan does not effect changes to the terminal building or the control tower. Therefore, future revenues from these sources for the period 1976-1980 were projected at their current level with a 6.2% increase per year to reflect increases in custodial and maintenance expenses related to the buildings. For the period 1981-1995 revenue from these sources were increased at 5.5% per year.

(2) Land and Hangar Revenues

Land rental revenue is expected to be about $30,000 in 1976. A review of the land lease agreements indicated that many of the leases are long-term and have rates which are increased every five years based on 10% of the appraised value of the rental land. However many increases are subject to a maximum of $.01 per square foot per five year period. Therefore, land rental revenue forecasts reflect lease limitation restrictions.

During Stage II (1981-1985) of the Master Plan, the relocation of runway 2L-20R will enable over 400,000 square feet of land currently used as a safety zone to be used for hangar construction. It is presumed that this land will be rented at the current market value. For revenue forecasting purposes, the land rental rate for this land is assumed to increase about 5.5% a year.

Lease agreements for City owned hangar buildings were also reviewed. Future revenues from this source for the period 1976-1980 were increased by 6.2% and 5.5% per year for the period 1981-1995. These are the same rates of increase which were used in forecasting terminal and tower rental revenue.

(3) Fuel Flowage Revenues

Fuel sales commissions were projected by developing the relationship between annual total gallon flowage to total annual operations. This relationship was applied to operation forecasts and multiplied by the estimated future commission rate to determine fuel flowage revenues. The airport presently collects $.03 per gallon pumped. In keeping with the constrained operations forecast, this revenue source increases at the inflation rate only for the period 1987-1995.

(4) Commission Revenues

The relationship between commissions from fixed base operator sales and the number of based aircraft at the airport was used to forecast future revenues from this source. The rate of payment used

for forecasting was the existing rate of 2.0%, increased by the inflation rates, on commercial sales, excluding fuel sales. During the period 1987-1995, this revenue forecast reflects the effect of the inflationary rate increase only because it is predicted on the constrained based aircraft forecast.

(5) Utility Reimbursement Revenues

This revenue item consists of reimbursement to the airport by the tenants for electricity used by them. The airport does not profit from the sale of electricity to its tenants. About 55% of the airport's total utility expense is recovered in the form of utility reimbursement revenues. Therefore, this revenue item was forecast at 55% of the forecast of utility expense.

(6) Other Revenues

Income on investments was forecast to remain at its 1974 level of $8,000 per year. Revenue from other miscellaneous sources was also forecast to remain constant.

Exhibit VIII-5 presents the forecast of revenues.

6. CASH FLOW AND FINANCIAL PLAN

As mentioned earlier, local funds for major capital improvements at Lunken Airport are expected to be provided by the City of Cincinnati. The estimated effect these improvements will have on the operating revenues

EXHIBIT VIII-5

Lunken Airport Master Plan

FORECAST OF REVENUES

	1976	1980	1985	1990	1995
Terminal Rental	$ 32,600	$ 41,700	$ 54,500	$ 71,200	$ 93,100
Land Rental	30,500	39,000	86,800	107,400	132,000
Hangar Rental	54,300	69,000	90,200	117,900	154,000
Control Tower Rental	15,200	19,300	25,200	33,000	43,100
Fuel Flowage Fees	71,200	117,500	184,900	255,300	355,400
Restaurant Commissions	14,900	25,500	39,600	55,000	72,000
Utility Reimbursements	26,200	34,200	48,100	65,000	87,700
Permits	3,200	3,700	4,200	4,700	5,200
FBO Commission	21,100	36,100	56,200	78,000	102,000
Other	9,200	9,200	9,200	9,200	9,200
Total Revenues	$278,400	$395,200	$598,900	$796,700	$1,053,700

and expenses of the airport is summarized in Exhibit VIII-6. This exhibit indicates that, based on the forecasts and assumptions presented in this report, the airport can be expected to produce an operating surplus beginning in about 1985 and continuing throughout the forecast period. In light of this, the master plan is considered economically feasible.

The feasibility of this plan is predicated to a large degree on the presumption that airport management will consider the financial self-sufficiency of the airport as top priority. While it has not been a management practice to assess airport users a proportionate share of the cost of operating, maintaining, and administering the facilities and services each uses, it is not unreasonable to expect that the airport will do so in the future in order to operate a financially sound and self-supporting airport.

Failure of the City to implement the changes necessary to increase revenues to levels presumed in the foregoing assumptions could result in an operating deficit.

EXHIBIT VIII-6

Lunken Airport Master Plan

HISTORIC AND FORECAST CASH FLOW

Year	Total Operating Revenues	Total Operating Expenses	Net Operating Surplus (Deficit)	Debt Service and Reserve	Total Surplus (Deficit)
Actual					
1970	$214,500	$210,200	$ 4,300	$53,000	$ (48,700)
1971	235,100	198,900	36,200	52,400	(16,200)
1972	246,300	211,700	36,900*	52,400	(15,500)
1973	267,100	205,300	61,800	52,400	9,400
1974	265,500	240,300	25,200	52,800	(27,600)
Forecast					
1976	278,400	325,000	(46,600)	53,800	(100,400)
1980	395,200	400,200	(5,000)	53,500	(58,500)
1985	598,900	525,400	73,500	52,800	20,700
1990	796,700	691,500	105,200	-0-	105,200
1995	1,053,700	911,800	141,900	-0-	141,900

* Includes $2,300 recovery of bad debt.

