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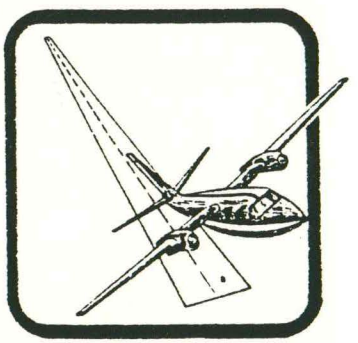

Airport Development Plan

Boone Municipal Airport

1984

Donohue & Associates, Inc.
Engineers & Architects

Donohue

October 1, 1984

Boone Airport Commission
Boone Municipal Airport
Boone, Iowa 50036

Re: Airport Development Plan
Donohue Project 12703.

Gentlemen:

It is a pleasure to present this final report of the Airport Development Plan for the Boone Municipal Airport. This report should be your guide for improving and maintaining the airport facilities in the years to come. It can also be an excellent reference for informing Boone citizens of the importance of the airport and for soliciting their support.

Since our initial investigations were completed, we are aware of several improvements which have already been made on the airport. We would like to acknowledge those improvements at this time.

-A significant crack repair program was completed in the spring of 1984 on the paved runway, connecting taxiway and terminal apron.

-Runway End Identifier Lights (REIL's) at the Runway 14 approach have been repaired. New REIL's have been installed at the Runway 32 end by the FAA at no cost to the Airport Commission.

-Landing strip markers have been removed from the Runway 14/32 strip.

-A maintenance program has been completed on the runway lights by resetting, aligning and cleaning the fixtures.

-The runway markings have been repainted.

-Dual altimeters have been installed at the UNICOM station. Lower minimums are now authorized.

-A new Nondirectional Beacon transmitter has been ordered and is scheduled for installation soon.

Donohue & Associates, Inc.
540 United Central Bank Building
Locust at Sixth
Des Moines, Iowa 50309
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515-244-1470

This impressive list of accomplishments is evidence that you are already benefiting from this report and that you are using it in the most productive possible way. You are to be congratulated for a job well done. We are confident your successes will continue.

Yours for better airports,

DONOHUE & ASSOCIATES, INC.

William H. Green
Chief Airport Engineer

MAH/ks

AIRPORT DEVELOPMENT PLAN
BOONE MUNICIPAL AIRPORT

Prepared for the:

Boone Airport Commission
Boone, Iowa

Prepared by:

Donohue & Associates, Inc.
Des Moines, Iowa

Preparation of this report was financed in part through a grant from the Iowa Department of Transportation.

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TABLES

CHAPTER 1

SUMMARY

Since its establishment in 1949, the Boone Municipal Airport has been developed to meet the needs of a growing air transportation industry. To date, the airport has physical assets netting a replacement value in excess of $1.5 million on land valued at approximately $600,000. Facilities include a 3,000 foot by 75 foot paved runway, instrument navigation facilities, and storage facilities for more than 40 aircraft. The airport serves 20,000 civil aircraft operations annually in addition to 14,000 military operations by members of the Iowa Army National Guard. The airport has a Fixed Based Operation offering a full line of services to air travelers including refueling, major and minor aircraft maintenance, flight instruction, aircraft charter, and aircraft rental and sales. The Boone Municipal Airport is a safe and modern facility offering Boone area residents convenient access to the air transportation system.

The number of aircraft based at the Boone Municipal Airport is expected to increase to 54 in the next five years and to 62 by 1992. Aircraft operations are forecast to increase to 25,000 by 1987 and to nearly 30,000 be 1992. These estimates are evidence that air transportation in the Boone area is a dynamic transportation mode of significant importance to Boone citizens. The numbers however, tell only part of the story. The air transportation industry is flying larger, faster, and more advanced aircraft every year.

Finally, as airplane owners become accustomed to air travel, they tend to upgrade periodically to more sophisticated equipment. This is particularily true in the business aviation segment of the industry. There are at least two aircraft owned by local businessmen in Boone which cannot be safely operated from the Boone Municipal Airport because of inadequate facilities. Furthermore, several businesses which regularly travel to Boone use corporate aircraft which cannot safely operate from the Boone Municipal Airport.

Improvements recommended for the Boone Municipal Airport include a 1,000 foot extension to the primary runway and a new ten unit hanger by 1988. Between 1989 and 1993, additional developments should include a taxiway parallel to the primary runway and a new modern instrument approach facility. In the next 20 years, a second paved runway should be built on the airport. In addition to the new developments recommended herein, many of the existing facilities will have to be rehabilitated or replaced in the next 20 years.

The total cost of improvements on the airport are estimated to be as follows:

1984 - 1988	$1,156,000
1989 - 1993	$1,095,000
1994 - 2003	$1,203,000

Development at the Boone Municipal Airport is eligible for state and federal aid. In the next five years, funding distribution for improvements needed at the airport is estimated to be as follows:

Federal	$ 581,400
State	$ 248,500
Local	$ 326,100

All facilities deteriorate with time and use. This aging process can be slowed considerably with a conscientious maintenance program. A maintenance program to preserve all assets on the airport to their maximum practical service life will cost approximately $30,000 per year.

CHAPTER 2

INVENTORY

HISTORY

The Boone Municipal Airport was established in 1949 on a 226-acre site east of the City of Boone. Initial development consisted of two turf runways each 2,600 feet long, one commercial hangar with administrative offices, and two six-unit "T" hangars. Initial development included a gravelled access road and gravelled taxiways. The primary runway was lighted with low intensity edge lights. A wind cone and airport beacon were also installed on the airport. Municipal water was extended from a city main to the administration building and a septic tank and drain field were installed on a site north of the administration building.

In 1960, the primary runway, Runway 14/32, was lengthened and paved 3,000 feet long by 75 feet wide. Medium Intensity Runway Lights (MIRL) were installed on this runway and the original airport beacon was replaced with a 36-inch beacon on a standard 51-foot beacon tower.

A non-directional beacon (NDB) was installed in 1967 and an instrument approach was commissioned to Runway 14. In that same year, the secondary landing strip (2/20) was extended to 3,400 feet.

In 1964, two new six-unit "T" hangars were constructed on the airport. In 1970, the original commercial hangar and administration building were replaced by larger, more modern facilities. In 1974, an additional commercial hangar with administrative offices was constructed on the airport.

Runway 14/32, the connecting taxiway, and terminal apron received a two-inch bituminous overlay in 1976.

The Iowa National Guard has been present on the airport since 1950 on a site south of the airport's terminal area. The National Guard has maintained and expanded an aviation training facility which, through three property transactions, now occupies an approximately 22-acre site.

In 1979, the City of Boone investigated several sites for a new airport to be jointly owned with the City of Ames. Following the investigation and consideration of environmental and political factors, the Boone City Council decided to retain and develop the existing airport site to meet future air service needs of the Boone area.

AIRPORT DESCRIPTION

Site

The Boone Municipal Airport is located on approximately 200 acres, on the east side of Boone within the corporate City limits. The airport property is bordered by Mamie Eisenhower Avenue on the north and by Corporal Roger Snedden Drive on the west. Property to the south and east of the airport is agricultural. Property to the north is zoned light industrial, and

to the west is primarily zoned residential. There are two parcels of privately owned property bordering the airport south of Mamie Eisenhower Avenue which are zoned for general commercial use. The airport site itself is zoned general industrial.

Soils

Soils in the vicinity of the airport consist generally of clays and silty clays with low bearing strength and high moisture content. The site is flat with slopes generally less than two percent. Natural drainage is to the south.

Existing Facilities

The airport has a paved 3,000-foot by 75-foot bituminous primary runway (14/32) and a 3,400-foot by 300-foot turfed secondary landing strip (2/20). Runway 14/32 has Medium Intensity Runway Lights (MIRL) with Runway End Identifier Lights (REIL) at the northwest end. Runway 2/20, a turf strip, has runway edge reflectors. Both runways have landing strip markers. There is a paved 30-foot wide taxiway from Runway 14/32 to the terminal area and a turf taxiway from Runway 2/20 providing access to the south hangars. All hangars have paved taxiway access. The terminal parking apron has paved tiedowns for approximately 10 aircraft. An additional 5 tiedowns are available on grass.

Pilot aids available on the airport include: a non-directional beacon (NDB) for instrument approaches, a 36-inch airport beacon for airport identification at night, a lighted eight-foot wind cone and a lighted tetrahedron for wind direction identification, and segmented circle markers with traffic pattern indicators showing nonstandard traffic for Runway 32 and Runway 2.

There are 24 individual hangar slots for small aircraft provided in four, six-unit "T" hangars. In addition, there are two commercial hangars. The north commerical hangar has approximately 80 feet by 80 feet of aircraft storage floor space. The south commercial hangar has approximately 100 feet by 100 feet of aircraft storage floor space. Both commercial hangars have administrative offices attached. The fixed base operator (FBO) operates from administrative offices in the south commercial hangar. Administrative offices in the north commercial hangar are, at present, unoccupied.

The FBO operates a UNICOM radio on VHF frequency 123.0 for dispensing wind and traffic information during hours of operation. The FBO has access to wind speed/direction instruments at the UNICOM station.

Ground access to the terminal area is provided by a 20-foot wide, paved horseshoe shaped roadway from Corporal Roger Snedden Drive. Vehicle parking is available for approximately 30 cars.

There is an aircraft refueling system immediately east of the south commercial hangar consisting of two underground 8,000-gallon storage tanks and two above-surface fuel pumping stations which dispense 100-octane low lead, and jet fuel. Eighty-octane fuel is also available on the airport.

Water and sanitary sewer service is provided from City utilities.

The airport has NDB instrument approaches to Runways 14 and 32. The minimum descent altitude authorized on the Runway 14 approach is 753 feet above ground level (AGL). The minimum authorized descent altitude on the Runway 32 approach is 893 feet AGL. The Runway 32 approach can be reduced to 553 feet with radar assistance from Des Moines Approach Control.

Condition of Facilities

Runway 14/32 has excellent riding qualities and good drainage indicating adequate pavement strength. However, the pavement has a great deal of random cracking throughout its length. The most severe transverse shrinkage cracks were repaired in 1981. The connecting taxiway and terminal tiedown ramp exhibit similar cracking distress. Taxiways to the "T" hangar areas have deteriorated from age and lack of attention to a poor condition. The access road and vehicle parking areas are in poor to good condition with several sections showing severe distress. Pavement conditions are described in more detail in Table 2-1 and on Figure 2-1.

Runway and taxiway lights on the airport are in need of considerable maintenance. Many stake-mounted light fixtures have been raised by frost so that stakes are exposed 8 to 10 inches above the surface. This condition constitutes a hazard in the runway safety area. Runway light fixtures, in general, are not properly aligned to the runway. A few fixtures are in a poor state of repair and all lenses should be cleaned. Runway threshhold lights are not fitted with "split" lenses as prescribed by the FAA. Runway End Identifier Lights (REIL) at the northwest end of Runway 14/32 are out of service.

Runway strip markers and segmented circle markers are in good to excellent condition with very few exceptions. Strip markers on the west side of Runway 2/20 define a runway edge such that a runway light and taxiway edge light from Runway 14/32 are located within the landing strip boundary. Consequently, these lights are theoretically obstructions to traffic using Runway 2/20.

Runway strip markers are being maintained along the edges of Runway 14/32 safety area. Use of strip markers on paved runways is not advisable since they imply that all area within their boundaries is safe for landing of aircraft. In fact, runway edge lights and REILs are obstructions to safe landing outside the confines of the paved surface. The runway safety area, which the landing strip markers outline, is required only to accommodate the occasional passage of aircraft without causing major damage. In short, the presence of landing strip markers on Runway 14/32 advertises a condition that does not exist and may expose the Airport Commission to increased legal liability.

Runway and taxiway markings are visible in daylight hours but have deteriorated to the point where they are of little use during periods of adverse weather and darkness.

TABLE 2-1

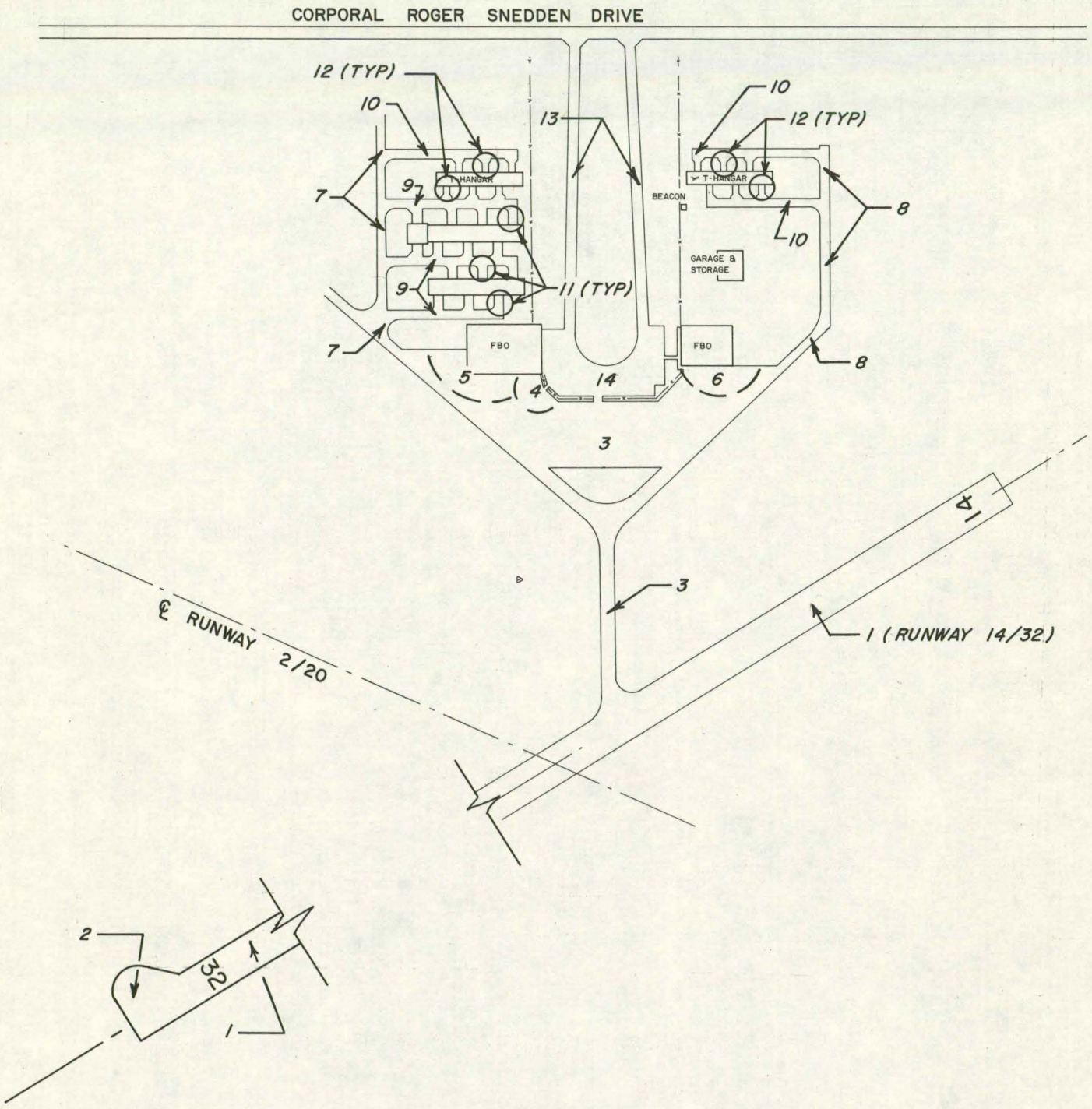
PAVEMENT EVALUATION
Boone Municipal Airport
(Visual Inspection - December 1982)

Area* Number	Item	Pavement Description	Distress Types	Amount
1.	Runway 14/32 (3000' x 75')	2" P-401 Bituminous Overlay (1977)	Random Cracks <1/4"	8000 lf
		2" P-401 Bituminous Pavement On 8" P208 Aggregate Base (1960)	Random Cracks 1/4" <3/4"	6000 lf
			Transverse Crack Patches	1875 lf
			Stress Cracks	5000 sf
2.	Turnaround SE End Rwy 14/32 (8000 sf)	Portland Cement Concrete	Joint Spalling	40 lf
			Slab Settlement	30 sf
			Cracks in Slab	30 lf
3.	Center Taxiway & Tiedown Apron (720'x30') (63000 sf)	Same as Runway 14/32	Random Cracks <1/4"	1500 lf
			Random Cracks 1/4" <3/4"	2000 lf
			Random Cracks >3/4"	800 lf
			Stress Cracks	100 sf
4.	Refueling Pad (3500 sf)	Portland Cement Concrete	Slab Settlement	230 sf
			Cracks in Slab	50 lf
5.	South FBO Hangar			
	- Door Approach (900 sf)	1-1/2" Bituminous Overlay	Random Cracks <1/4"	20 lf
	- Extended Approach (1800 sf)	Bituminous Seal Coat	Advanced Deterioration	1500 sf
	- Perimeter Pavement (7000 sf)	Bitiminous Overlay	Random Cracks <1/4"	100 lf
			Random Cracks 1/4" <3/4"	60 lf
6.	North FBO Hangar Approach (8500 sf)	Seal Coat Over Bituminous	Alligator Cracks - Severe	100 sf
7.	South Perimeter Taxiway (18' x 570')	Bituminous Hot Mix Over Aggregate Base Course	Edge Cracks - Severe	600 lf
			Rutting - Minor	400 lf
			Alligator Cracking - Severe	2500 sf

TABLE 2-1
(Continued)