EXHIBIT VII-7

NO.	BY	DATE	REVISION

APPROVED _____ DATE _____ APPROVED _____ DATE _____

APPROVED _____ DATE _____ APPROVED _____ DATE _____

LUNKEN AIRPORT
CINCINNATI, OHIO

LAND USE PLAN

SHEET 8 OF 8

LANDRUM & BROWN airport consultants

APPROVED BY | CHECKED BY | DRAWN BY | DRAWING NO.

APPENDIX A

AIRFIELD CAPACITY ANALYSIS

APPENDIX A

AIRFIELD CAPACITY ANALYSIS

The purpose of this appendix is to describe, in detail, analyses conducted to arrive at the capacity of existing airfield facilities at Lunken Airport. The computational techniques used for this capacity analysis (and associated delay analysis) were developed for the FAA by the Airborne Instruments Laboratory (AIL) and have become standard techniques in the industry. They have been in the process of development since 1959 and have been published in handbooks and advisory circulars for use by airport planners in determining additional airfield requirements.

Airfield capacity is stated in terms of practical hourly capacity (PHOCAP), practical annual capacity (PANCAP), and an associated level of annual delay (ANDE). The capacity calculations incorporate reasonable and practical amounts of aircraft delay, which are identified as:

- Three minutes average delay for all visual flight rules (VFR) departures where large aircraft constitute one percent to ten percent of the aircraft population.
- One minute average delay for all VFR arrivals.
- Four minutes average delay for all instrument flight rules (IFR) arrivals and departures.

The computed, practical capacity is established when these delay levels are reached. These delay levels were established during development of the computational techniques and reflect the impact of high demands at peak periods. Even with these apparently low average delay levels, an average delay of four minutes per aircraft can still result in a delay to any given aircraft of zero to twenty minutes. The practical airfield capacity should not be considered the maximum capacity since it can be exceeded, but only at higher delay levels.

1. FACTORS AFFECTING AIRFIELD CAPACITY

The capacity of a particular airport, when computed using the AIL method, is affected by many variables. In particular, the Airport Capacity Handbook [1/] identifies the following elements as key capacity determinants:

- Airspace
- Population
- Weather Conditions (Meteorology)
- Physical Properties of Runways
- Runway Geometry
- Airport Instrumentation

Each of these elements, and its associated impact on the computed capacity of Lunken Airport is discussed in detail in the following sections.

1/ Airport Capacity Handbook, Airborne Instruments Laboratory (AIL), June, 1969.

(1) Airspace

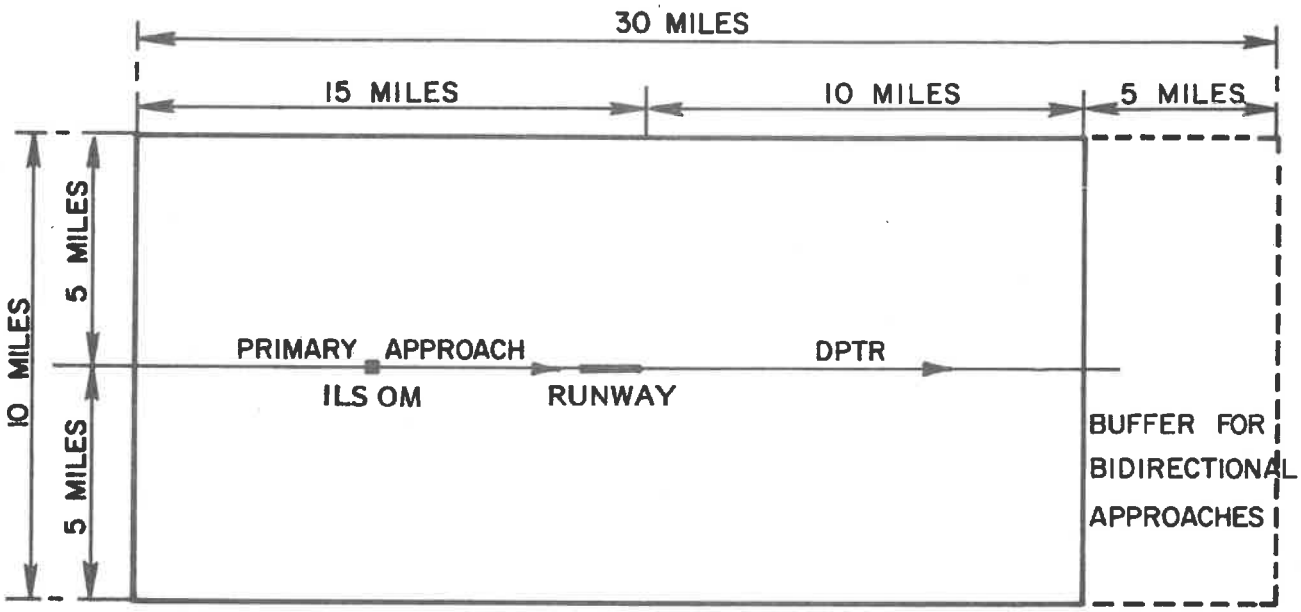
If unlimited airspace exists around an airport, multiple departures can occur within short periods of time. A slow aircraft ahead of a faster aircraft, for example, can be quickly turned away from the airport, allowing quick release of the following aircraft. Conversely, in a highly restricted airspace, each departure may have to follow preceding departures along the same path for some distance. This results in long service times, with a corresponding decrease in departure capacity.

The two major factors contributing to airspace restrictions are high density traffic and overlapping airspaces of airports in the same vicinity. In Cincinnati, a high density traffic flow is not of concern; however, the proximity of Greater Cincinnati Airport and Blue Ash Airports to Lunken indicated a need to analyze the structure of the Cincinnati airspace by applying FAA guidelines for airport spacing and traffic pattern areas. No VFR airspace conflicts were found to exist but when their IFR airspaces were identified according to the requirements shown in Exhibit A-1, following this page, a definite IFR airspace overlap was noted. This overlapping instrument airspace is shown in Exhibit A-2, following Exhibit A-1.

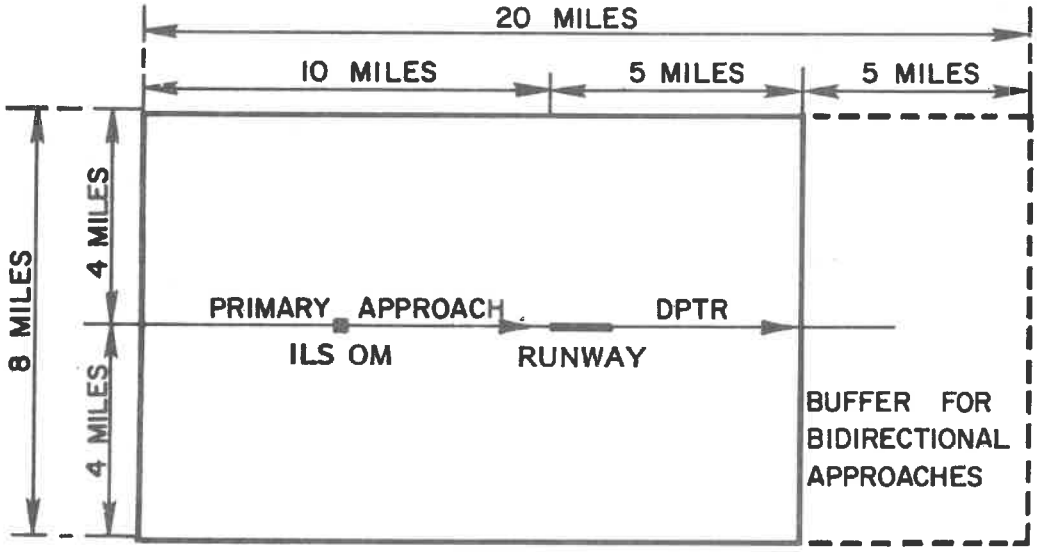
EXHIBIT A-1

Lunken Airport Master Plan

INSTRUMENT AIRPORT AIRSPACE REQUIREMENTS
FAA RECOMMENDED STANDARDS



AIR CARRIER AND BUSINESS JET AIRCRAFT

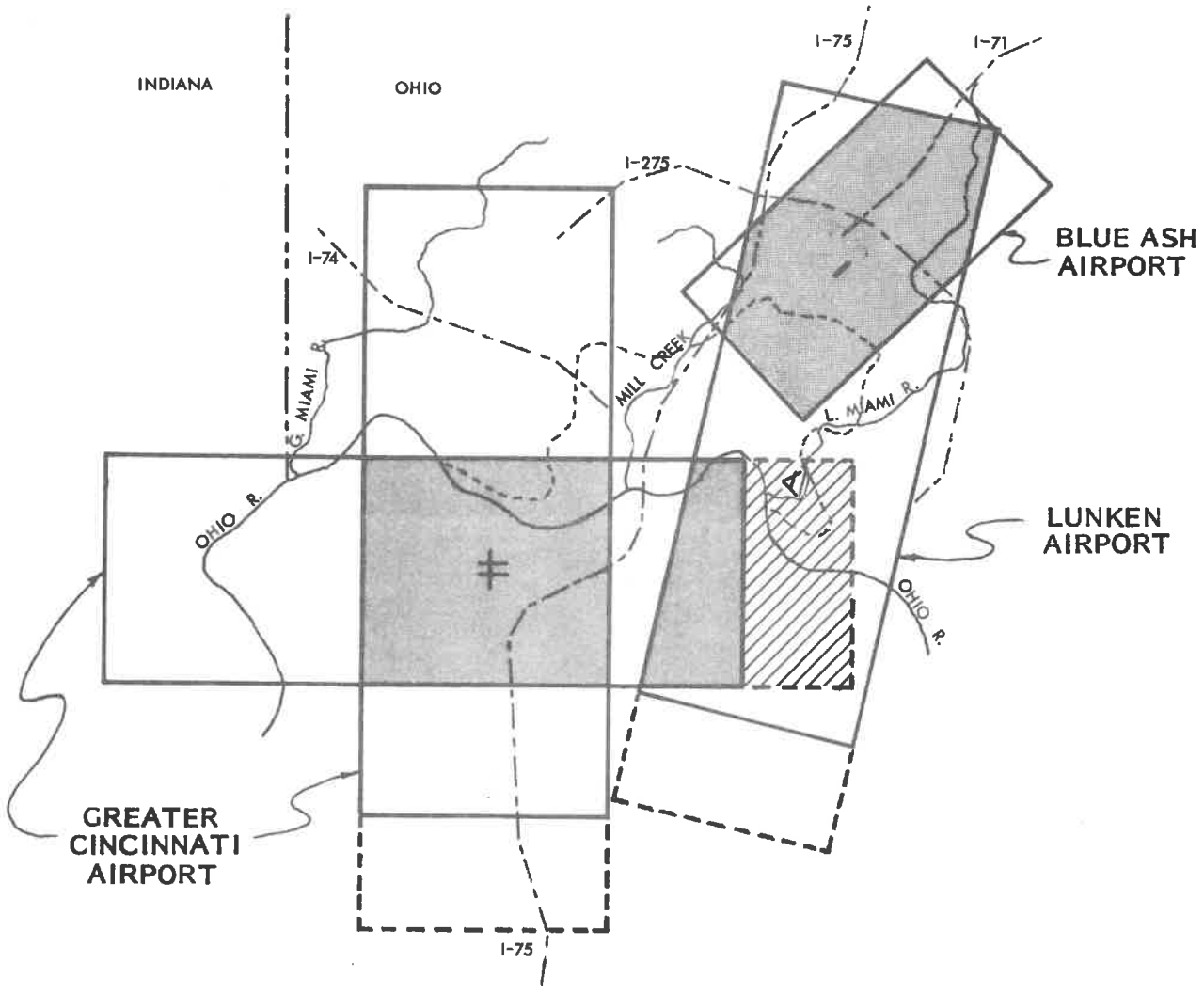


GENERAL AVIATION AIRCRAFT

EXHIBIT A-2

Lunken Airport Master Plan

INSTRUMENT AIRSPACE REQUIREMENTS OF
AIRPORTS IN THE GREATER CINCINNATI AREA



For the purpose of capacity analysis, airspace had to be classified as either unrestricted, normal, or highly restricted. Due to close coordination of all instrument approaches into Cincinnati's three instrument airports (provided by Cincinnati radar approach control) and the levels of instrument operations involved, the overlapping IFR airspace areas were not considered detrimental to IFR capacity at Lunken. Because of this and the lack of VFR airspace conflicts, Lunken airspace was classified as normal.

(2) Population

For capacity analysis purposes, population is defined as the actual mixture of aircraft classes making up a movement rate. Aircraft types are categorized into five distinct classes which are defined and illustrated in Exhibit A-3, following this page. The mixture of aircraft classes greatly affects capacity delays. For a given runway configuration, a population of light aircraft produces a much higher capacity than a population of heavy aircraft including jets.

In determining the population of aircraft using the various runways at Lunken, certain assumptions were made in the absence of recorded data. These assumptions were based on informed judgment and interviews with local Federal Aviation

EXHIBIT A-3

Lunken Airport Master Plan

AIRCRAFT CLASSIFICATIONS
FOR AIRPORT POPULATIONS

Class-A Aircraft:

All jet aircraft normally requiring runway lengths exceeding 6,000 feet (corrected to sea level) for takeoff and/or landing.

BAC (Vickers) VC 10