Area* Number	Item	Pavement Description	Distress Types	Amount
8.	North Perimeter Taxiway	200'x25' Bituminous Hot Mix (1" Overlay) 370'x18' Seal Coat	Random Cracks <1/4" Random Cracks 1/4" <3/4" Advanced Deterioration w/Vegetation	100 lf 50 lf 6000 sf
9.	Taxiways to Large "T" Hangars (3 each)	2 @ 265'x18' 1" Hot Mix Over Portland Cement Concrete 1 @ 235'x18' Portland Cement Concrete	Reflective Cracks w/Vegetation Sawed Joints Cracks in Slab	800 lf 200 lf 200 lf
10.	Taxiways to Small "T" Hangars (3 each)	1 @ 265'x18' 1" Hot Mix Over Portland Cement Concrete 1 @ 260'x18' Portland Cement Concrete 1 @ 230'x18' Portland Cement Concrete	Reflective Cracks w/Vegetation Cracks in Slab w/Vegetation Surface Spalling	500 lf 1200 lf 160 sf
11.	Approaches to Large "T" Hangars (12 @ 18' x 28')	6000 sf Portland Cement Concrete	Cracks in Slab w/Vegetation	400 lf
12.	Approaches to Small "T" Hangars (12 @ 12' x 27')	4000 sf Portland Cement Concrete	Cracks in Slab w/Vegetation Surface Spalling	400 lf 60 sf
13.	Access Road (2 @ 540' x 20')	Bituminous Pavement Over Agg. Base Course With One or More Bituminous Overlay	Random Cracks <1/4" Random Cracks 1/4" <3/4" Random Cracks >3/4" Edge Cracks - Severe Alligator Cracks - Light Alligator Cracks - Moderate Alligator Cracks - Severe	1000 lf 200 lf 160 lf 100 lf 50 sf 200 sf 2500 sf
14.	Parking and Turnaround (24000 sf)	Bituminous Pavement Over Aggregate Base Course - North Half Has Bituminous Overlay	Random Cracks <1/4" Random Cracks 1/4" <3/4" Random Cracks >3/4" Alligator Cracks - Moderate Alligator Cracks - Severe	200 lf 300 lf 200 lf 200 sf 23000 sf

*See Figure 2-1



Donohue

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FEB. 1984

Engineers & Architects

PAVEMENT EVALUATION AREAS

NORTH

0 100 200 300

AIRPORT DEVELOPMENT PLAN

BOONE MUNICIPAL AIRPORT

FIGURE 2-1

Several landing strip reflectors on Runway 2/20 are missing and many of the remaining reflectors are not properly aligned. This condition makes identification of Runway 2/20 during hours of darkness by use of reflectors marginal at best. In fact, there are no airport standards which permit use of reflectors to outline a landing runway at night. The existence of reflectors on Runway 2/20 constitutes an invitation to pilots to use an unlighted runway. This condition may expose the Airport Commission to increased legal liability.

The lighted wind cone is serviceable and appears to be in excellent condition. The wind tetrahedron is also serviceable.

The 36-inch airport beacon and tower are serviceable and appear to be in excellent condition. The beacon emits two rotating beams of light (white and green) spaced 180° apart to help the pilots visually identify the location of the airport.

The NDB is serviceable, but is an obsolete tube-type design. The NDB antenna and housing are in serviceable condition.

All buildings in the terminal area appear to be in fair to excellent condition.

The Runway 14 NDB approach procedure has a minimum descent altitude (MDA) of 753 feet AGL. This relatively high minimum altitude results from a combination of factors. One factor is a tower with an elevation of 1,409 feet above mean sea level (MSL) approximately 9 miles northwest of the airport in the approach path. The minimum approach altitude is required to be 350 feet above the highest obstruction within the approach corridor. An additional 135-foot penalty is assessed because current altimeter settings are not available on the field. The resulting elevation is then rounded up to the next even increment of 10 feet. The Runway 32 NDB approach altitude is established in a similar manner with a 1,538-foot MSL obstruction within the approach corridor approximately four miles southeast of the airport. This procedure, however, has provision for a lower MDA concurrent with a radar fix from Des Moines Approach Control. The MDA without radar assistance is 893 feet AGL. With a radar fix, the MDA is 553 feet AGL for straight in approach.

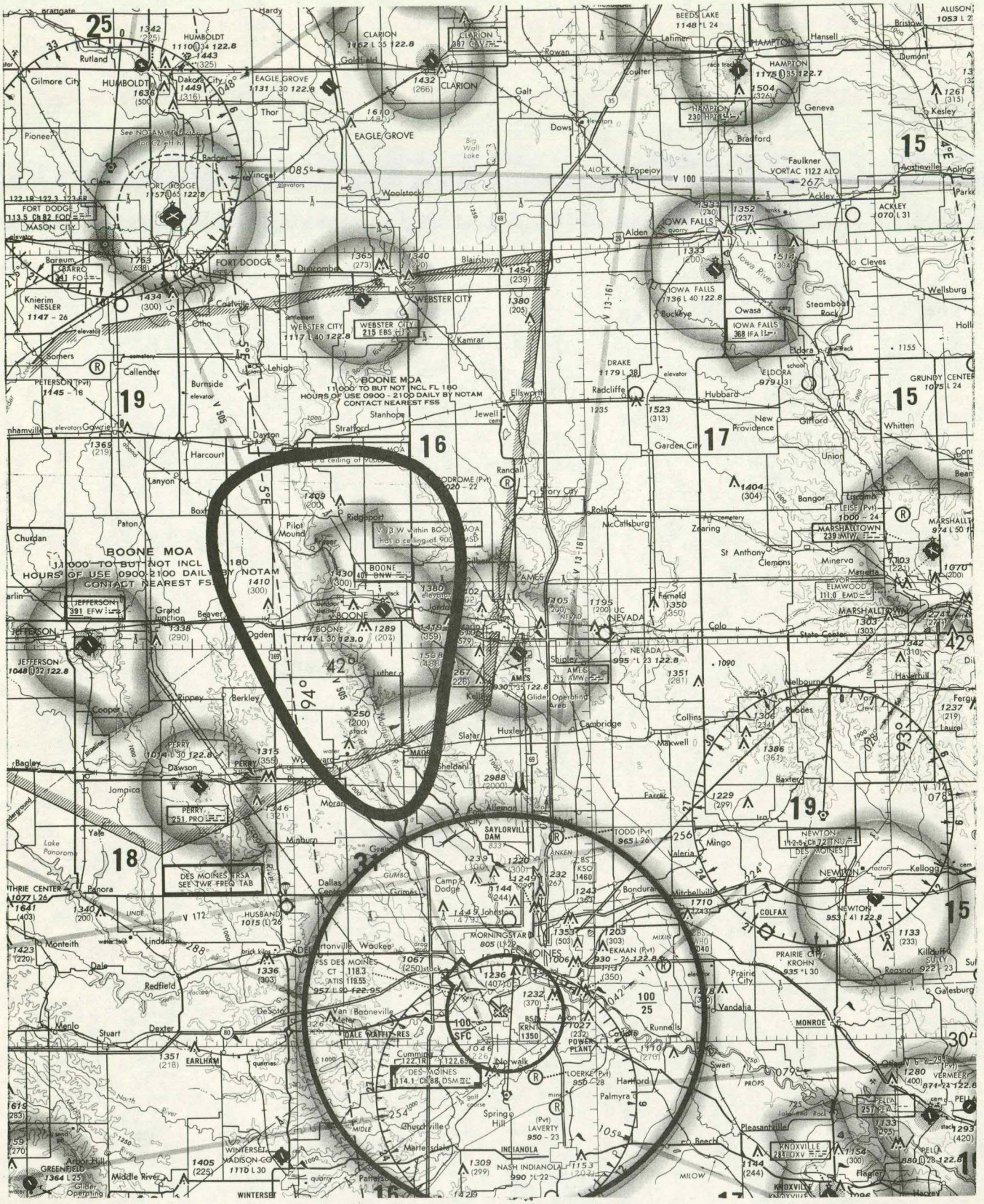
Airport Layout Plan

The current Airport Layout Plan (ALP) for the Boone Municipal Airport was prepared by Eschliman Engineering, Inc., in 1974. The plan calls for ultimate development of Runway 14/32 to 5,000 feet by 100 feet with a secondary paved runway (2/20) 4,100 feet by 75 feet. Runway 14/32 would be constructed to accommodate 30,000-pound aircraft. Both runways are planned for development of parallel taxiways. The initial stage of plan development indicates a Runway 14/32 extension to 4,100 feet by 75 feet wide.

AVIATION ENVIRONMENT

Service Area

The service area of the Boone Municipal Airport is shown on Figure 2-2. The service area was plotted from points equal distance between the Boone Municipal Airport and airports having similar or "competitive" facilities. Airports influencing the service area include Webster City, 25 nautical miles



Donohue

12703
1983

Engineers & Architects

AIRPORT SERVICE AREA

AIRPORT DEVELOPMENT PLAN
BOONE MUNICIPAL AIRPORT

N

0 5 15 MI.

Figure 2-2

north, Ames, 10 nautical miles east; Des Moines, 31 nautical miles south, Perry, 19 nautical miles southwest; and Jefferson, 22 nautical miles west. The Fort Dodge Municipal Airport 33 nautical miles northwest of Boone exhibits some influence on Boone traffic due to its better instrument approach facilities.

There are two airports within 35 nautical miles of Boone which offer scheduled passenger service. They are the Des Moines Municipal Airport, 33 nautical miles south, and the Fort Dodge Municipal Airport, 34 nautical miles northwest. Fort Dodge offers scheduled commuter airline service. Des Moines is the only facility within reasonable driving distance from Boone which offers full jet passenger service by major carriers. Therefore, the majority of Boone citizens using scheduled passenger service originate and terminate their flights at the Des Moines Municipal Airport.

Aircraft and Operations

There were 47 civil aircraft based at the Boone Municipal Airport as of May 6, 1983. Among these are 6 light twin engine aircraft. Eighteen of the aircraft are considered to be "business aircraft." In addition, the Iowa Army National Guard bases 14 helicopters and 1 light twin engine airplane at the Airport. A list of these based aircraft is included as Appendix A. The listing identifies the make, model, and N number of the aircraft.

In September, 1982, the FAA estimated 18,000 general aviation operations from the Boone Municipal Airport. These include 10,000 local and 8,000 itinerant operations. In addition, FAA estimated 800 air taxi operations and 8,000 military operations. An operation consists of one landing or one take off from the airport.

SOCIOECONOMIC FACTORS

Population

The population of Boone, Iowa, has remained virtually stable since 1940. A gradual increase in industrialization in Boone with its inherent effect on the population has been offset, in part, by the decrease in railroad activity in the City. The County population, also, has been very stable over the past 40 years. The 1980 population of Boone was 12,602 and Boone County was at 26,184. The population is projected to remain stable through the year 2000.

The City has a very low proportion of minorities. According to a 1980 estimate, only one percent of the population is minority.

The City has a relatively high representation of persons over 65 years of age. Approximately 20 percent of the population of Boone is 65 or older.

The average educational level of Boone residents is quite high. Approximately 70 percent of all persons in Boone over 25 years of age, have at least a four-year high school education.

Economy

The City of Boone is the major retail center for the central portion of Boone County. Boone's trade area is influenced primarily by the City of Ames to the east, the Des Moines metropolitan area to the south, and the City of Fort Dodge to the north. Consequently, Boone's trade area can be approximated as being the same as the boundaries of Boone County. A recent study prepared by the Central Iowa Regional Association of Local Governments (CIRALG) forecasts that Boone's total sales index will increase by 50 percent by the year 2000. The report indicates that towns with population less than 500 will lose influence of retail activities to larger cities such as Boone in that period.

The City of Boone is actively promoting the Boone area as an attractive site for industry.

LAWS AND ORDINANCES

Federal

The use of air space in the United States is regulated exclusively by the federal government, administered by the Federal Aviation Administration (FAA). Air space regulation has a major influence on airports because approaches to runways and air space in the immediate vicinity of airports must be obstacle free as prescribed by law. Obstacle clearance requirements dictate, to some extent, runway orientation and length, building setbacks from runways, and the suitability of instrument approaches to the airport. These air space laws do not specifically regulate the development of structures on the ground, but they do regulate the suitability of air space for aeronautical purposes. It is the owner's responsibility to maintain this prescribed air space free of obstructions as a precedent to retaining air transportation service at the airport.

In order to bring the convenience of air transportation to the people of the United States, Congress enacts laws to ensure adequate financing of safe and serviceable airport facilities. In 1970 a comprehensive aviation law was enacted which taxes users of air transportation facilities. Revenues obtained from that taxation go into an Aviation Trust Fund from which the Congress authorizes expenditures for airport development.

In order to ensure a system of safe and serviceable airports throughout the country, the FAA has established comprehensive standards to which airports developed with federal aid must adhere. Although these standards are only imposed by agreement with an airport owner in exchange for federal aid for development, they are widely recognized as reasonable standards for application to any airport facility developed and offered for use by the general public.

The most recent legislation enacted by Congress to ensure continued air transportation service in America is the Airport and Airways Improvements Act of 1982. One provision of this Act prescribes an Airport Improvements Program (AIP) authorizing prescribed amounts annually for the continued improvement of safe and serviceable airports.

In order to be eligible for federal aid for airport improvements, the owner must meet certain criteria. Two of these are that the Airport must be included in the National Airport System Plan (retitled National Plan of Integrated Airport Systems under the Airport and Airways Improvements Act). Another requirement is that the owner prepare an Airport Layout Plan showing development intentions for a 20-year period. When a significant expansion of facilities is contemplated, the FAA requires an environmental assessment of potential impacts of the expansion as a prerequisite to receiving federal aid. Requests for federal assistance are submitted by an airport owner to the local office of the FAA in the form of a preapplication. The local FAA office with jurisdiction in Iowa is the Central Region office in Kansas City, Missouri.

The Boone Municipal Airport is included in the National Airport System Plan as a basic utility airport to be developed to general utility status.

State

Chapter 328 of the Iowa Code describes the role of the Iowa Department of Transportation in regulating, taxing, and improving aviation in the state. Taxes are collected in the form of aircraft registration fees and aviation fuel taxes. Aircraft are registered by the Iowa Aeronautics Division. Aviation fuel is taxed automatically under a state law designed for taxation of vehicular fuels for highway use. The aviation fuel tax is reimbursible to an aircraft operator by application to the Department of Revenue. Money collected from the sale of aviation fuel which is not reimbursed is channeled to the State Aviation Fund for use in improving aviation safety and airport service in Iowa.

Financial assistance is made available to owners of publically owned Iowa airports by the Department of Transportation from the State Aviation Fund. The state participates in approved planning projects and airport improvement projects in a ratio of 70 percent state to 30 percent local funding. Technical assistance and administration for airport planning is provided through the Planning and Research Division, and technical assistance and administration of construction projects is provided through the Aeronautics Division. Funding for small projects is available, through the Aeronautics Division, for safety projects not exceeding $10,000 on a 50 percent state, 50 percent local funding basis.

The state periodically publishes an aviation system plan which outlines air service needs of the state, identifies airport facilities required to meet these needs, and forecasts the cost of developments required to provide necessary facilities. The Boone Municipal Airport has been identified by the state as one of the Airports required to provide air service in Iowa.

Under the provisions of Chapter 328, the Department of Transportation issues certificates of registration to all airports in the state which are open for use by the public. The certificate requires compliance with minimum standards of safety established by the Department. Certificates of registration are renewed annually. The Boone Municipal Airport is registered and meets safety requirements of the Iowa Department of Transportation.

City

The City of Boone has vested responsibility for administration of the municipal airport in an Airport Commission formed under provisions of Chapter 330 of the Iowa Code and adopted by City ordinance on September 7, 1965. Under provisions of this ordinance each Commissioner serves for a period of six years. Appointments are made at regular intervals by the Mayor.

The Commission has all of the powers granted to cities except power to sell the airport. All funds derived from operation of the airport remain under control of the Commission. Additional funds, if required, are appropriated to the airport budget by the City Council.

In June, 1982, the City and Boone County adopted airport zoning ordinances in accordance with Chapter 329 of the Iowa Code. The zoning regulations limit the height of structures beneath imaginary air space surfaces defined in Federal Aviation Regulation Part 77. Surfaces defined in the ordinance are those consistent with anticipated airport developments outlined in the Airport Layout Plan.

These zoning regulations will protect the airport environment against future encroachments of structures and trees into air space needed for the safe operation of aircraft at the Boone Municipal Airport. It provides, however, a significantly lower level of protection than fee title or easements purchased on property beneath the air space requiring protection. Fee title and easements ensure virtually absolute control of obstructions. Persons subject to the airport zoning regulation may apply for variance to a Board of Adjustment which decision could result in an obstruction being legally constructed.

FINANCIAL HISTORY

Federal Aid

Federal assistance has been used in every major development at the Boone Municipal Airport, except that no federal assistance has been provided for hangars or buildings. Federal aid was provided for acquisition of the land on which the airport rests, for development of the original turf runways, for construction of the paved all-weather runway, and for the recent runway overlay. A summary of federal aid to the Boone Municipal Airport is shown on Table 2-2.

TABLE 2-2

FEDERAL AID

Year	Amount
1947	$ 44,927
1949	10,219
1960	61,665
1976	112,500

State Aid

State aid has been available in smaller amounts since 1958 for such improvements as: extending the turf strip (2/20) to 3,400 feet, installing the NDB, installing a UNICOM radio and wind instruments, and assisting on the major projects mentioned earlier. A summary of state aid to the Boone Municipal Airport is shown on Table 2-3.