Boeing 707
720
747
Convair 880
990
Douglas DC-8
DC-10

Class-B Aircraft:

1. Piston and turboprop aircraft having a normal loaded weight in excess of 36,000 pounds.

2. Jet aircraft not included in Class A but having a normal loaded weight in excess of 25,000 pounds.

BAC 111
Boeing 727
737
Convair 240/340/440
580/600
Curtiss C-46
Douglas DC-4
DC-6 (C-118)
DC-7
DC-9
Lockheed Constellation
Electra
Jetstar (C-140)

Class-C Aircraft:

1. Piston and turboprop aircraft having a normal loaded weight greater than 8,000 pounds and less than 36,000 pounds.

2. Jet aircraft having a normal loaded weight greater than 8,000 pounds but less than 25,000 pounds.

Class-C Aircraft: (cont'd)

Aero Commander
Jet Commander
Beach 18 (C-45)
Beech King Air
Dassautl Fan Jet Falcon
Douglas B-26
Fairchild F-27/F-227
H.S. (D.H.) 125
Lear Jet 23
24
North American Saberliner (T-39)

Class-D Aircraft:

All light twin-engine piston and turboprop aircraft having a normal loaded weight less than 8,000 pounds, and some high-performance single-engine light aircraft (such as the Beech Bonanza). They are normal, small, light, twin-engined aircraft with the exception of those marked with an asterisk (*).

Aero Commander (500, 600, 700 Series, Grand and Turbo)
Beech Bonanza*
Debonair*
Baron
Travel Air
Cessna 310/320/411/336/337
Piper Apache
Aztec
Twin Comanche
Beech Queen Air
Twin Bonanza

Class-E Aircraft:

All single-engine aircraft with the exception of the Mustang (C), Bonanza (D), and Debonair (D), and small STOL aircraft some of which may have two engines (Twin Otter).

The most common types of Class E aircraft are:

Cessna series 150 through 210
Mooney 20 series
Piper series, Tri-Pacer, Colt, Comanche, and Cherokee
Other miscellaneous types as Been Musketeer, D. H. Beaver, Bellanca, Helio Courier, Luscombe, Navion, and the Stinson.

Administration personnel and pertained to the population of aircraft that actually use each runway. The populations used in the analysis are presented in Exhibit A-4, following this page.

In determining the population at Lunken Airport it was also necessary to consider the percentage of touch and go operations to total operations. As the percentage of touch and go operations increases the capacity of the airport also increases, due to decreased runway occupancy times by aircraft conducting touch and go operations. Assumptions made concerning touch and go operations were again made only after extensive interviews with local FAA tower personnel. The percentage of touch and go operations assumed for each runway is presented in Exhibit A-4.