TABLE 2-3

STATE AID

Year	Amount	Year	Amount
1958	$ 238.00	1969	$5,182.08
1961	361.75	1971	1,480.50
1963	3,121.59	1972	1,300.00
1967	1,212.65	1973	304.50
1968	1,000.00	1974	5,000.00

The Airport Commission has entered into two leases on the airport which bring revenue to the City. The Commission leases approximately 92 acres of airport property for agricultural purposes. This lease is renewable annually. The Airport Commission has a lease with a Fixed Base Operator (FBO) on the field which prescribes conditions and privileges under which the operator may use airport facilities for flight training, aircraft maintenance, aircraft charter and rental, and servicing of aircraft. This lease is a ten-year lease with a ten-year FBO option and a provision for negotiation of rental amounts after five years. This lease was executed in 1981.

Tables 2-4 and 2-5 present summaries of annual receipts and disbursements at the airport since 1960.

TABLE 2-4

AIRPORT RECEIPTS - 1960 TO PRESENT

Year	Receipts	Subsidy	Farm Rent	IARNG Rent	Facilities Rent	Sale of Bonds	Gov't Grant
FY82	33,060	10,000	10,200	3,150	9,000		
81	61,160	10,000	10,919	1,620	13,700		
80	36,423	10,000	15,197	3,150	7,000		
79	30,870	9,000	9,303	2,520	6,291		
78	265,966	8,250	5,667	2,520	4,606	50,000	101,151[2]
77	129,674	8,250	6,436	2,520	4,890	75,000	10,267[2]
76	44,785	8,250	15,449	2,520	4,451		
Note 1							
75	42,668	12,375	1,860	3,780	6,900		
1973	38,191	8,362	14,270	2,520	4,600		5,000[3]
1972	21,357	8,288	2,612	2,520	2,700		1,300[3]
1971	23,221	8,335	4,099	2,520	3,300		
1970	60,008	8,307	5,471	2,520	1,100	28,000	
1969	23,777	10,018	3,005	2,520	1,100		
1968	26,216	7,543	4,447	2,520	600		5,000[3]
1967	20,789	6,794	6,992	2,520	1,500		2,213[3]
1966	14,809	6,691	3,675	2,520	900		
1965	28,361	2,853	4,002	2,520	875	14,000	
1964	23,079	11,656	4,032	2,520	420		
1963	23,467	11,783	2,642	2,520	420		
1962	25,502	11,805	4,972	2,520	420		6,284[2]
1961	18,109	11,699	2,399	2,520	420		
1960	167,123	6,504	1,767	2,100	420	85,501	55,381[2]

Note 1 - FY 75 was transition year from January 1, 1974 to June 30, 1975
2 - Federal Aid
3 - State Aid

TABLE 2-5

AIRPORT DISBURSEMENTS - 1960 TO PRESENT

Year	Disbursements	Utilities	Services[2]	Bonds	Repairs/ Improvements
82	31,311	2,506	2,392	5,000	15,832
81	57,904	2,317	9,956	5,000	38,336
80	15,991	2,214	2,968	5,000	2,981
79	30,119	1,857	5,483	5,000	9,684
78	262,811	1,798	6,515	770	251,596
77	40,824	1,438	4,315	--	32,486
76	42,109	1,470	2,383	12,000	--
Note 1					
75	29,291	1,967	10,953	4,000	7,742
1973	21,313	1,038	259	4,000	12,604
1972	18,188	1,045	1,516	4,000	8,976
1971	19,549	942	2,138	8,000	4,889
1970	55,432	338	785	2,000	49,848
1969	11,044	978	2,500	--	4,644
1968	19,925	725	230	2,000	15,081
1967	14,852	775	1,781	4,000	5,678
1966	14,039	769	1,800	2,000	7,112
1965	27,384	808	2,068	--	23,157
1964	19,275	671	1,696	7,000	5,873
1963	19,084	720	5,063	7,000	3,004
1962	19,530	655	2,019	7,000	5,844
1961	18,648	566	1,433	7,000	4,873
1960	166,331	413	1,324	7,000	153,844

Note 1 - FY75 was transition year from January 1, 1974 to June 30, 1975
2 - Includes insurance and maintenance equipment

CHAPTER 3

AVIATION FORECASTS

INTRODUCTION

This chapter presents the forecasts of future activity at the Boone Municipal Airport. Forecasting aviation activity is one of the most important aspects of the development plan. From the forecasts, the relationship between demand and the existing airport facilities can be established and future airport requirements can be determined.

Aviation forecasting is, at best, an inexact science. Forecasting techniques commonly used by planners include: (1) trend forecasting - a technique based on past experience at a facility, (2) base forecasting - based on assumptions that local air traffic will vary similarly with national forecasts, (3) expectation forecasts - based on published judgments of aviation "experts," and (4) judgment - the planners anticipation of future activity based on past experience at similar airports. All of these forecasting methods make assumptions of future conditions.

The safest position for a planner to take is to assume that future conditions will simulate conditions of the past. Consequently trend forecasts and base forecasts are commonly used. However, since the future does not often simulate the past, these forecasting techniques sometimes prove to be inaccurate. On the other hand, basing forecasts of the future strictly on the judgment of an individual or group of individuals is a risky business. Credible forecasting depends upon a judicious blending of historical projection and judgment.

It is important that the planners' forecasting procedures are presented in such a way that they can be understood by airport administrators. Understanding forecasts is a necessary prerequisite for an administrator to support facility requirements which are the basis of the plan. This support of facility requirements is, in turn, a prerequisite to an orderly development of airport facilities to meet the air service needs of the area.

Standard planning procedure for airports dictates that forecasts be made for 5, 10, and 20-year periods. Long-range planning is important primarily to protect land and air space which may be needed to meet future airport requirements. The 20-year forecast should be used by airport administrators for this purpose. When long-range forecasts are interpreted as dictating requirements for airport expansion, the credibility of the plan can be compromised, sometimes to the extent that the plan is abandoned. Administrators can guard against this interpretation by working to implement facility requirements recommended in the first five-year period of the plan. Then continually evaluating anticipated improvements in the 10-year planning period against evolving conditions, and working to ensure that land and air space identified as potentially required for long-range development will be available if needed. Depending upon the variance of conditions influencing the airport from planning forecasts, an airport plan may need updating at 5 to 10-year intervals.

INFLUENCING FACTORS

Population

Population trends give a planner an indication of whether an area will be dynamically expansive, relatively stable, or on a decline. Population is probably the most common indicator used by planners for any forecasting purpose. Demand for air transportation does not, however, parallel population trends. The emergence of the aviation industry as a safe, reliable means of transportation offering speed, convenience, and prestige has resulted in a steady increase in the percentage of the population which relies on or participates in air transportation.

The population of the City of Boone has been virtually stable for the past 40 years and is expected to remain stable or increase slightly through the planning period. The 1980 census indicates that the population of Boone increased slightly from 1970. Boone's growth is similar to other rural communities in the corn belt, which experienced a two to seven percent change from 1970-1980. The national trend, indicated by the 1980 census, showed that in the aggregate, people had stopped leaving rural areas as they had been doing since World War II.

A stable population leads to anticipation of a gradual increase in air transportation requirements at the Boone Municipal Airport.

Industrial Mix

Statistics through the past 40 years have shown a gradual change in Boone's financial base from agricultural toward commercial and industrial. Although this transition has been much slower in the Boone area than at the State and National level, the trend has been consistent. Boone continues to be a farming support community, but there is growing awareness that the economic welfare of the community depends on its ability to attract commercial business and light industry. To this end, the Boone Chamber of Commerce operates an Industrial Development Commission dedicated to attracting industry to Boone.

The Executive Vice President of the Chamber of Commerce and a leader of the Industrial Commission is optimistic about Boone's ability to attract industry. The City's close proximity to Iowa State University makes Boone an attractive site for "high technology" industry. Boone's historical status as a railroad town may lead to significant railroad industrialization following a recent judgment that the Chicago & Northwestern railway will be allowed to purchase assets of the bankrupt Rock Island Line. Three industries in Boone have expanded recently and several others are planning expansion in the near future. Most industrial prospects consider air service potential from the local airport to be an essential factor in their evaluation of the community.

The prospect for Boone to attract a major industry seems remote unless major railroad development occurs. However, it is reasonable to expect that the City will be successful in attracting small industries and that existing commercial businesses and industries will expand and modernize their transportation philosophies. It is reasonable to forecast that the business community in Boone will continue to increase its use of air transportation and that the rate of increase will to some extent be a function of the availability of air service at the Boone Municipal Airport.

Area Economy

The Boone area enjoys a very stable economy relative to State and National averages. Its roots in agriculture provide an economic base which gives protection against radical fluctuation. The same factors which protect Boone from high unemployment among its citizens and rapid turnover in business are at work to dampen potential for explosive economic expansion. Notwithstanding the temporary turndown of the economy experienced in the past three years, Boone citizens enjoy, along with our society in general, an improving standard of living with a corresponding increase in disposable income. The average per capita income of citizens in Boone County is slightly above the average for the State of Iowa.

The forecast of economic conditions in the Boone area is for continued stability with a trend toward economic growth generating an increase in individual disposal income and continued industrial expansion. There is a latent citizen demand for recreational outlets and a commercial inclination toward expansion and modernization which have, to a great extent, been stifled by the recent recession. These demands will be met as soon as a recovering economy permits. We anticipate a significant increase in student flying, aircraft sales, and business aircraft use at the Boone Municipal Airport in the next five years.

Competition For Aviation Activity

An airport has only one function. It brings air service to an area. The degree to which an airport serves the air transportation requirements of the community measures the success of the airport. Each airport has a potential market unique to its area. It is imperative that this market be identified and airport facilities and services be developed to reach as much of the potential market as is economically feasible.

A major consideration in identifying an airport's potential market is an assessment of other airports in the service area. This plan evaluates other airports to determine which services should be offered at the Boone airport, and which are best provided from another airport.

All airports within about 30 miles of Boone have an influence on air traffic at Boone. Those offering equal or lower level service affect the amount of traffic and the size and shape of the service area. Those which offer higher levels of service than are available at Boone affect not only the service area but the kinds of service which Boone might reasonably offer. Three airports which offer higher levels of service are Ames, Des Moines, and Fort Dodge.

The Ames Municipal Airport has a very high potential for expansion based on present and forecast activities. It is likely that the Ames Municipal Airport will significantly expand its facilities in the next five to ten years. Anticipated facilities will include a hard surfaced runway long enough to accommodate intermediate sized commercial jet aircraft. The airport already has a localizer for non-precision instrument approachs. This approach may be upgraded to full ILS with glide slope in the future.

The Des Moines Municipal Airport has all facilities required for any aircraft in the domestic fleet. It has a full complement of instrument approaches, including full ILS, and radar. The Des Moines Airport offers air passenger service by several major air carriers and commuter airlines. Passenger connections are offered to virtually any destination with a wide choice of arrival and departure times between 6:00 a.m. and 11:00 p.m. daily.

The Fort Dodge Municipal Airport has runway facilities to accommodate most aircraft in the commercial fleet. It offers a full ILS approach and commuter air carrier passenger service with limited arrival and departure options.

Given these area airports, the potential for scheduled passenger service at Boone is remote. The 1982 Iowa Aviation System Plan reports that Boone has a daily passenger potential of 9 persons. However, Boone's proximity to Des Moines indicates it could not "generate a significant number of passengers in the face of competition" to support scheduled service.

The Ames Municipal Airport will almost certainly develop in the near future to accommodate up to 90 percent of aircraft in the business aviation fleet. In light of this probability, it seems unlikely that Boone could reasonably compete for significant volumes of business jet traffic. Existing industry at Boone generates relatively small demand for jet operations and the cost to develop facilities to accommodate such infrequent activity would be extensive.

FORECASTING PARAMETERS

Facilities required at the Boone Municipal Airport are determined by forecasts of based aircraft, aircraft operations, and types of aircraft which will use the airport. Runway length, strength, and width are dependent upon types of aircraft. The need for parallel taxiways, instrument approaches, and parking areas is a function of operations. Requirements for hangars and tiedown areas are influenced by based aircraft and operations.

Based Aircraft

The 1976 Iowa Airport System Plan (IASP) forecast indicates 42 based aircraft at Boone by 1982. The 1978 IASP Update forecasts 28 based aircraft by 1982. The 1980 National Airport System Plan (NASP) forecast indicates 32 based aircraft by 1982. A December, 1982, count revealed 47 aircraft based at the airport.

The disparity between recent forecasts by both State and FAA planners and actual based aircraft at Boone is worthy of note. The significantly greater number of actual based aircraft would seem dramatic, particularly under conditions of reduced aviation activity brought on by the strained economy of

the past three years. Earlier forecasts may have been based on aircraft registration records which do not reflect aircraft owned by the FBO for resale. Numbers of based aircraft at an airport can vary from year to year, also. Table 3-1 presents a review of FAA 5010 inspection records at Boone in the last five years.

Still another factor must be considered. There is considerable opportunity for error in estimating based aircraft. Estimates are made in various ways from physical counts, to visits with FBOs to mere statistical analysis based upon a sampling of counts state-wide. The forecasts in this plan use actual aircraft counts for the base year, 1982.

Forecasts of future based aircraft are crucial to facility planning for hangars and tiedown areas. The 1976 IASP forecasts based aircraft increases of about one aircraft per year until 1985, thereafter increasing at one aircraft per two years. The 1978 and 1982 IASP updates forecast increases in based aircraft at about one per two years. The 1980 NASP projects a three percent annual growth at Boone through 1990. The FAA General Aviation forecasts for FY 1983-1994 indicate that single and multi-engine piston aircraft will grow approximately 3.2 percent per year. The number of turbine powered aircraft is projected to more than double in the same period.

Attitudes of the Fixed Base Operator and the Airport Commissioners is important in attracting aircraft to an airport. We believe both the FBO and the Airport Commission are presenting Boone as an attractive site for aircraft owners. Additionally, as the Ames Municipal Airport continues to grow, some aircraft owners will be attracted to the less hectic environment of the Boone Municipal Airport. We are optimistic that all previously mentioned factors will stimulate growth at Boone which will reflect the average national growth rate. We project an average rate of three percent per year through 1992 and 1-1/2 percent per year thereafter. Table 3-2 presents the relationships of recent based aircraft forecasts at Boone.

TABLE 3-1

FAA 5010 ANNUAL INSPECTIONS

Year	Based Aircraft
1982	43
1981	31
1980	30
1979	39
1978	20

Aircraft Operations

An aircraft operation is defined as either a takeoff or a landing at an airport. Forecasts of aviation operations and the mix of local and itinerant operations allow planners to anticipate potential revenues from flight instruction, aircraft sales, fuel sales, and airplane services. In addition, operation forecasts guide planners in predicting requirements for transient apron space,

TABLE 3-2

BASED AIRCRAFT

Year	1976 IASP	1978 IASP	1980 NASP	1982 IASP	1983 ADP
1975	32[1]				
1977	34[2]	25[1]			
1980	39	27[2]	30[1]	30[1]	
1982	42[2]	28	32[2]	32[2]	47[3]
1985	45		35	34	
1987		31			54
1990			40	36	
1992					62
1995	50				
1997		35			
2000				42	
2002					72

Notes:

[1]Base year data reflect estimates of actual based aircraft, not forecasts.
[2]Interpolations from published forecasts.
[3]Base year data reflect actual count.

TABLE 3-3

CIVIL OPERATIONS

Year	1976 IASP Local	1976 IASP Itinerant	1978 IASP Local	1978 IASP Itinerant	1980 NASP[1] Local	1980 NASP[1] Itinerant
1975	11,500	8,000				
1977			10,600	6,700		
1980	13,100	9,400			12,000	9,000
1982			11,700	7,700		
1985	14,000	10,600			13,000	11,000
1987			12,400	8,400		
1990					15,000	14,000
1992						
1995	15,000	11,700				
1997			13,500	9,300		

[1]NASP forecasts are made including military operations. Figures shown here are reduced to approximate equivalent civil operations assuming equal numbers of local and itinerant operations each year.

instrument approach facilities, turnarounds and taxiways, and other pilot aids such as Visual Approach Slope Indicators (VASI) and Runway End Identifier Lights (REIL).

Military activities on the Boone Municipal Airport are an important element of the planning process. Although military aircraft are based in a separate area of the airport and do not influence required apron or hangar space, they are important in evaluating air space requirements, airport capacity, and instrument facilities. Military operations are reasonably well documented and are expected to remain relatively constant through the planning period at 14,000 per year, based on recent information obtained from Guard personnel.

Forecasts of civil operations are shown in Table 3-3. There are several points of interest apparent from this table. First, the 1978 IASP update is more conservative than the 1976 IASP. Second, the 1980 NASP is somewhat more optimistic in later years than either Iowa forecast. Finally, all forecasts show a gradual increase in the ratio of itinerant operations with time. The national forecast, especially, shows a significant trend toward increased itinerant operations. This trend reflects an anticipated increase in business flying relative pleasure flying in the future.

We feel the state's operations forecasts are somewhat conservative for the same reasons presented in the previous section on based aircraft forecasts. In addition, we anticipate a gradual increase in training operations at the Boone Municipal Airport as traffic congestion continues to increase at Ames and Des Moines. Unfortunately, there has been no physical count of operations at Boone to date which would help establish a baseline for forecasting.

Our forecast of aviation operations is shown in as follows.

TABLE 3-4

OPERATIONS FORECAST

	Local	Itinerant	Military	Total
1983	12,000	8,000	14,000	34,000
1987	14,000	11,000	14,000	39,000
1992	15,500	14,000	14,000	43,500
2003	17,500	17,500	14,000	49,000

Instrument Operations

Instrument approach activity at an airport is a function of operations, weather, aircraft and pilot sophistication, available approach aids, and instrument training activities. Forecasts of instrument activities are necessarily subjective at small airports because records are not available to document past activity and because instrument approach facilities at Boone are

marginal. Actual instrument approaches will increase as pilot and aircraft sophistication increase and as instrument approach facilities are improved. Practice instrument approaches will increase as student activity increases and as congestion at adjacent instrument facilities increases. All these factors will influence the demand for instrument facilities at the Boone Municipal Airport.