According to methods established by Airborne Instruments Laboratory for determining capacity, an airport must be classified according to its predominant use--either air carrier (type A airport) or general aviation (type G airport). This usage is defined in terms of aircraft population. Specifically, an airport is said to be an air carrier (A) airport if its population consists of more than ten percent Class A and Class B aircraft. If the population is comprised of ten percent or less Class A and Class B aircraft, the airport is defined as a general aviation airport.

EXHIBIT A-4

Lunken Airport Master Plan

AIRCRAFT POPULATION AND
PERCENTAGE TOUCH AND GO
OPERATIONS BY RUNWAY

Runway	Population by Aircraft Type (%)					Percentage of Touch and Go Operation
	A	B	C	D	E	
2R	-	-	10.3	9.5	80.2	25
20L	-	-	10.3	9.5	80.2	25
2L	-	-	1.0	17.0	82.0	50
20R	-	-	1.0	17.0	82.0	50
6	-	-	10.3	9.5	80.2	50
24	-	-	10.3	9.5	80.2	50
15	-	-	-	15.0	85.0	0
13	-	-	-	15.0	85.0	0

This distinction between general aviation and air carrier facilities is made because of the difference in operational characteristics of each. For example, at an airport where the air carrier population is greater than ten percent of the total population, interaction between air carrier aircraft and general aviation (GA) aircraft significantly decreases the operational capacity of the facility. Conversely, at an airport where less than ten percent of the population is air carrier, this interaction is minimal and capacity is much greater. Greater levels of training activity which includes a high proportion of touch and go operations, serves to further increase the capacity of the G type or general aviation airport.

From the definitions stated above, and the results of the population analysis, Lunken Airport was defined as a general aviation airport (type G) and is referred to as such in all subsequent airfield capacity discussions.

(3) Meteorology

Meteorological conditions experienced at an airport affect runway utilization due to visibility and prevailing wind directions. These conditions determine the directions in which operations may be conducted and the frequency of use for each runway configuration. The percentage of time each configura-

tion can be used, based upon meteorological conditions, is necessary to determine the practical annual capacity (PANCAP) of a runway system. That is, higher capacities will result if the prevailing meteorological conditions favor the use of higher capacity operating configurations. As is discussed in the next section, all operational configurations in use at Lunken were identified in the capacity analysis. Weather data presented in Chapter II, Inventory, were analyzed in order to determine the percentage of the year each may be used.

(4) Physical Properties of Runways

The physical properties of a runway determine not only the ability of that runway to accommodate various aircraft types, but also the operating efficiency of the configurations in which the airport functions. At Lunken, for example, the efficiency of the primary operating configuration is limited at present, due to the lack of taxiway exits or turn-offs on runway 2R/20L. This lack of turn-offs does not pose serious problems at present, but does constrain the capacity of the airport as a whole. In addition to the number of turn-offs, the type of runway turn-offs also affects the capacity of an airport. Angled turn-offs, for example, permit arriving aircraft to depart the active runway more quickly, thereby making the runway available sooner for the next arrival or departure.

For the purposes of the airport capacity determination, runway ratings, or runway service times (which measure the average number of seconds a landing aircraft will occupy a runway) are used to measure the impact of the types and numbers of turn-offs on airport capacity. Exhibit A-5, following this page, presents the calculated runway service times (ratings) for each runway at Lunken.

(5) Airport Runway Geometry

Airport runway geometry with respect to the location of runway intersection points also has a significant impact on the capacity of the total facility. The method for computing capacity takes this into account by including an intersection ratio 1/ for every arrival and departure runway of an intersecting arrival/departure pair.

For example, Exhibit A-6, following Exhibit A-5, compares the computed capacities for two hypothetical operational configurations under conditions of identical demand. In this case, different capacities are determined by simply varying the arrival and departure intersection ratios. The actual impact of the intersection ratios of various operational configurations on the capacity of Lunken is minimal; however, they were considered.

1/ The intersection ratio for a runway is determined by dividing the distance from the threshold to the intersection by the total length of the runway.

EXHIBIT A-5

Lunken Airport Master Plan

RUNWAY RATINGS 1/

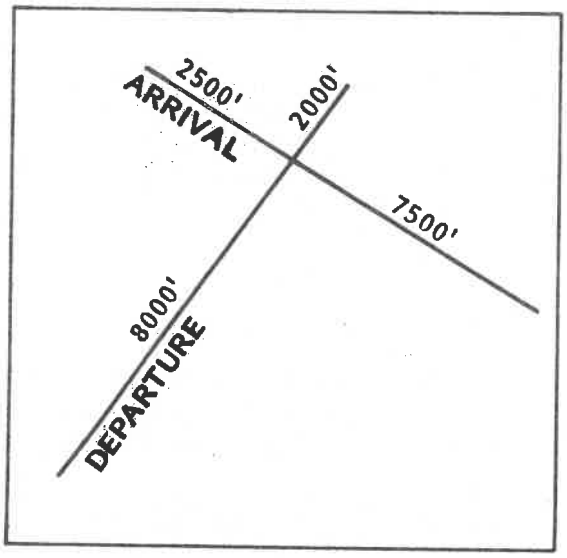
Runway	Rating (seconds)
2R	40.9
20L	43.4
2L	38.8
20R	34.9
6	40.9
24	28.4
15	24.5
33	35.2