Perhaps the most important consideration in forecasting instrument approach requirements has to do with trends in the aviation industry. Instrument qualification is becoming more common among rated pilots. It has long since been a prerequisite for pilots of commercially owned aircraft. Business aviation must be reliable under all weather conditions. The inconvenience to an executive when his aircraft is diverted to an alternate airport due to weather can be devastating. Tomorrow's aviation industry must be able to deliver its passengers on time at the destination airport with a very high degree of reliability. Pilot qualification and aircraft instrumentation to meet this requirement are available today. The most serious limiting factor is ground based instrumentation.

The value of improved instrument approach facilities must be weighed against initial cost and operating cost. Of course, at the Boone airport, many users will not use instrument approach facilities. However, an increasing ratio of pilots using the Boone airport will make use of such facilities. In fact, the availability of modern instrument facilities will encourage more airport users to utilize the facilities. Military users of the airport make regular and frequent use of instrument approach facilities at Boone. Military pilot instrument training requirements dictate frequent practice instrument approaches.

We believe adequate modern airport instrument approach facilities are an essential component of a modern general aviation airport.

Critical Aircraft and Operations Mix

Required runway length, width, and pavement strength are direct functions of the critical aircraft forecast to use the facilities. To anticipate the critical aircraft requirement, it is necessary to analyze the business community in the airport service area. It would be nice if the City of Boone could provide airport facilities adequate to accommodate all aircraft owned by or served by Boone based businesses. However, such facilities may not be economically feasible when compared with the potential activity of the most sophisticated aircraft in that group. This is a particularly difficult issue when facilities may be available to accommodate such occasional activity as near as 15 miles away.

In the 1982 IASP, the Boone Municipal Airport is forecast to develop to General Utility status. The General Utility class airport is intended to serve aircraft under 12,500 pounds gross weight. Although General Utility airports are not intended for use by the business jet fleet, many small business jets with short field capabilities routinely operate from such airports. A General Utility airport should have a minimum of 500 operations by airplanes having a gross weight in excess of 6,000 pounds. A Beech King Air based at the airport, exceeds this weight and is the critical aircraft for planning purposes.

The King Air is classified as a Class C aircraft. Aircraft are grouped into six categories based on general characteristics as follows:

Class	Description
AA	Wide body jumbo jets
A	Four engine jet and larger
B	Two and three engine jet, four engine piston and turbo props
C	Executive jet and transport type twin engine
D	Light twin engine piston
E	Single engine piston

Aircraft "mix" can be defined as the percentage of each class of aircraft, as defined above, which operates from a specific airport. Class AA, A, and B aircraft do not operate at the Boone Municipal Airport presently nor are they expected to operate from this airport in this planning period. The mix estimated to be presently operating at the Boone Municipal Airport follows. This present aircraft mix is expected to change over time as the airport service area develops and, by the turn of the century the mix is expected to be as shown. These forecasts follow the national trends as outlined in the NASA sponsored report prepared by the Massachusetts Institute of Technology, July, 1982, entitled "The U.S. Aviation System to the Year 2000".

EXISTING AND PROPOSED AIRCRAFT MIX

	Aircraft Classification		
	C	D	E
1982 Mix (percent)	2%	11%	87%
2002 Mix (percent)	7%	18%	75%

Class C aircraft, such as the King Air will increase operations at Boone from 400± operations in 1982 to over 2,000 operation by the end of the planning period. Boone is forecast to have 750 operations by Class C aircraft by 1987.

Development of the Boone Municipal Airport to General Utility status will provide airport service for virtually all presently owned aircraft in the Boone business community and can be expected to accommodate most air transportation requirements of potential commercial interests during the planning period. The occasional demand by Boone industry for airport capability beyond General Utility class can be accommodated at the Ames, Fort Dodge, or Des Moines airports.

Airport Capacity

The FAA considers an airport runway to have reached its capacity when delays to departures average two minutes for the normal peak two-hour period of the week. This capacity is normally associated with approximately 150,000 annual operations and 200 based aircraft. It seems quite obvious that the Boone Airport will not reach capacity in the planning period.

CHAPTER 4

FACILITY REQUIREMENTS

This section deals with the physical needs of the Boone Municipal Airport to accommodate existing and projected levels of aviation activity throughout the planning period. Forecasts presented in Chapter 3, in conjunction with the proximity of other airports, indicate that the Boone Airport should be planned for ultimate development to General Utility Standards. A General Utility Airport is designed to accommodate all airplanes with maximum gross weight less than 12,500 pounds and approach speeds less than 121 knots. Criteria recommended in this chapter were developed with full consideration for design standards of FAA Advisory Circular 150/5300-4B, the Iowa State Airport System Plan, and Sufficiency standards of the Iowa Airport Sufficiency Ratings.

LAND

The proposed extension of Runway 14/32 and construction of a paved Runway 2/20 will require that property interests be obtained to provide the necessary clearances between airport operational surfaces and adjoining properties. The land which provides obstruction-free approach and operational surfaces will protect aircraft and the adjoining property owners.

It is important to obtain the land required for airport growth as early as possible. This land is an important investment in airport growth, and in many instances, it can be leased for agricultural purposes and become an additional source of airport revenue. Likewise, acquiring the necessary clear zone and avigation easements early will be advantageous to the airport owner. By obtaining the necessary land and easements early, construction can continue on schedule without becoming involved with lengthy purchase or condemnation proceedings. Early control of land and easements can also preclude the development of non-compatible land uses adjacent to the airport.

Property interests required for development of the Boone airport are identified on the Airport Layout Plan, included in Chapter 6. The acquisition of 67 acres will include approximately 61 acres in fee simple and 6 acres in easements. Following is a definition for each type of acquisition:

Avigation Easement

An avigation easement grants the "right of flight" over the subject property, together with the right to cause noise, vibration, smoke, fumes, glare, dust, fuel particles, and all the other effects of aircraft operations. The intent of an avigation easement is not to eliminate development, but to compensate the property owner for the increased noise and noxious effects of airport operations. An avigation easement also allows the physical removal of obstructions which extend into the flight path of an aircraft.

Clear Zone Easement

A clear zone easement grants the right to keep the subject property free of structures, trees, or any other use of the land which would prove hazardous to aircraft taking off and landing. This easement is in addition to the "right of flight" avigation easement previously defined. The clear zone easement allows for flights that may be so low and so frequent as to amount to a "taking" of the property. The price paid for the easement is considered the compensation for the "taking" of the property and is generally more than for an avigation easement.

Fee Simple

Fee simple acquisition is the outright purchase of property through a negotiated purchase or through the power of eminent domain. Fee simple acquisition of land in the clear and approach zones is used in order to preserve open space and restrict intensive development or to remove existing development within these areas. When living quarters are located on the affected property, the residents are eligible for relocation assistance.

Fee Simple

Recommended fee acquisition includes approximately 13 acres in two parcels along the south side of Mamie Eisenhower Road, approximately 36 acres along extended centerline in the approach to Runway 32, and approximately 12 acres on extended centerline in the approach to Runway 2.

The two parcels along Mamie Eisenhower Road are presently zoned for commercial development and could be developed in ways detrimental to the airport. The approximately 4-acre lot in the northwest corner of the airport site is most critical, since it is within the clear zone of Runway 14. The approximately 9 acre parcel is presently used for commercial purposes. The Airport Commission should meet with the owners to discuss ultimate acquisition by the airport. Such acquisition should coincide with the owners desire to sell, thereby reducing any hardship to and relocation of the owner and reducing the corresponding monetary obligations. Initially an easement should be obtained over the property until acquisition in fee is completed.

Acquisition of the entire clear zone in the approach to Runway 32 is recommended out to the building restriction lines (BRL). This area is used for agriculture. The FAA recommends the acquisition of clear zones where possible. Acquisition provides the greatest degree of protection for critical areas of the airport environment. In this case, Runway 32 is planned to accommodate the primary instrument approach. Absolute protection of the approach environment is important. Furthermore, in the event that future circumstances warrant extending the runway beyond the presently anticipated length, such development would be possible.

Approximately 12 acres of land will be required in the approach to Runway 2. This acquisition will provide a site for grading and maintenance of the runway safety area and primary surfaces. This area is used for agriculture.

If the Iowa Army National Guard should relocate its facilities from Boone, or if any of the property initially obtained from the City is relinquished, it should return to control of the Airport Commission. Traditionally, the Guard has received land for its developments by donations from the cities. Historically, when facilities were no longer required by the Guard, they would be returned to the City. However, recent sales of National Guard property holdings at Humboldt, Cherokee, and Des Moines, indicate that present National Guard policy is to sell to the highest bidder. The Airport Commission should pursue an option to purchase the approximately 23 acres of land now occupied by the Guard on the airport site at such time as the facilities are no longer needed by the Guard.

Easements

Easements are recommended to protect approximately 6 acres in the clear zones of Runway 2, 14, and 20. Approximately 2 acres in the approach to Runway 14 should be added to the existing easement in order to protect the entire clear zone. Approximately 3 acres in the Runway 20 clear zone and one acre in the Runway 2 clear zone should be acquired.

Compatible Land Use Zoning

Future land use zoning around the airport adjacent those areas previously listed for acquisition in fee or easement is also important to the future of the airport. The majority of undeveloped lands adjacent to the airport are presently zoned compatible with airport operations in Agricultural or Light Industrial categories. The airport itself is zoned General Industrial. These compatible zoning patterns should be maintained.

RUNWAYS

Orientation

Based on FAA criteria, adequate runways would provide a 95 percent usability with crosswind components not exceeding 12 miles per hour. Where a single runway cannot provide 95 percent coverage, an additional runway will be required to increase the coverage to that value. The minimum coverage of 95 percent was selected by FAA after consideration of various factors influencing operations to and from airports and the economics of providing the coverage. In any airport operation, there are periods when factors other than wind determine when a runway may be used. Low ceilings, reduced visibility, periods of runway maintenance, etc., may preclude use of a particular runway even though existing wind conditions are favorable.

In order to investigate the adequacy of the existing runway alignment, an analysis of the weather was undertaken. It is necessary to utilize weather data recorded at the Des Moines Municipal Airport because a weather recording station is not located at Boone. The recorded Des Moines weather data for the period 1965 to 1974, was obtained for this analysis. Table 4-1 shows the percentage of runway wind coverage at Boone for all weather conditions.

TABLE 4-1

RUNWAY WIND COVERAGE
ALL WEATHER CONDITIONS

Runway	12 MPH	15 MPH
Runway 2/20	82.5%	91.1%
Runway 14/32	88.7%	95.1%
Combined Runway 2/20 and 14/32	96.1%	98.7%

From examination of the wind information it is concluded that, on an annual basis, no single runway provides the 95 percent wind coverage under all weather conditions. The combined average of Runway 2/20 and Runway 14/32 does, however, provide 96.1 percent coverage with a 12 MPH crosswind component. Therefore, the present runway orientation is adequate with respect to crosswind coverage.

Runway 14/32 is presently the primary runway at the airport. Runway 14/32 will remain the primary runway for the following reasons:

- Runway 14/32 has better wind coverage, 88.7 percent versus 82.5 percent for Runway 2/20 at a 12 MPH crosswind.
- Runway 14/32 presently has a paved surface versus a turf strip for Runway 2/20.
- Runway 14/32 will require less grading to construct a 4,000-foot length, than would Runway 2/20.
- Runway 14/32 is less restricted by existing development to provide a 4,000-foot length, primary surface, and clear zones than Runway 2/20.

Primary

FAA publication AC 150/5300-4B establishes the criteria for runway lengths at general utility-type airports. Based upon the FAA criteria, the primary runway length was determined using the following conditions: normal maximum temperature (86°F), elevation of 1,137 feet above sea level.

Primary Runway: 4,000 feet x 75 feet wide

The Iowa Airport System Plan and Iowa Airport Sufficiency Ratings also recommend an ultimate primary runway to 4,000 feet in length.

The standard width for a general utility runway with nonprecision approach, by both FAA and State criteria is 75 feet. FAA standard for general utility runways with precision instrument approach is 100 feet. However, our present forecasts do not indicate a precision approach at Boone.

Secondary

Iowa Airport system plan standards are that the secondary runway should be the same length as the primary and that the secondary runway can be a turf strip. The Iowa system plan specific recommendations for secondary runway length at Boone is 3,700 feet, probably established in consideration of existing site limitations. FAA standards for secondary runways are that lengths should be at least 80 percent of primary runway length, that the secondary runway of a general utility airport should also be 75 feet wide, and that the runway should be paved.

A secondary runway of 3,500 feet is recommended because the physical restraints in the approaches to Runway 2/20 will prohibit construction of a 4,000 foot secondary runway. Adequate road clearance on the north end, steeply falling topography on the south end, and runway safety area requirements limit the length of Runway 2/20 to 3,500 feet. We also recommend grading at the south end of Runway 2/20 to provide a runway with only a slight gradient.

The choice between a paved runway and a turf strip for the secondary runway is relatively simple. The Iowa system plan standard turf secondary runway seems primarily based on consideration of anticipated available funding levels. FAAs standard for a paved secondary runway is based on safety and service. In our estimation, a paved secondary runway provides an element of safety and reliability which is essential to a general utility airport serving aviation needs during the planning period. Turf strips, though widely used for secondary runways at general aviation airports today, inherently carry an element of risk from two perspectives. First, during a significant period of the year from the first snowfall until late spring, safety on a turf strip due to snow and soft conditions, is highly questionable. Second, a turf strip can develop washouts, badger holes, and other defects which may go undetected for extended periods of time except under the most conscientious inspection program. Consequently, pilots of modern aircraft rarely consider use of turf strips. For reasons of safety, serviceability, and reliability, we recommend that the secondary runway be paved. The runway width should be 75 feet, consistent with Iowa Airport System Plan Standards.

Secondary Runway: 3,500 feet x 75 feet wide

TAXIWAYS

As a minimum, every airport must have an exit taxiway to provide access to and from the runway. In addition, there should be taxiways to provide access to hangar areas. For many low volume airports this may be enough. Present and forecast traffic at Boone puts this airport in a category for consideration of a parallel or partial parallel taxiway from the primary runway. A parallel taxiway increases capacity and safety of a runway by allowing aircraft to clear the runway expeditiously after landing and to remain clear of the runway until departure is eminent.

FAA standards for parallel taxiways are closely related to capacity and safety. A sponsor is eligible for funding for a parallel taxiway when annual operations reach 20,000. Iowa State System Standards call for a partial parallel taxiway with annual operations between 30,000 and 50,000, and a full parallel taxiway when annual operations exceed 50,000. Iowa sufficiency ratings allow 100 percent sufficiency for general utility airports, regardless of operations, without a parallel taxiway.

Due to the present location of the exit taxiway at Boone at approximately the one-third point on the runway, and the proximity of the terminal area to the northwest runway end, we have recommended a partial parallel taxiway for Runway 14/32 from the Runway 32 end to the terminal exit taxiway. The runway to taxiway separation will be 240 feet. We recommend exit taxiways at both ends of Runway 14/32 and at approximately the midpoint of the parallel taxiway. We also recommend an exit taxiway from approximately the midpoint of Runway 2/20 to the ramp.

FAA and Iowa System Plan Standards agree that these taxiways should be 35 feet wide. We believe taxiways to corporate hangars should be 30 feet wide and taxiways to individual tee hangars should be 20 feet wide.

APRONS

Aircraft parking aprons are provided for several purposes. Turnaround aprons at the ends of runways not served by parallel taxiways allow aircraft to make a clearing turn at the end of the runway prior to taking off. A turnaround increases the level of safety and capacity on a runway by reducing the amount of time an aircraft taxiing to position for takeoff is required to continuously occupy the runway. Turnaround aprons should be provided at both ends of Runway 2/20.

Holding aprons are sometimes provided at the ends of runways on very busy airports to provide aircraft an area for runup where they will not obstruct runway access to other aircraft. Holding aprons serve important functions on airports with large numbers of highly sophisticated aircraft requiring extensive runup time. Boone forecasts do not indicate significant numbers of this type aircraft. Holding aprons are not recommended on either runway.

Itinerant aprons are provided on an airport to accommodate transient aircraft parking for only limited periods of time. The itinerant apron or ramp is used for refueling, maneuvering of aircraft into and out of a maintenance hangar for servicing, passenger and cargo transfer, and limited time parking of eight hours or less.

Area required on an itinerant apron is related directly to itinerant operations on the airport. Determination of required itinerant parking is quite subjective unless a survey can be conducted during a relatively normal period of aircraft operations. The timing of this study during a period of significantly curtailed operations throughout the aviation industry suggests that a survey might lead to overly conservative forecasts of itinerant apron requirements during the planning period. Conversations with the FBO at Boone have allowed us to develop an estimate of itinerant operations for an average busy day of an average week during the most active months of the

year. We estimate that, on this day, 20 itinerant aircraft will stop at the airport for fuel, maintenance service, visitation, passengers, or cargo. This number, of course, will include based aircraft flown under itinerant or local conditions which require fueling prior to return to a hangar or tie down. These figures represent present traffic. Projecting these figures in direct ratio to forecasts of itinerant operations for the planning period we arrive at requirements for itinerant apron based on FAAs recommended 350 square yards per aircraft for one-half the total number of aircraft in the busy day based on a projected total itinerant aircraft in that day of 44.

Itinerant Apron: 7,700 square yards

In addition to the itinerant parking requirements, an airport must have a more permanent parking area with tie downs for overnight aircraft storage. This area will accommodate aircraft based on the airport but not hangared, and visiting aircraft on an overnight or extended stay status. Calculation of tie down apron requirements will be a function of based aircraft and, more specifically, the difference between airport hangar spaces and total based aircraft.

At present, the airport is able to accommodate all but one based aircraft in hangars. However, forecasts for the planning period indicate an increase in based aircraft from 47 to 72. Of course, additional hangar construction is anticipated. However, we do not expect that hangars will be constructed until a quantifiable demand for spaces is shown. Therefore, tie down spaces should be provided for enough aircraft to fill one new bank of ten tee hangars. In addition, 5 tiedowns should be provided for aircraft not hangared by owner choice. Therefore, apron space for 15 airplane tie downs is required for based aircraft. In addition, there is a need for tie down space for itinerant overnight traffic. We estimate, on the same busy day of the average week of the busy season, five aircraft will remain overnight at the Boone Airport. Total tie down apron requirements, then, for the Boone Airport are calculated on the basis of FAAs recommended 300 square yards per aircraft times 20 aircraft.

Tie Down Apron: 6,000 square yards

BUILDINGS

Discounting any requirements for maintenance or rehabilitation during the planning period, existing accommodations for fixed base operations on the airport are adequate. There are accommodations for two fixed base operators. Accommodations are relatively similar and both are appropriately located in the terminal area.

The airport commission constructed a new equipment building in 1981. This building appears adequate for that purpose through the planning period. However, access paving will be required to this building.

Providing for the storage of aircraft requires large areas. It is important, therefore, to reserve adequate land in the building area to meet future aircraft storage needs. Because of the severe climate and the advent of increasingly more sophisticated and costly aircraft, it was assumed that all of the based aircraft could require hangar space. This approach allows sufficient area to be reserved for the construction of adequate hangars to house all based aircraft.

There are presently 24 T-hangar spaces on the airport. Twelve of these are suitable only for very small single engine aircraft. The other 12 are large enough to accommodate most single engine and some small twin-engine aircraft.

Additional T-hangars will be required as the number of based aircraft increases throughout the planning period. These should be constructed according to airport commission management philosophy in response to waiting list demand, or in order to encourage additional aircraft to base at the airport. Sufficient sites are available in the vicinity of existing T-hangars to provide for all additional T-hangars anticipated in the planning period.

A separate area on the airport will be designated for development of corporate hangers in anticipation of an increasing demand for same. These sites will be set aside for construction of individual hangars for corporate aircraft, to be constructed either at corporate expense or by the airport commission under lease-back to a corporation. We anticipate a requirement for six corporate hangars during the planning period.

A separate administration building was considered for the Boone airport. FAA recommended criteria for a separate administration building is as follows:

- A minimum of 10 itinerant arrivals and departures on a typical busy day.
- One or more active FBOs on the airport.
- Airplane fuel available on the airport.
- Aircraft repair facilities available on the airport.
- A full-time manager on duty during a normal day.

Boone appears to meet all these criteria except the availability of a full-time airport manager. However, experience at other airports in Iowa, for example, Chariton and Jefferson, indicates that traffic will routinely congregate at the offices of the FBO where adequate facilities are available by the FBO. Adequate restroom, telephone, lounge area and flight planning facilities are available in the FBO offices at Boone. Consequently, we do not anticipate a requirement for a separate administration building during the planning period. However, allowance should be made to construct a separate administration building should changing circumstances dictate such development. The space between FBO hangars at the east end of the access road should be reserved for possible future construction of an administration building.

AUTOMOBILE ACCESS AND PARKING

The existing access roads and vehicle parking areas on the airport are efficient and adequate in scope during the planning period. Each FBO site has sufficient adjacent parking, and there is parking available along the fence adjacent to the aircraft apron for visitors, observers, and passenger parking. Existing pavement strength is obviously inadequate, and strengthening will be required. Parking lines should be painted on the pavement.

PROTECTED AIRPORT SURFACES

Imaginary Surfaces

Federal Aviation Regulation Part 77 prescribes imaginary surfaces for runways and approaches at civil airports in the United States. As was mentioned in Chapter 2, these regulations define air space which is reserved and protected for the safe operation of aircraft in America's air transportation system. At Boone such air space in the immediate airport environment is defined by the following surfaces:

> The primary surface for Runway 14/32 is 500 feet wide, is centered longitudinally on the runway centerline, is at the elevation of the nearest point on runway centerline, and extends 200 feet beyond each runway end. At the side boundaries of this surface, transitional surfaces continue outward and upward at a 7:1 slope to an elevation of 150 feet above airport elevation. At end boundaries, approach surfaces continue outward and upward at 20:1 slopes for a distance of 5,000 feet flaring out from 500 feet wide at the beginning to 2,000 feet wide at the outer edge. These approach surfaces exist on both ends of the runway and they are centered on the extended runway centerline.
>
> The primary surface on Runway 2/20 is 250 feet wide, is centered on runway centerline, has an elevation equal to the nearest point on runway centerline, and extends 200 feet beyond each end of a paved runway. (It terminates at the ends of a turf strip.) Transitional surfaces extend outward and upward from the lateral edges of this surface at a 7:1 slope. Approach surfaces at each end of the runway extend outward and upward on a 20:1 slope for 5,000 feet from the primary surface. They are 250 feet wide at the primary surface and flare outward and upward to 1,250 feet wide at 5,000 feet.

Air space enclosed within the surfaces defined above must remain free of obstructions which might be hazardous to aircraft movement. The FAA investigates other obstructions encroaching into this air space and determines the degree of hazard. In some cases, protrusions can be obstruction lighted when, in the determination of FAA personnel, the level of hazard is sufficiently slight.

Safety Areas

Safety areas and other protected airport surfaces described subsequently herein define areas on the ground as opposed to air space. The FAA prescribes safety areas for paved runways in Advisory Circular 150/5300-4B. Safety areas are required to be maintained free of obstructions (except those

required for navigational purposes, such as runway edge lights) and with sufficient smoothness to allow passage of an occasional aircraft, at near landing speed, without risking major damage to the aircraft. Safety areas and other airport surfaces described below are required by Federal Aviation Regulation Part 152 in conjunction with Federal aid improvements at the airport. Since Boone accepted a Federal aid grant in 1976, these requirements are mandatory for the first 14 years of the planning period.

The safety area for Runway 14/32 is 150 feet wide, extends 300 feet beyond each runway end, and is centered longitudinally on the runway.

The safety area for Runway 2/20, when paved, will be 150 feet wide, will extend 300 feet beyond each end of the runway, and will be longitudinally centered on the runway.

Clear Zones

Clear zones exist beyond the ends of runways beneath the approach surfaces. Clear zones are projections on the ground of the approach surfaces. This trapezoidal area at ground level begins at the end of the primary surface, is symmetrically centered on the extended runway centerline, and extends 1,000 feet beyond the primary surface to a point where the approach surface is approximately 50 feet above the ground. Clear zones are the most critical safety areas under the approach path. Control of the clear zones by the airport is recommended to provide obstruction free approach and operational surfaces which will protect aircraft and adjoining property owners.

Building Restriction Lines

Building Restriction Lines (BRL) are marked on a layout plan to identify minimum building setbacks from airport runways. The building restriction line is normally derived from the point on the 7:1 transitional surface where a structure of maximum anticipated height would just touch. The BRLs at Boone are calculated to accommodate a 21 foot high structure. No building should be permitted on the runway side of this line. All land between building restriction lines should be owned by airport owners.

Line of Sight

FAA standards for airport grading along a runway where there is no operating control tower are that any object five feet above the runway surface at any point on the runway should be visible from five feet above the surface at any other point on the runway. Runways at the Boone airport are quite level and this standard is easily met on both runways.

Another line of sight standard pertains to visibility between crossing runways. FAA Advisory Circular 150/5300-4B states that it is desirable that an aircraft at the end of any runway should be visible from an aircraft at the end of any other runway. Since Boone is an uncontrolled field (without an operating control tower), a significant potential exists for aircraft to begin departures from intersecting runways simultaneously. This condition sets up a very real senario for a mid-air collision. All pilots, and particularly low time and student pilots, tend to concentrate their attention within a very limited area to the aircraft's front during takeoff. If at all possible, grading

should be done so that the line of sight visibility is maintained from runway end to runway end. At present, line of sight obstructions exist between runway ends 32 and 2 and between runway ends 32 and 20. Sight obstructions can be corrected by grading and we recommend that this grading be done in conjunction with a runway extension project.

Clearways/Stopways

Clearways and stopways are graded, carefully maintained areas intended to be provided at the ends of certain runways to allow turbojet operators additional flexibility in calculating safe departure and landing runway length requirements. The purpose of the clearway is to assure turbojet operators of an extended area beyond the runway end without obstructions. A stopway is defined as an area beyond the takeoff runway which is able to support an airplane during an aborted takeoff without causing structural damage to the airplane. Clearways and stopways are not recommended under normal circumstances due to their high cost relative to potential benefit. We do not recommend that clearways or stopways be designated at Boone. However, the potential exists for a clearway and a stopway to be constructed on the departure end of Runway 14 should a specific operator require such advantage in the future.

VISUAL AIDS

Runway/Taxiway Markings

Standard runway and taxiway markings are essential on airports. Pilots routinely use airports in widely diverse areas of the country. Runway and taxiway markings represent pilot information in code. In order to be effective, pilots must understand the code and codes must be consistent nationwide. FAA Advisory Circular 150/5340-1 prescribes standard runway and taxiway markings for airports. These marking standards must be adhered to.

Runway 14/32 and the exit taxiway at Boone have standard markings for a non-precision instrument runway. These are the proper markings for the runway and exit taxiway. Runway 2/20, when paved, will be marked with basic visual runway markings.

Additional markings of a less standardized nature should be considered to designate traffic flow and parking in the apron areas. An important addition to taxiway and apron markings is taxiway edge lines where taxiways merge with apron pavement.

The setback for a standard holding line has been increased by the latest change to the advisory circular. When markings are repainted, a new holding line should be painted at the new setback distance, and the old holding line should be painted out. In addition, a recent change to the advisory circular prescribes lighted taxiway holding signs outboard of the painted lines for pilot reference at night and during periods when painted lines are covered with snow. Taxiway holding signs should be installed in conjunction with the next airport lighting project.

Segmented Circle Markers

The segmented circle markers, including traffic direction indicators, at the Boone airport are in excellent condition and are highly visible from the air. We recommend that the segmented circle markers and traffic direction indicator markers be lighted with low intensity lights for better night visibility in conjunction with the next airport lighting project.

Wind Indicators

There are three types of visual wind indicators in common use on airports. They are, wind cone, wind tee, and wind tetrahedron. Boone has a wind cone and a wind tetrahedron on the airport. Both appear to be in excellent condition, and the wind cone is lighted during periods of darkness. The wind cone is located in the center of the segmented circle. These wind indicators are adequate for the airport during the planning period.

LIGHTING AIDS

Runway Edge Lights

Existing edge lights on Runway 14/32 are Medium Intensity Runway Lights (MIRL). This runway edge lighting intensity is suitable for Runway 14/32 during the planning period. However, the existing system is more than 20 years old and is showing visual signs of deterioration. It should be replaced during the planning period. In conjunction with installation of new MIRL on Runway 14/32, a new electrical vault should be constructed on the airport and new vault equipment provided. Concurrently, a radio control unit should be installed for operation of runway lights by pilots.

The existing MIRL on Runway 14/32 have obsolete lenses installed. Runway threshold lenses should be replaced by red/green lenses and runway edge light lenses should be replaced with clear/amber lenses.

Runway 2/20 is an unlighted runway. When Runway 2/20 is paved, it should be lighted with Medium Intensity Runway Lights (MIRL). This recommendation exceeds Iowa State System Plan recommendations which prescribe that only one of two paved runways on a general aviation airport be lighted. However, cross wind conditions are doubly hazardous during hours of darkness when a pilot's peripheral vision is limited. For safety, as well as for optimum service potential, we recommend that the secondary runway be lighted with medium intensity lights.

Taxiway Lights

At present, the airport has Low Intensity Taxiway Lights (LITL) only on the exit taxiway to the parking apron. These lights, also, are showing signs of visual deterioration and should be programmed for replacement within the planning period. All taxiways intended for use by itinerant aircraft and multi-engine based aircraft should have taxiway edge lights except in those areas where apron flood lighting adequately illuminates pavement markings.

Rotating Beacon

The existing rotating beacon at the airport is adequate for the planning period.

Runway and Identifier Lights (REIL)

REILs provide identification of a runway end for pilots at airports where the runway ends might not be readily definable from surrounding urban area lighting. Runway 14 approach has REILs installed. However, they do not operate properly and attempts to repair them have been unsuccessful. We recommend new REILs at the Runway 14 approach.

Visual Approach Slope Indicators (VASI) Lights

VASI lights provide visual approach guidance. They are most useful for corporate multi-engine and turbo-engine aircraft with approach speeds at or above 100 knots. They are recommended by FAA for all utility runway ends where ILS instrument facilities are not installed. They are recommended by the Iowa System Plan for paved runways on airports with annual operations in excess of 10,000. We recommend two-box VASI installation for approaches to Runways 14 and 32.

Omni Directional Approach Lighting System (ODALS)

ODALS is a relatively new approach light innovation adopted subsequent to the invention of omni directional REILs. This approach light system performs much the same function as a standard or modified approach lighting system except that it requires less land area for installation and offers a somewhat lesser degree of visual guidance on instrument approach under limited visibility conditions. It has an advantage that it identifies the runway end and orientation for VFR aircraft approaching the airport from any direction. We recommend ODALS in the approach to Runway 32.

INSTRUMENT NAVIGATION AIDS

Nondirectional Beacon (NDB)

There is a NDB transmitter on the airport and Boone has instrument approaches from this transmitter to Runways 14 and 32. A NDB transmitter should be maintained on the airport during the planning period. However, the existing unit is obsolete (operates with vacuum tubes) and should be replaced by a transistorized unit. The existing location will be suitable unless FAA should discover interference of the transmitter with antennas for an approach aid recommended in the following paragraph.

Instrument Approach Aid

Instrument approach technology is developing rapidly. Non-directional beacon facilities are the least precise and most susceptible to weather interference of instrument procedures available to the civil fleet today. More accurate and

reliable instrument approach aids include Visual Omni Range (VOR), Instrument Landing System (ILS), Microwave Landing System (MLS), Simplified Direction Finder (SDF) and Localizer approaches. Although not yet approved as an approach aid, LORAN is widely used for enroute navigation and has been shown to provide exceptional accuracy in tests of approach path definition.

As Class B and C activities increase at Boone following extension of Runway 14/32 to 4,000 feet, there will be increasing need for a new generation approach aid to replace or supplement the NDB. We are not able to recommend a specific type at this time since developments in the next five years may significantly affect the selection. We do, however, recommend that the NDB approach be supplemented or replaced by a more accurate and reliable nonprecision instrument approach following completion of the Runway 14/32 extension.

This recommendation is not a function of present or forecast instrument approach activity nor does it relate to published minimum descent altitude. The recommendation is made solely to upgrade equipment to meet demands of the industry.

Altimeter Setting Instrumentation

Accurate altimeter settings for pilots is an important element in determining minimum descent altitudes for an approach procedure. The amount of penalty assessed when accurate altimeter settings are not available on the airport for which the approach is published depends upon the distance from the nearest reliable altimeter source. At Boone, there is a 135-foot altitude penalty because accurate altimeter settings are not available on the field. This penalty could be removed with installation of appropriate altimeter setting instrumentation which is described in Advisory Circular 91-14. We recommend altimeter setting instrumentation, which consists essentially of two aircraft-type altimeters, be procured, calibrated and certified at the Boone airport.

CHAPTER 5

ALTERNATIVES AND ENVIRONMENTAL CONSIDERATIONS

AIRPORT DEVELOPMENT ALTERNATIVES

One of the primary purposes of a development plan is to review the adequacy of an airport's location. After the optimum location is determined, the best method of development must also be decided. This chapter examines three alternative development schemes including, (1) a new airport site, (2) no development, and (3) improvement of the existing site.

These alternatives are evaluated on the basis of engineering, environmental, social, and economic criteria. After these comparisons are made, the most feasible alternate will be selected for implementation.

New Airport Site

The City of Boone and Ames, in 1979, investigated several sites for a new airport to be jointly owned. Following the investigation and consideration of environmental and political factors, the Boone City Council decided to retain and develop the existing airport. The present site is suitable to meet the future air service needs of the Boone area for the planning period and therefore a new airport site was eliminated from further consideration.

No Development

The No Development alternative does not imply abandonment of the existing airport at Boone. Rather, this alternative involves maintaining the existing level of service. No long range planning and facility construction would be undertaken to keep up with or to encourage the orderly growth of aviation activity. This alternative was eliminated from further consideration for the following reasons:

- Airport service would not keep up with economic and business growth in the service area, nor could the airport successfully attract new business and industry to the area.
- Air traffic safety would gradually be reduced because the level of operations will increase while the facilities at the airport remain static.
- The airport would not be able to fulfill its role in the state and national airport system plans.

Improvement of Existing Site

Improvement of the existing airport facilities was deemed to be the most prudent and feasible alternative for providing air transportation for the Boone area. The following portions of this chapter will evaluate the environmental consequences of such action. The proposed improvements outlined in this plan and some of the details of the associated major construction items are:

- Extend Runway 14/32 1,000 feet southeast.

  Runway 14/32 would have a total length of 4,000 feet and a width of 75 feet. A partial parallel taxiway would also be constructed from the 32 approach end to the existing center taxiway. A service taxiway would also connect the 14 approach end to the north apron area. An area between the runways, south of the runway intersection, will require approximately 100,000 cubic yards of excavation to maintain a line of sight between the runways.

- Construct Runway 2/20.