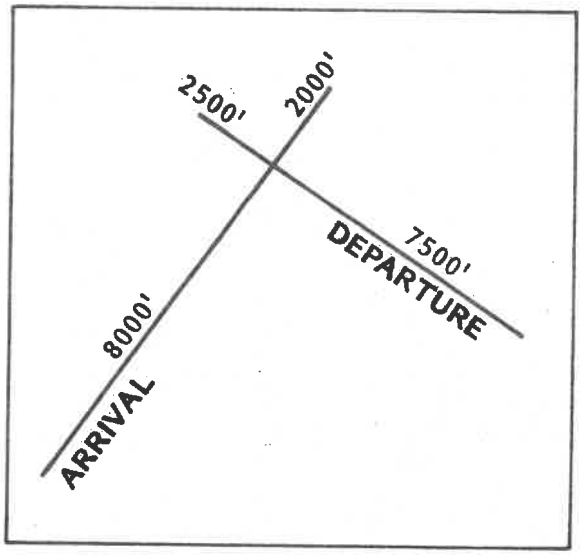
1/ Expressed in Seconds

EXHIBIT A-6

Lunken Airport Master Plan

CAPACITY DIFFERENCES FOR
INTERSECTING RUNWAY
CONFIGURATIONS





Intersection Ratio

Arrival = .25
Departure = .20

% Class A & B = 40
% Class B = 25
Airspace - Normal
No Touch and Go
Arrival/Departure Ratio = 1.0

PHOCAP

Departure Capacity = 45
Arrival Capacity = 39

Intersection Ratio

Arrival = .80
Departure = .25

% Class A & B = 40
% Class B = 25
Airspace - Normal
No Touch and Go
Arrival/Departure Ratio = 1.0

PHOCAP

Departure Capacity = 39
Arrival Capacity = 39

(6) Airport Instrumentation

The availability, types, and locations of navigational aids (NAVAIDS) on and in the vicinity of the airport, affect the capacity and utilization in both visual and instrument weather conditions. Multiple ILS runways, for example, increase the number of operational configurations with which the airport can operate during IFR weather, and therefore permit the use of the most capacity-efficient configurations available, based on other factors such as prevailing wind direction. For Lunken, an inventory of the existing NAVAIDS was presented in Chapter II, Exhibit II-5.

2. DESCRIPTION OF METHODOLOGY AND ANALYSIS

Section 1 detailed the elements of the airfield capacity analysis that were examined prior to any final capacity computations. Using the data gained from examining these elements in conjunction with the methodology described in this section, three separate results were obtained: the practical hourly capacity (PHOCAP); the practical annual capacity (PANCAP); and the annual delay (ANDE) for each PANCAP. The PANCAP is a composite of the PHOCAP's and the annual utilization of the airport under certain delay criteria. The ANDE, which relates the operational demand to the PANCAP, expresses the total number of minutes of delay which are realized during a specific year at a specific operational level.

PHOCAP is defined as the movement rate which results in a selected average delay. For the purposes of this analysis, a three minute average delay for VFR departures, and a one minute average delay for VFR arrivals is utilized (yielding four minutes average delay per aircraft). Similarly, a four minute average delay is utilized for all IFR arrivals and departures. These criteria were established for use with general aviation airports, as described in the Airport Capacity Handbook.

The remainder of this section will discuss each step in the capacity analysis of Lunken.

(1) Determination of Operational Configurations

The initial step in determining the capacity of Lunken included the evaluation of the existing runways (see Exhibit A-7, following this page) to identify the various operating configurations in which the airport can safely and satisfactorily operate. Consideration was given to runway length requirements of the existing population, the location of the terminal, navaids, meteorological conditions, and the preferred air traffic control (ATC) operational configurations. The configurations identified in this step are shown in Exhibit A-8. While these configurations do not represent all possible ways in which the airport may be operated, they do represent all configurations which are either used at present or are practically possible. Those configurations identified by a V were analyzed for VFR weather, and those with I for IFR.