  A 3,500-foot by 75-foot paved runway would be constructed in the same approximate location as the present 3,400-foot by 300-foot turf strip. The southern third of the runway area should be graded (approximately 130,000 cubic yards of excavation) to lower the Runway 2 end elevation and reduce the longitudinal gradient of the runway. A taxiway would connect the south apron area with the approximate midpoint of Runway 2/20.

- Acquire necessary land and air rights.

  The proposed extension of Runway 14/32 and construction of a paved Runway 2/20 will require that property interests be obtained for the runway itself and the necessary clearances between airport operational surfaces and adjoining properties. The acquisitions include approximately 73 acres; 67 acres in fee simple and 6 acres in easements.

- Expand apron areas.

  Approximately 14,000 square yards of apron area would be provided for itinerant and based aircraft parking and tie downs.

- Construct hangars.

- Install navigational aids.

ENVIRONMENTAL CONSEQUENCES

In 1974 an Airport Layout Plan and Environmental Impact Assessment Report were prepared for the Boone Municipal Airport. Airport facilities as planned in 1974 are very similar in type and location to those presented in this plan. The proposed facilities in this plan are generally a "downsizing" of the 1974 planned airport facilities.

In light of these similarities, the 1974 Environmental Impact Assessment report served as a basis for evaluating environmental impacts and was supplemented by field reconnaissance. The following analysis is a measure of the impact on the airport's environment if the ultimate development is attained. Impacts will be evaluated under three major environmental segments.

- Socioeconomic Environment.
- Physical Environment.
- Biological Environment.

Socioeconomic Environment

Population

Construction of these projects will create employment, but it is expected that the employment will be taken by persons presently in the construction field and it would not necessarily create new jobs in the Boone area. The expanded airport facilities and improved air service may encourage new industries or businesses dependent upon air transportation to locate in the Boone area. These improved facilities will also help to retain existing businesses and industry.

One commercial operation with a residential unit on-site could possibly be relocated as a result of these projects. However, acquisition is expected to coincide with the owner's desire to sell his property.

Land Use

The airport is located at the eastern edge of the City of Boone. The immediate area north and west of the airport is partially developed with industrial, commercial, and residential uses, however, the majority of the adjacent lands are used for agricultural purposes.

The proposed land acquisition as outlined in this plan will convert approximately 67 acres to airport contral because of the change in ownership. The approximately 54 acres on the south end of the airport are presently agricultural and will be converted to airport use. However, only 16 acres will be intensively used for airport facilities with the balance remaining in agricultural production. The Airport Commission could lease the land to local farmers. Thirteen acres on the north end of the airport just south of Mamie Eisenhower Avenue will be converted from commercial and residential to airport usage, however it is anticipated that these 13 acres would be put into agricultural production.

Public Services

The airport receives water and sanitary sewer service from City utilities. Expansion of airport facilities is not expected to have a significant impact on these services and these facilities will be adequate throughout the planning period.

Economics

The proposed projects should prove beneficial to the economic growth of the community by providing access to advanced modes of air transportation. The proposed extension of Runway 14/32 will permit a larger number of business aircraft to use the airport and operate at a greater capacity. Construction of the proposed airport improvements will have a temporary positive impact on the area's economy due to project construction. These costs, of which a great portion is salary and wages, create a favorable economic advantage for those persons employed. The increase of money in circulation in the region will provide indirect economic uplift for many persons and businesses. The direct long-term monetary benefits of the airport improvements are extremely difficult to measure. An adequate airport facility; considered by business and industry as an essential factor in conducting business, will have a positive impact on the economy of the Boone area. The airport improvements are compatible with the trend of industry and business to rely more and more on general aviation. The community will benefit from the increase of employment opportunities with industrial expansion.

Historical and Archaeological

There are no known historical or archaeological sites which would be impacted by these projects.

Recreational Facilities

The projects will have no impact on any parks or recreational areas.

Physical Environment

Air Quality

Improvement of the airport facilities anticipates an increase in air traffic, resulting in a small increase of aircraft emissions. This slight increase would not be expected to cause significant degradation of ambient air quality. Any increase in pollutant load to the atmosphere caused by increased aircraft operations would represent a very small percentage of the load to the region.

Water Quality

The majority of the airport site is in the Big Creek drainage area. Big Creek orginates in this area and drains into the Des Moines River near the City of Des Moines. A small area in the western part of the airport site is in the Peas Creek drainage area. Peas Creek drains into the Des Moines River south of Boone. This project is not expected to affect the quality of water in the area.

The impervious surfaces created by runway, taxiway, and apron areas would somewhat increase the volume and discharge rate of the stormwater runoff over existing conditions. Approximately 130,000 cubic yards of excavation will be removed in the southwestern portion of the airport property for construction of Runway 2/20. Approximately 100,000 cubic yards of excavation will be required to maintain line of sight for the extension of Runway 14/32. Careful development of drainage patterns during design will

avoid such problems as channels scouring or ecological distress in the downstream receiving waters. Construction specifications will also limit water and air pollution during project construction in accordance with state regulations.

Noise

One of the most conspicuous aspects of airplanes is the noise they produce. The inherent variability in the way individuals react to noise makes it impossible to predict accurately how any one individual will respond to a given noise. However, considering a community as a whole, trends from past experience emerge which relate noise to annoyance. In this way a noise index can be correlated with community annoyance. The FAA has identified certain threshold levels, based on general past experience, below which aircraft noise has not been a problem to the community. These thresholds as identified in FAA Order 5050.4 are 90,000 annual adjusted propeller operations or 700 annual adjusted jet operations. Operations at the Boone Airport are not expected to exceed these levels and the fact, combined with the minimal residential development in the airport area, indicate that noise will not be a problem.

Energy Resources

An increase in energy use will result from proposed airport improvements. This energy consumption increase is associated with the fuel used by the increased frequency of flight operations. There will be an increase in electrical energy associated with the operation of improved NAVAIDS, additional runway and taxiway lighting, and expanded terminal and hangar facilities.

Biological Environment

The area surrounding the airport is primarily agricultural. Besides the agricultural crops, grasses are the major vegetation along with scattered groups of trees. The wildlife most likely to inhabit these areas consist of upland birds and small field animals. No waterfowl permanently inhabit the area.

Construction activities will remove approximately 30 to 40 small trees in a fence line along the south airport property line in the approach to Runway 2.

ENVIRONMENTAL ASSESSMENT

Review of this preliminary Airport Development Plan and Airport Layout Plans was completed by FAA. A June 1, 1984, letter from FAA has "determined that none of the development proposed on the Airport Layout Plan requires environmental assessment."

CHAPTER 6

AIRPORT LAYOUT PLANS

This chapter contains a brief description of the various maps and plans prepared in conjunction with this planning effort. Reduced scale copies of the drawings are included in this chapter. Included in the airport layout plans are:

1. Title Sheet.
2. Airport Layout Plan.
3. Terminal Area and Access Plan.
4. Runway Approach Plans.
5. On-Airport Land Use Plan.
6. Far Part 77 - Airspace Plan.

TITLE SHEET

The title sheet contains location and vicinity maps for easy identification of the airport. An all weather wind rose graphically shows the wind conditions upon which the design of airport facilities were based. This wind information was obtained from the National Oceanic and Atmospheric Administration for observations obtained at the Des Moines Municipal Airport for the period of 1965 to 1974. The title sheet also includes approval blocks for acceptance by the Boone Airport Commission and state and federal review agencies.

AIRPORT LAYOUT PLAN

The Airport Layout Plan is a graphic representation of the existing and proposed airport facilities, their location on the airport, and pertinent dimensional information required to show conformance with state and federal standards. The Airport Layout Plan also includes pertinent runway and airport data.

TERMINAL AREA AND ACCESS PLAN

The proposed development of the terminal area at the Boone Municipal Airport is illustrated graphically on this drawing. Access to the terminal area is provided from Corporal Roger Snedden Drive. The objective in preparing the terminal area plan was to utilize, where possible, the existing physical facilities and integrate them with the proposed facilities. The terminal area plan was developed from the Facilities Requirements outlined in Chapter 4 of this report.

RUNWAY APPROACH PLANS

This sheet shows four plan and profile views of the area immediately adjacent to the approach end of each of the runways at the Boone Municipal Airport. The plan view shows the spatial relationship of the objects in the approach area which are near or penetrate the approach slope as outlined in FAR Part 77. Where applicable, both existing and proposed approach slopes are shown.

ON-AIRPORT LAND USE PLAN

This sheet recommends future land uses within the proposed airport property limits, and shows the ultimate development of the forecast period.

The following land uses are shown on the plan:

- Aviation areas consisting of runways, taxiways, and safety areas.
- Terminal area.
- Aviation related commercial or industrial development area.
- Iowa National Guard.
- Agricultural areas.

Agricultural areas are an excellent revenue producing source for the airport. Areas in the line-of-sight between the runway ends and in the clear zones should be restricted to low growing crops (less than four feet in height). The remainder of the agricultural areas within the airport boundaries may be used for any field crop.

FAR PART 77 - AIRSPACE PLAN

The Airspace Plan shows all imaginary surfaces associated with the Boone Municipal Airport, as outlined in the Federal Aviation Regulations (FAR), Part 77.25. These imaginary surfaces are superimposed on a USGS topographical map of the area. It should be noted that the approach surfaces shown are for proposed approaches at the airport and not existing approaches. This plan will aid in relating airport imaginary surfaces to natural and manmade features surrounding the airport. This drawing will provide the City with a document to use in reviewing and revising the June 1982 airport zoning ordinance.

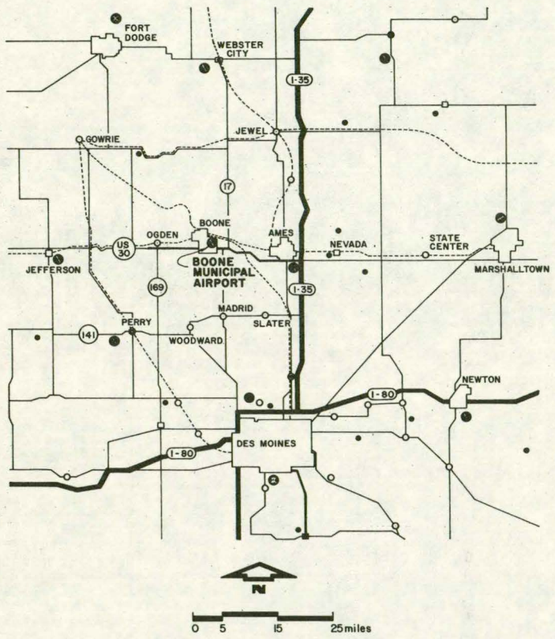
INDEX TO SHEETS

SHEET	TITLE	REVISION DATE
1	TITLE, APPROVAL, INDEX, LOCATION, WIND ROSE	
2	AIRPORT LAYOUT PLAN	
3	TERMINAL AREA & ACCESS PLAN	
4	RUNWAY APPROACH PLANS	
5	ON-AIRPORT LAND USE PLAN	
6	FAR PART 77 - AIRSPACE PLAN	

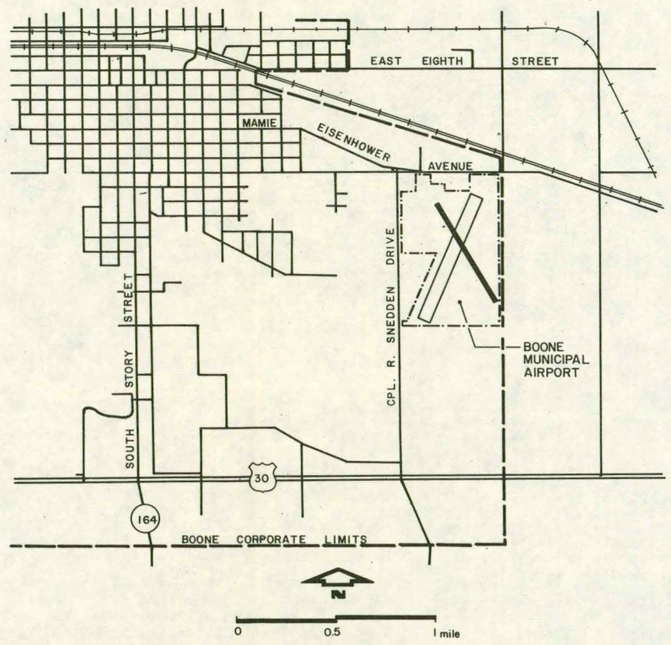
STATE OF IOWA
DEPARTMENT OF TRANSPORTATION
DIVISION OF AERONAUTICS

AIRPORT LAYOUT PLANS

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

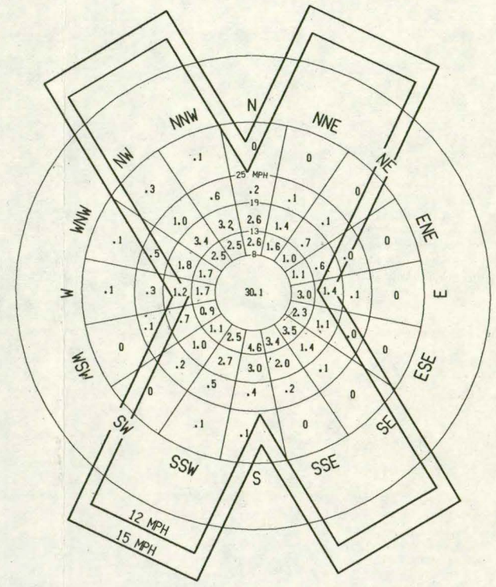


LOCATION MAP



VICINITY MAP

All Weather Wind Rose (% Distribution)



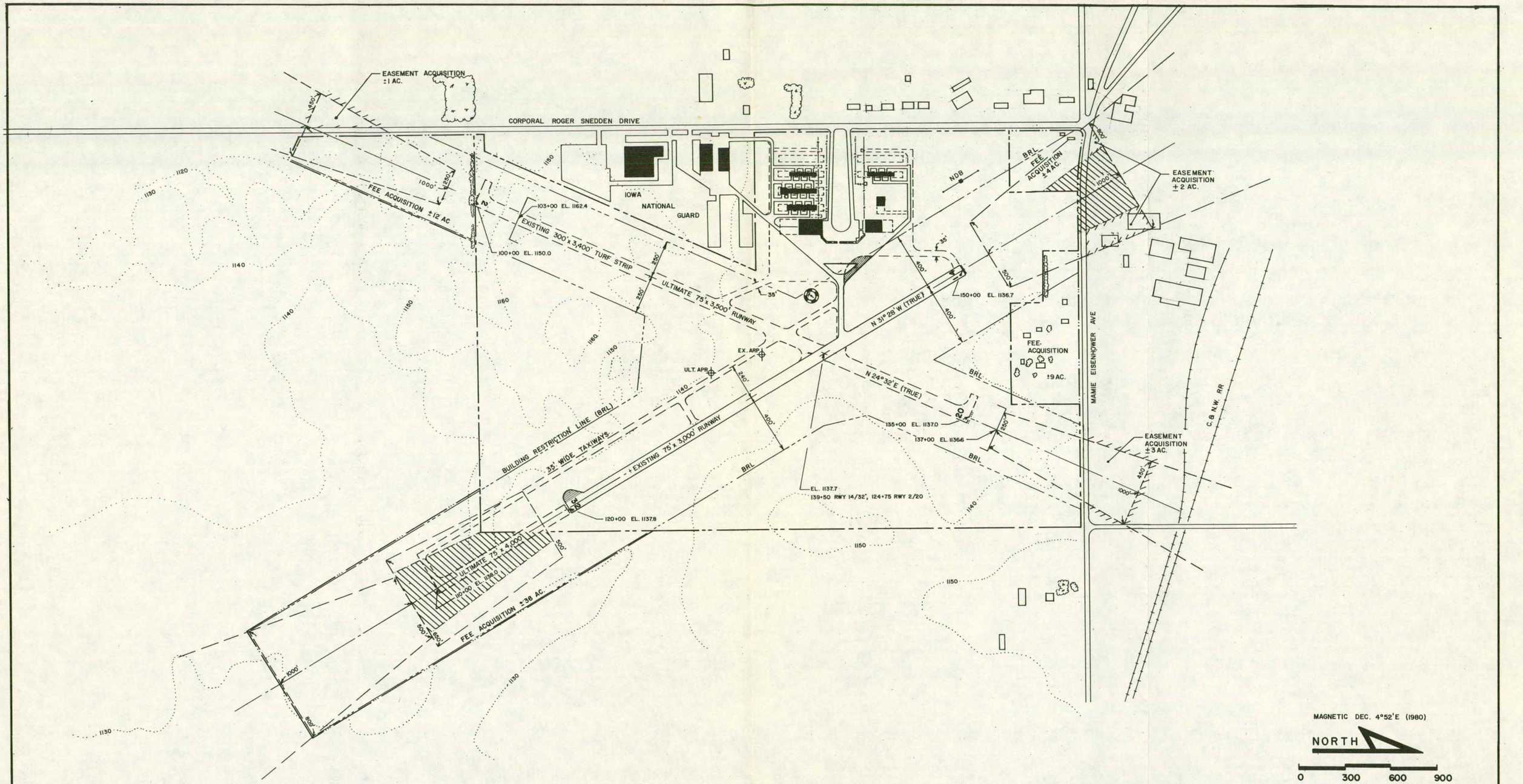
PERIOD OF RECORD: 1965-1974
SOURCE: NATIONAL OCEANIC ATMOSHERIC ADMINISTRATION
DES MOINES MUNICIPAL AIRPORT

	RUNWAY COVERAGE @12 MPH	@15 MPH
2/20	82.5	91.1
14/32	88.7	95.1
2/20 & 14/32	96.1	98.7

FEDERAL AVIATION ADMINISTRATION	IOWA DEPARTMENT OF TRANSPORTATION DIVISION OF AERONAUTICS	BOONE AIRPORT COMMISSION	Donohue Engineers & Architects	BOONE AIRPORT COMMISSION
APPROVED _____	APPROVED _____	APPROVED _____ PRESIDENT	APPROVED _____ PROJECT MANAGER	TITLE, APPROVAL, INDEX, LOCATION & WIND ROSE BOONE MUNICIPAL AIRPORT BOONE, IOWA
DATE _____	DATE _____	DATE _____	DATE _____	

Donohue Engineers & Architects

Designer	Date	Project No.	File No.
MAH	9-30-83	12703.0	A-39889
Drafter	Checker	Scale	Sheet No.
MAH	WHG	AS SHOWN	1



LEGEND

EXISTING	ULTIMATE	
		AIRPORT PROPERTY LINE
		EASEMENT
		BUILDING RESTRICTION LINE
		BUILDINGS
		PAVED AREAS
		PAVEMENT TO BE REMOVED
—x—x—	—xx—	FENCE

RUNWAY DATA

		RUNWAY 14/32		RUNWAY 2/20	
		EXISTING	ULTIMATE	EXISTING	ULTIMATE
EFFECTIVE GRADIENT (%)		0.037%	0.032%	0.759%	0.371 %
PAVEMENT STRENGTH		12,500lb.-S	12,500lb.-S	TURF	12,500lb.-S
RUNWAY LIGHTING		MIRL	MIRL	NO	MIRL
RUNWAY MARKING		BASIC	NPI	NONE	BASIC
RUNWAY PAVEMENT TYPE		BIT.	BIT.	TURF	BIT.
INSTRUMENT RUNWAY		YES	YES	NO	NO
APPROACH SLOPES		20:1	20:1	20:1	20:1
WIND COVERAGE	12 MPH	88.7%	88.7%	82.5%	82.5%
	15 MPH	95.1%	95.1%	91.1%	91.1%
RUNWAY SAFETY AREA			150'x 4,600'		150'x 4,100'

AIRPORT DATA

	EXISTING	ULTIMATE
MEAN MAX. TEMP. OF HOTTEST MONTH	86°F	86°F
AIRPORT ELEVATION (MSL)	1138	1150
AIRPORT COORDINATES (ARP) LAT.	42°03'03" N	42°03'00" N
LONG.	93°50'55" W	93°50'54" W
AIRPORT NAVIGATIONAL AIDS	NDB	NDB, LOCALIZER
VISUAL AIDS	NOTE 1	NOTE 1&2

NOTE 1
TETRAHEDRON
WIND CONE
SEGMENTED CIRCLE
ROTATING BEACON
REIL- RUNWAY 14

NOTE 2
REIL- RUNWAY 14
VASI - RUNWAYS 14&32
ODALS- RUNWAY 32

NO.	REVISIONS	BY	APR.	DATE

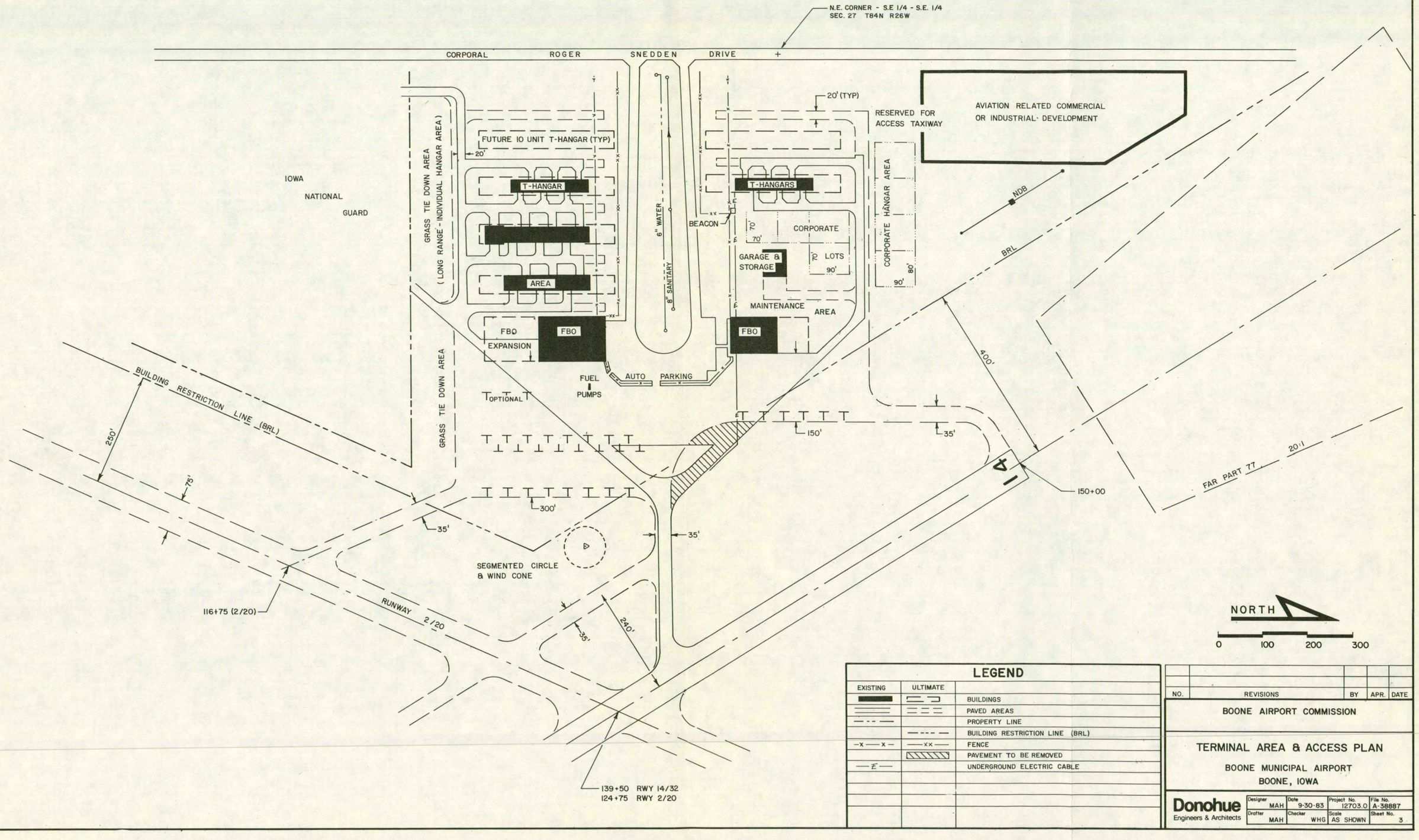
BOONE AIRPORT COMMISSION

AIRPORT LAYOUT PLAN

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

Donohue
Engineers & Architects

Designer	Date	Project No.	File No.
MAH	9-30-83	12703.0	A-38888
Drafter: MAH	Checker: WHG	Scale: AS SHOWN	Sheet No.: 2



NORTH

0 100 200 300

LEGEND

EXISTING	ULTIMATE	
▬▬	⊏ ⊐	BUILDINGS
═══	═══	PAVED AREAS
— — —		PROPERTY LINE
	— — —	BUILDING RESTRICTION LINE (BRL)
-x — x-	—xx—	FENCE
	▨▨▨	PAVEMENT TO BE REMOVED
—E—		UNDERGROUND ELECTRIC CABLE

NO.	REVISIONS	BY	APR.	DATE

BOONE AIRPORT COMMISSION

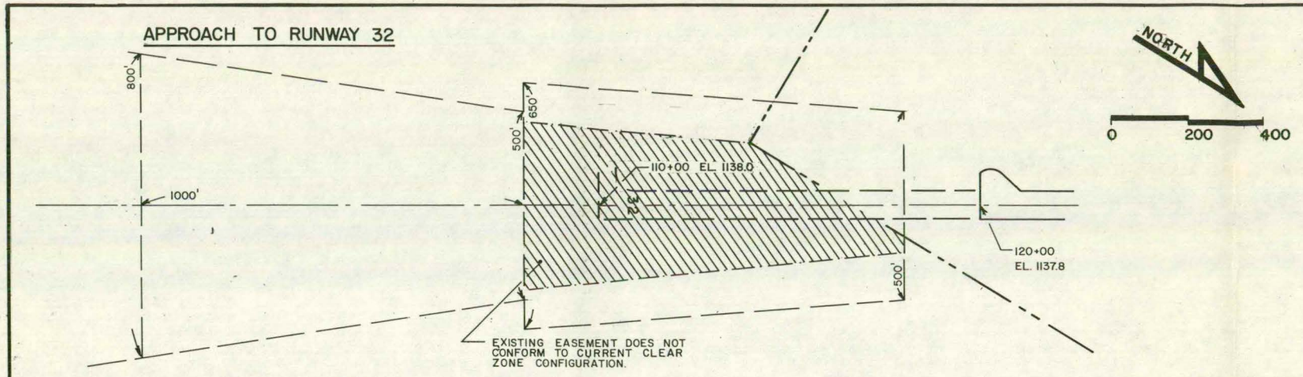
TERMINAL AREA & ACCESS PLAN

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

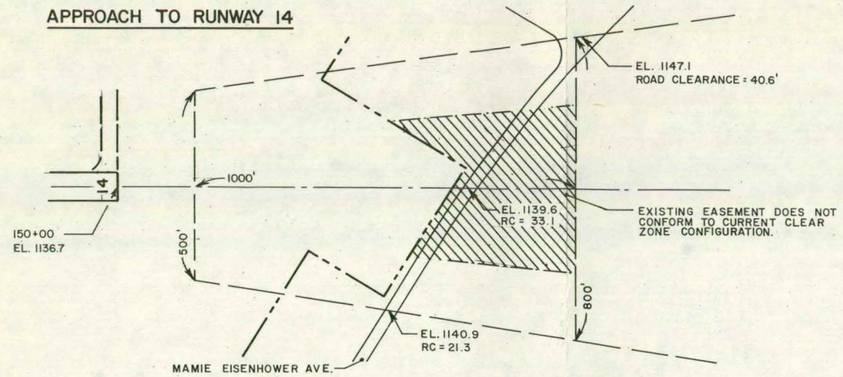
Donohue
Engineers & Architects

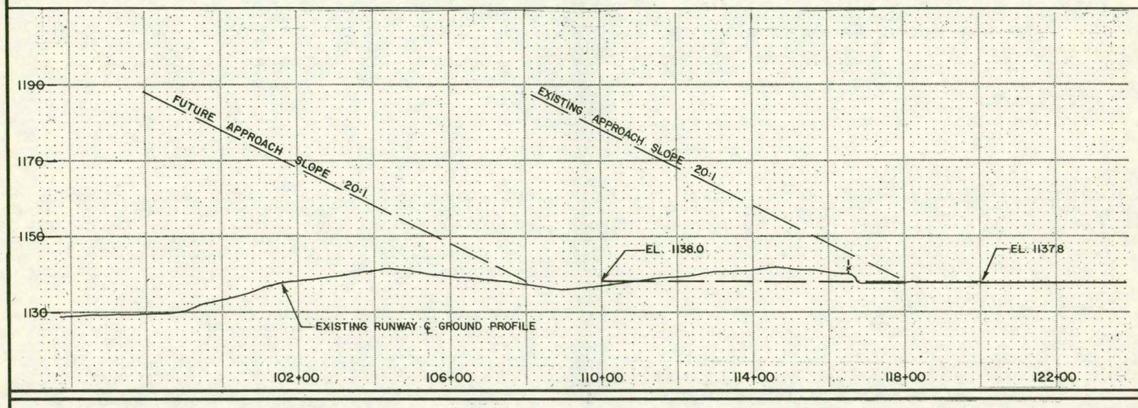
Designer	Date	Project No.	File No.
MAH	9-30-83	12703.0	A-38887
Drafter: MAH	Checker: WHG	Scale: AS SHOWN	Sheet No. 3