EXHIBIT A-7

Lunken Airport Master Plan

LUNKEN AIRPORT

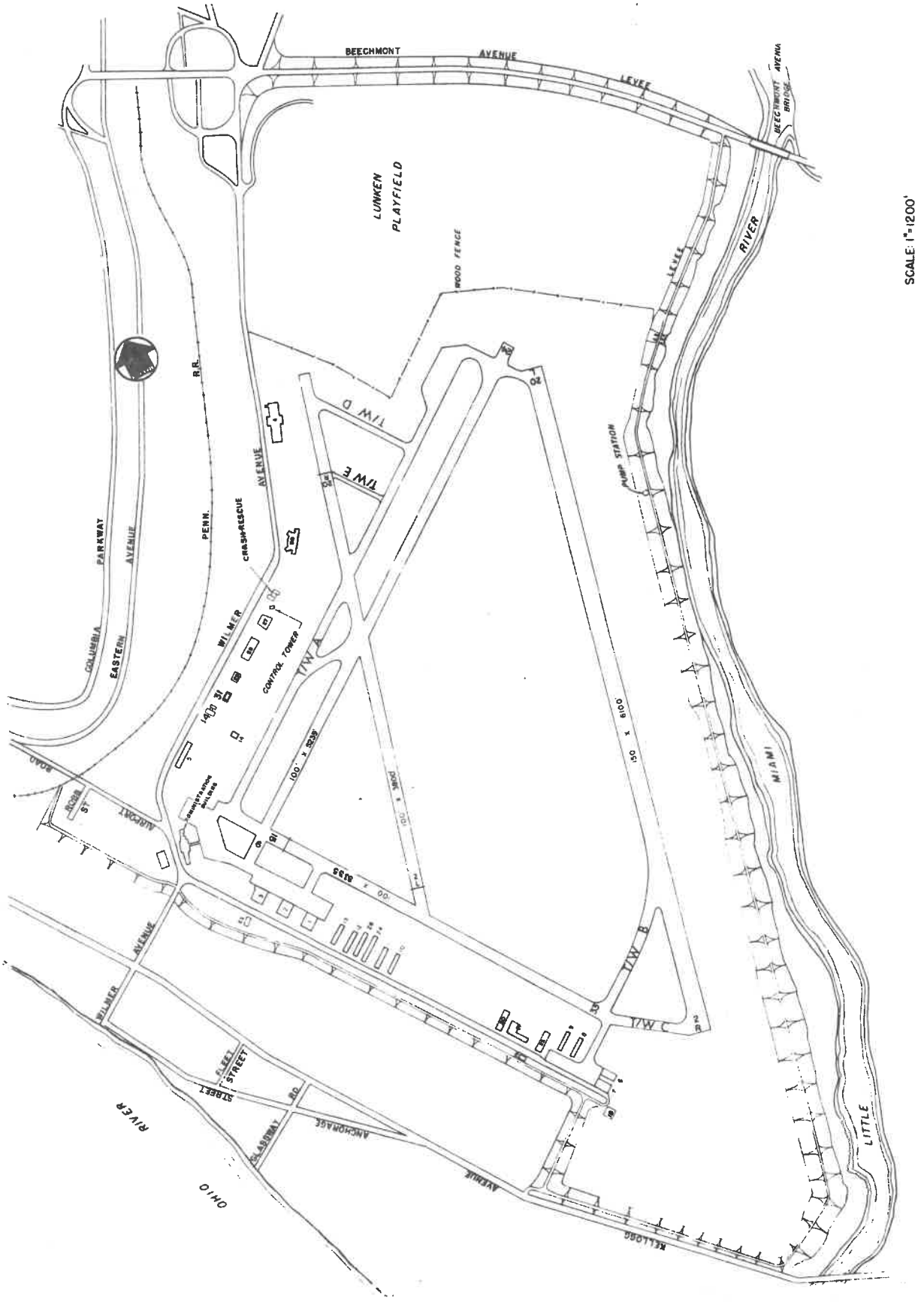
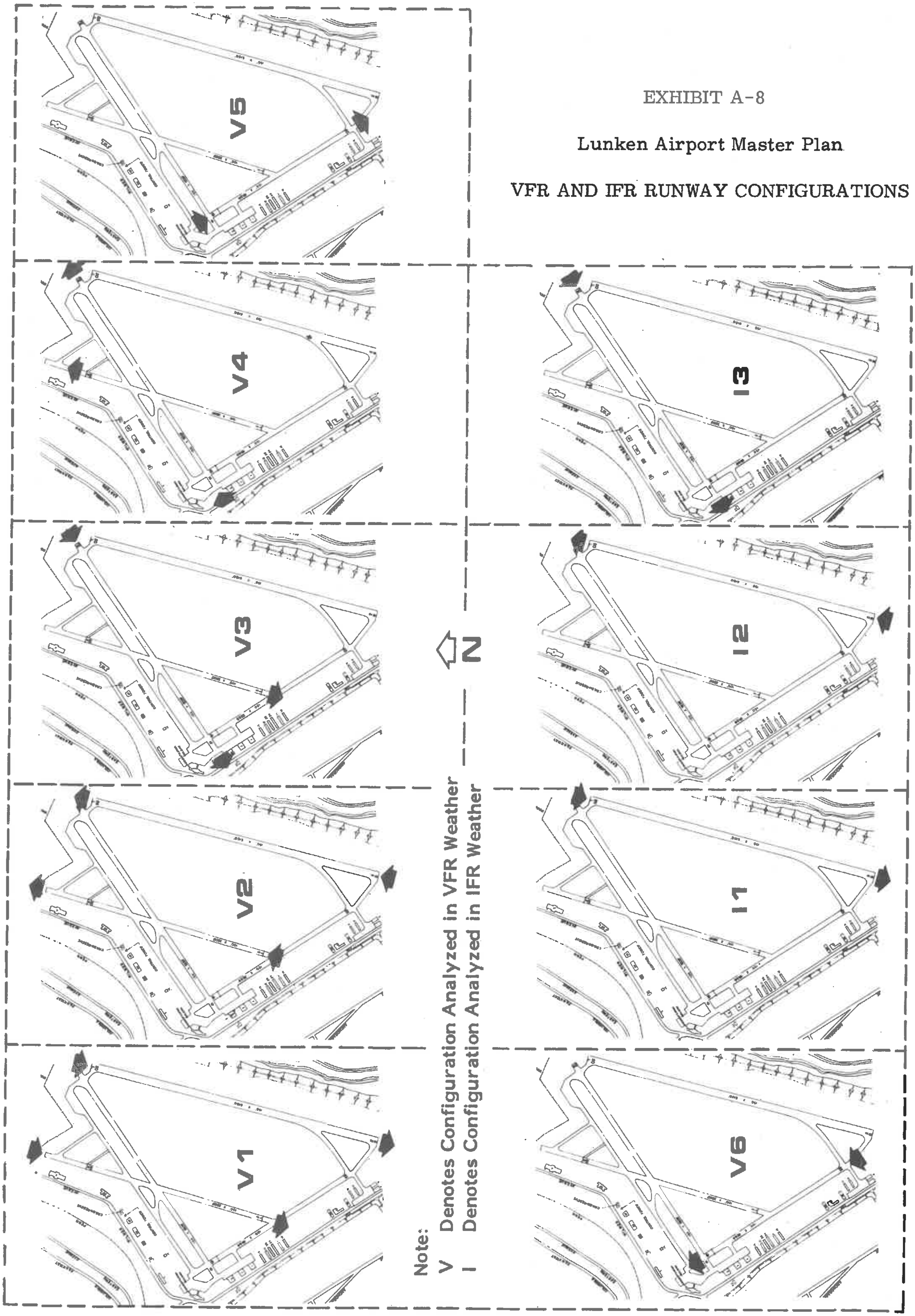


EXHIBIT A-8

Lunken Airport Master Plan

VFR AND IFR RUNWAY CONFIGURATIONS



(2) Determination of Practical Hourly Capacity (PHOCAP)

The second step in the airport capacity analysis was the determination of the practical hourly capacity of each operating configuration identified in the preceding step. To accomplish this task, PHOCAP nomographs presented in the Airport Capacity Handbook were used with specific data for Lunken, and PHOCAP values for each operational configuration were obtained. These PHOCAP's are presented in Exhibit A-9, following this page. The airport parameters input to these PHOCAP nomographs for each configuration were described in Section 1 with the exception of the ratio of arrivals to departures. No historic data were available for the distribution of arrivals and departures during particular hours of the day. Consequently, the arrival/departure ratio was assumed to be 1.0, since the number of arrivals will be approximately equal to the number of departures over the course of a normal day. The PHOCAP nomograph input parameters are listed below:

- Airspace definition (normal)
- Ratio of arrivals to departures (1.0)
- Runway ratings
- Intersection ratios
- Percentage of operations that are touch and go
- Population
- Population distribution on each runway
- Airport instrumentation
- Taxiway and runway exit locations

EXHIBIT A-9

Lunken Airport Master Plan

PHOCAPS OF RUNWAY
CONFIGURATIONS ANALYZED

Configuration Name	PHOCAP
V1	182
V2	180
V3	132
V4	120
V5	112
V4	88
I1	40
I2	40
I3	36

The PHOCAP values were subsequently used for the determination of the airport's practical annual capacity in the third step. Before leaving this step, however, it should be emphasized that the practical hourly capacities obtained in this manner are the movement rates which result in a selected average delay per aircraft for a given one-hour period. Alternatively, when the delay per aircraft is averaged over a longer period (e.g., one year for the determination of the practical annual capacity of an airport), then a certain percentage of overloaded, or peak hours, are permitted in which the demand level exceeds the PHOCAP, albeit at a higher average delay per aircraft during that peak hour.

(3) Determination of Practical Annual Capacity (PANCAP)

The practical annual capacity of an airport is reached when the annual average delay per aircraft reaches a predetermined acceptable level. Because this acceptable delay is an average however, the actual delay for any given aircraft can exeed this value.

The actual computation procedures required to develop the PANCAP for each runway configuration are also described in the Airport Capacity Handbook, mentioned previously. These

procedures determine the practical annual capacity of the airport after consideration of the following variables:

- PHOCAP of each runway configuration
- Frequency of use of each runway configuration based on an analysis of historic meteorological data.
- The average delay per aircraft and overload criteria to be used for the capacity analysis.

In effect, the PANCAP computations take the PHOCAP of each particular runway configuration, and weigh it by its expected annual frequency of use, based on an analysis of meteorological conditions (e.g., prevailing wind direction). A weighted average hourly capacity is obtained, which represents the demand level at the acceptable delay level criteria. PANCAP is then obtained by multiplying this weighted average hourly capacity by an annual airport utilization rate which relates hourly demand to annual demand under alternative assumptions regarding the level of demand peaking.

It should be noted that PANCAP may be defined at two levels:

- PANCAP at public desire utilization. This is the computed annual capacity if historic peaking patterns are permitted to continue.

- PANCAP at off-peak utilization. This is the computed annual capacity if aircraft movements are spread outside the peak periods, in order to reduce delay.

The two PANCAP measures are based on the fact that capacities are dependent not only on airport and airspace facilities, but also on the level of demand imposed upon the system. That is, delay levels increase exponentially with increased demand, resulting in higher average delays per aircraft. If, then, a level of demand can be spread over a larger period of time (i.e., away from the peak periods), a higher capacity at the acceptable delay criteria will be achieved.

At Lunken, actual public desire utilization was estimated for present patterns of use to be 2,125 hours. There is no reason to assume Lunken will ever be utilized other than by public desire; therefore, the PANCAP was defined at this level and calculated as 320,000 operations. The future addition of radar is expected to improve Lunken's IFR capability somewhat and increase this PANCAP to 324,000 operations.

(4) Determination of Annual Delay (ANDE)

The determination of annual delay (ANDE) presently experienced at Lunken involved the estimation of the total delay attributable to arriving and departing aircraft for a one-year period. The annual delay attributable to all configuations analyzed was com-

puted, assuming public desire airport utilization. The annual operational demand level used in this calculation was 177,921 (1974 operations count). Annual delay (ANDE) was estimated to be 674 hours.