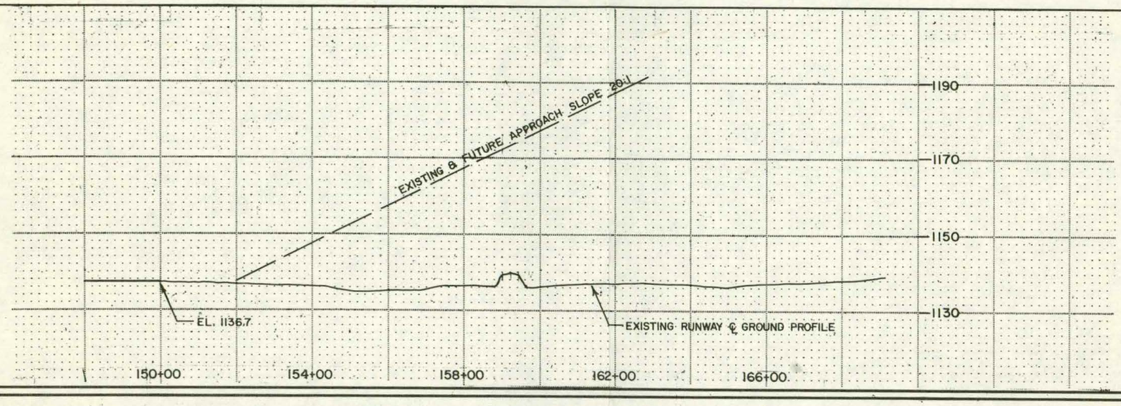
APPROACH TO RUNWAY 32



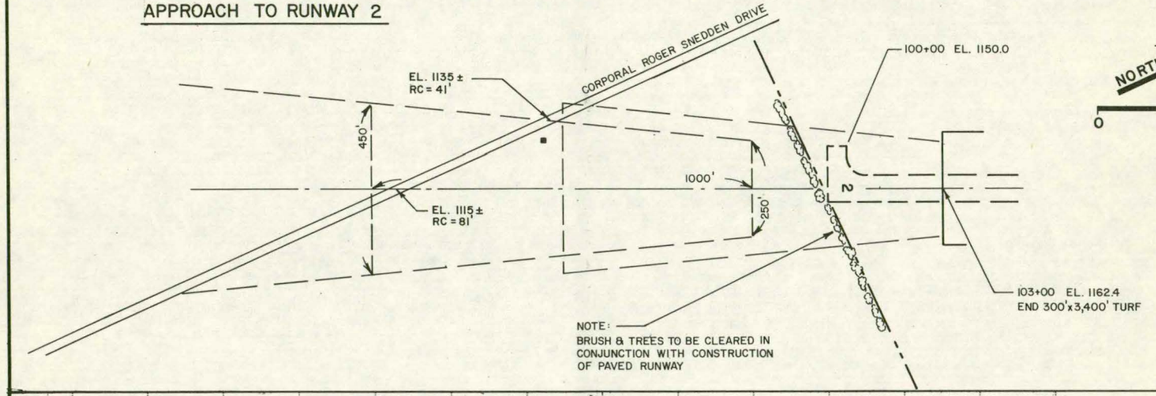
APPROACH TO RUNWAY 14

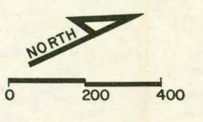




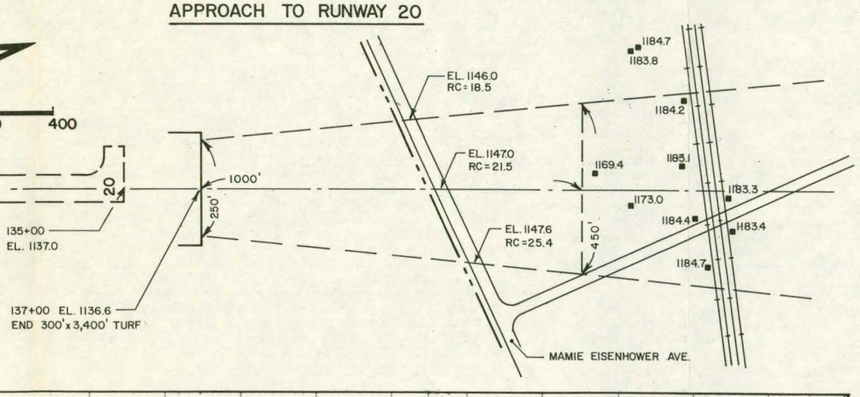


APPROACH TO RUNWAY 2





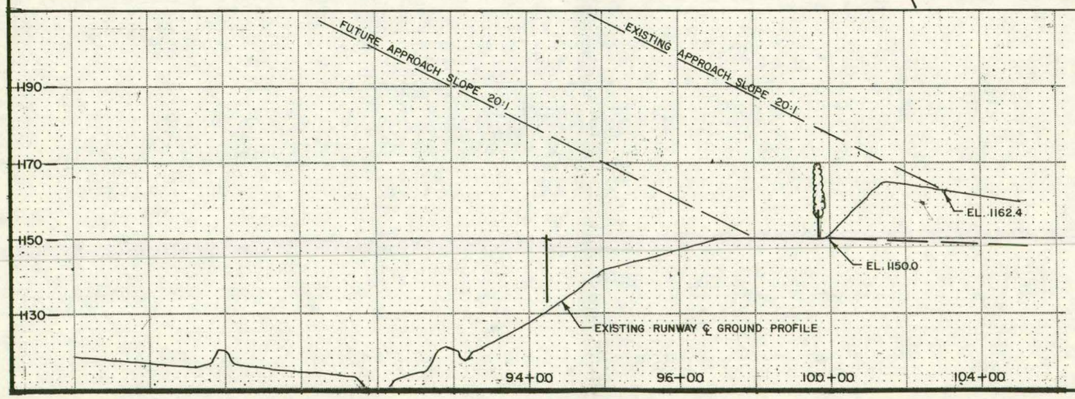
APPROACH TO RUNWAY 20

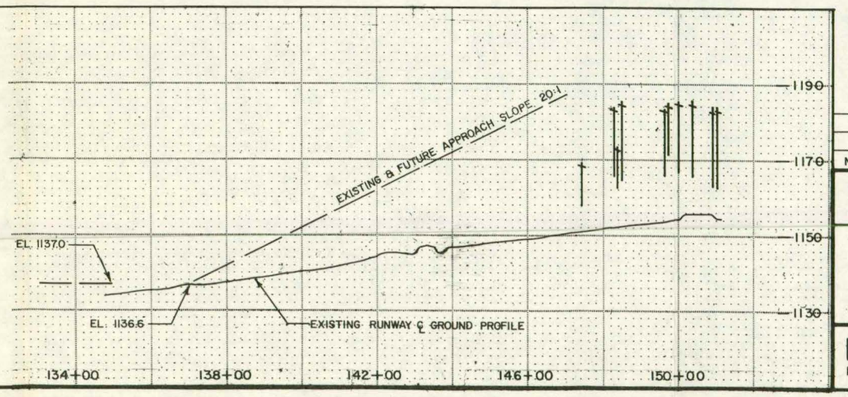


— LEGEND —

- POWER POLE
- RC= ROAD CLEARANCE
- 1173 OBJECT WITH ELEVATION
- AIRPORT PROPERTY
- EASEMENT

BASE MAP AND FIELD SURVEY PREPARED BY ESCHLIMAN ENGINEERING, INC.
SURVEY: 1-26-83





NO.	REVISIONS	BY	APR.	DATE

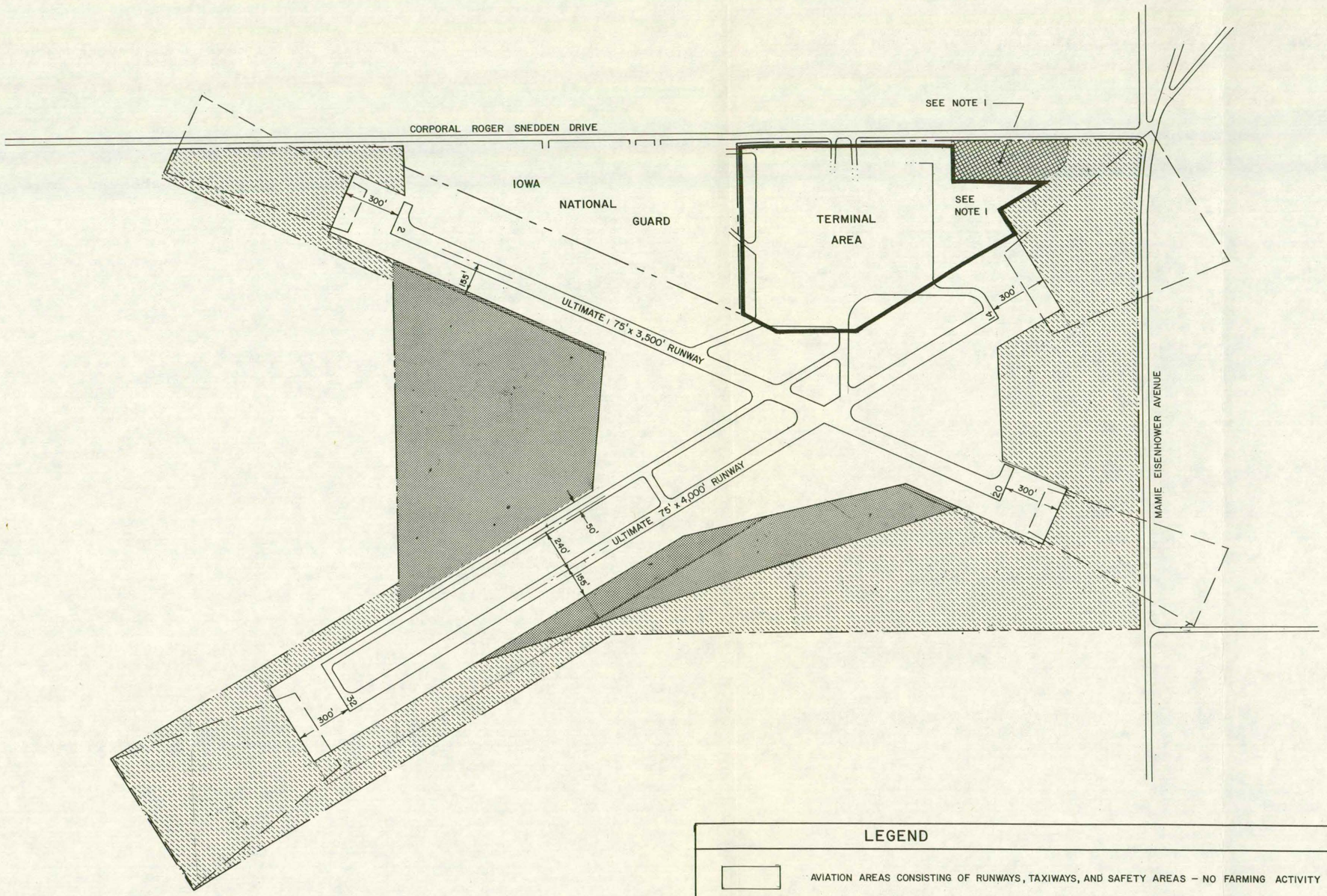
BOONE AIRPORT COMMISSION

RUNWAY APPROACH PLANS

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

Donohue
Engineers & Architects

Designer	Date	Project No.	File No.
MAH	9-30-83	12703.0	A-38886
Drafter: MAH	Checker: WHG	Scale: AS SHOWN	Sheet No.: 4



LEGEND

- AVIATION AREAS CONSISTING OF RUNWAYS, TAXIWAYS, AND SAFETY AREAS – NO FARMING ACTIVITY
- AVIATION RELATED COMMERCIAL OR INDUSTRIAL DEVELOPMENT AREA (SEE NOTE 1)
- TERMINAL AREA
- AGRICULTURAL AREAS: RESTRICTED TO LOW-GROWING CROPS (LESS THAN 4 FEET IN HEIGHT)
- AGRICULTURAL AREAS: MAY BE USED FOR ANY FIELD CROPS

NOTES:
1. FARMING OPERATIONS CAN CONTINUE UNTIL SUCH TIME AS REQUIRED FOR DEVELOPMENT

NORTH

0 300 600 900

NO.	REVISIONS	BY	APR	DATE

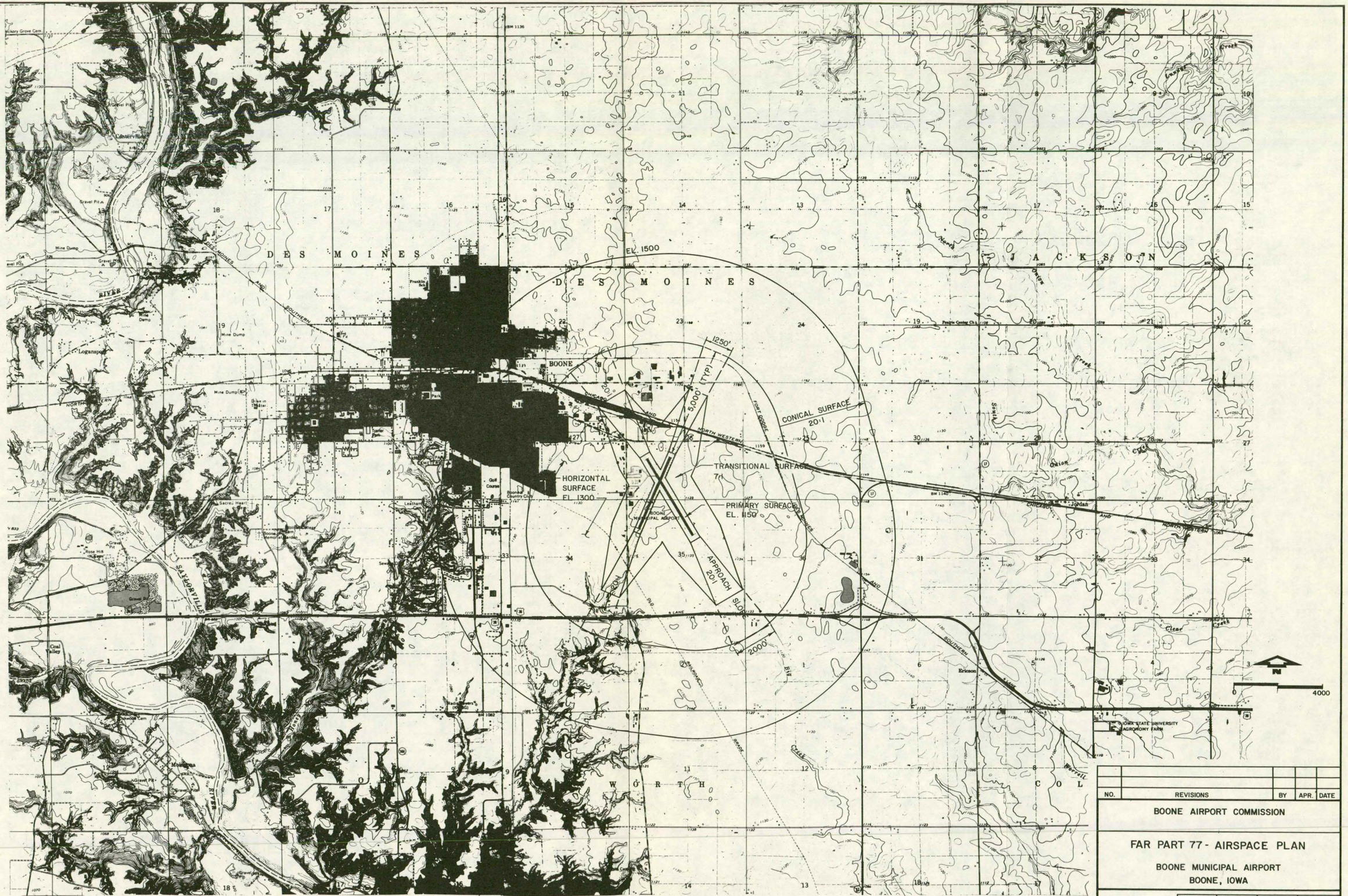
BOONE AIRPORT COMMISSION

ON-AIRPORT LAND USE PLAN

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

Donohue
Engineers & Architects

Designer	Date	Project No.	File No.
MAH	9-30-83	12703.0	A-38886
Drafter	**Checker**	**Scale**	**Sheet No.**
MAH	WHG	AS SHOWN	5



NO.	REVISIONS	BY	APR.	DATE

BOONE AIRPORT COMMISSION

FAR PART 77 - AIRSPACE PLAN

BOONE MUNICIPAL AIRPORT
BOONE, IOWA

Designer	Date	Project No.	File No.
MAH	8-30-84	12703.0	A-38886A
Drafter	**Checker**	**Scale**	**Sheet No.**
MAH	WHG	AS SHOWN	6

CHAPTER 7

MAINTENANCE AND REHABILITATION

The existing condition of pavements and other facilities on the airport were presented in Chapter 2. This chapter suggests procedures for preservation of facilities and analyzes alternatives for maintaining the airport in serviceable condition.

AIRPORT PAVEMENT

Priority

The largest single investment in facilities on the airport is in pavement. In order to determine appropriate action to preserve the pavement, operational priorities of the various areas, or features, must be assessed in addition to pavement conditions. Operational priority is a function of the importance of a pavement feature to the airport. Operational priorities have been assigned to airport features as follows: (See Figure 7-1)

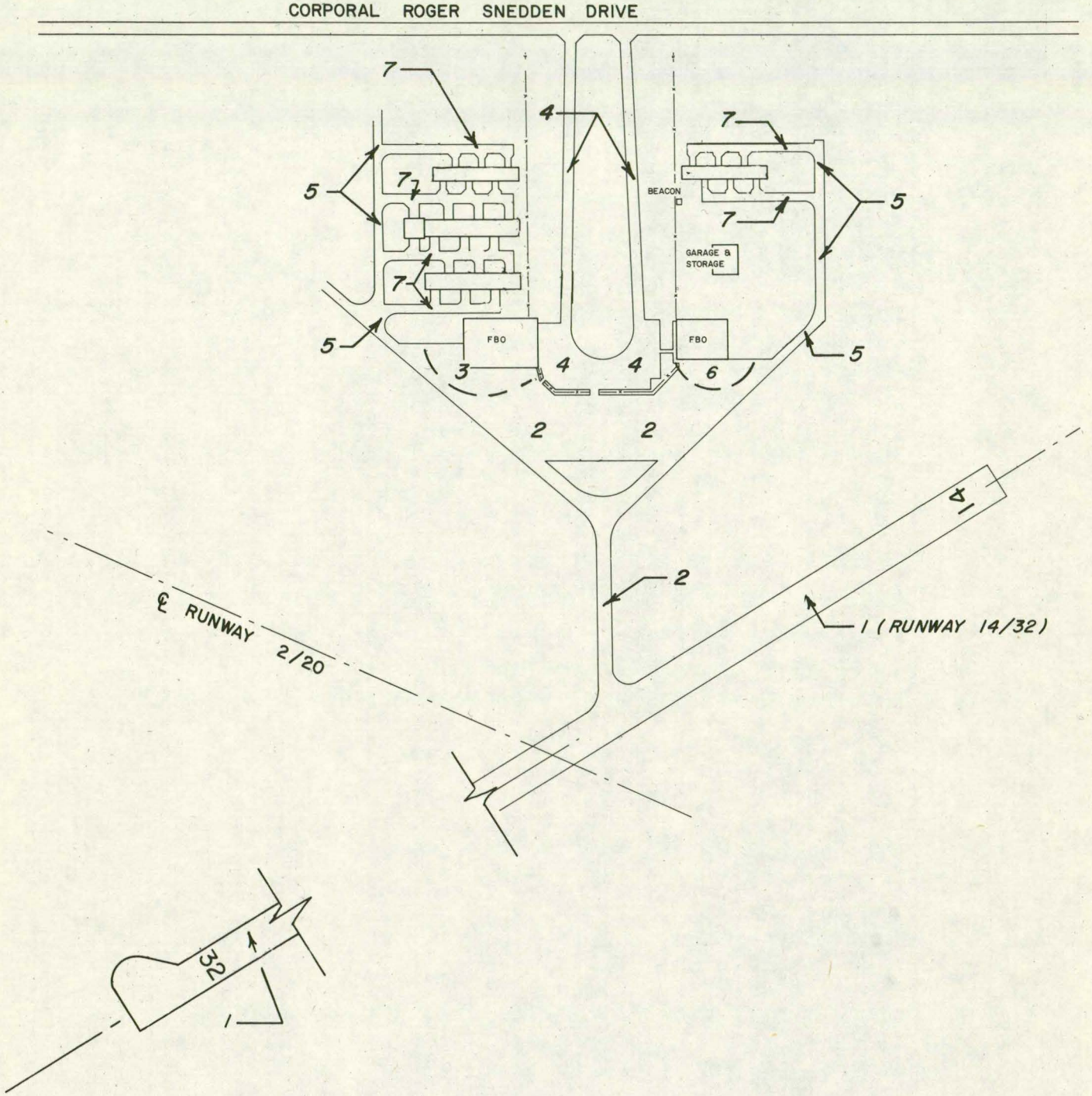
Priority	Feature
1	Runway 14/32 and southeast turnaround
2	Center taxiway and terminal apron
3	South FBO ramp
4	Airport access road and vehicle parking
5	North and south perimeter taxiways
6	North FBO ramp
7	"T" hangar taxiways

Condition Ratings

Pavement condition ratings are of value in describing the general condition and potential serviceability of the various features on the airport. Condition ratings assigned in this study are defined as follows:

Excellent. Fully Serviceable. No corrective maintenance required. Preventive maintenance, such as crack sealing, is recommended on a scheduled and routine basis.

Good. Serviceable. Some corrective maintenance indicated. Can be restored to excellent condition with appropriate corrective maintenance. No significant evidence of foundation distress.



Donohue

12703.0

FEB. 1984

Engineers & Architects

OPERATIONAL PRIORITIES - AIRPORT PAVEMENT

NORTH

0 100 200 300

AIRPORT DEVELOPMENT PLAN

BOONE MUNICIPAL AIRPORT

FIGURE 7-1

Fair. Marginally serviceable. Service life may be extended by performing appropriate corrective maintenance. Some foundation distress may be evident.

Poor. Partially serviceable or unserviceable. Not repairable by maintenance. Deteriorated to the point where preventive or corrective maintenance would not be cost-effective. Advanced subgrade failure is usually evident.

Alternatives

Several alternatives should be considered when evaluating pavement features in order to determine the most cost-effective action to be taken. Alternatives considered are: (1) no action, (2) maintenance, (3) rehabilitation, and (4) reconstruction.

No Action. The no action alternative is most cost-effective in two instances. When a feature is programmed for rehabilitation or reconstruction in the short-term, monies spent on corrective or preventive maintenance may not be justified. Also, when a pavement feature has deteriorated to poor condition, investment in maintenance would offer no improvement in serviceability or useful life and would, therefore, serve no useful purpose.

Maintenance. Two levels of maintenance are considered. Preventive maintenance includes such things as improving shoulder drainage and sealing cracks. Preventive maintenance is normally applied in a budgeted program intended for continuous application on a routine schedule. Corrective maintenance, on the other hand, includes replacing small deteriorated sections of failed pavement, repairing tiedown anchors, and repainting pavement markings. Corrective maintenance can be budgeted to a degree, but a reserve should always be set aside for emergency repairs. Both preventive and corrective maintenance may be done under contract or by City forces. In either case, maintenance should be performed based upon detailed specifications for the work.

Rehabilitation. This alternative gives consideration to pavement overlay preceded by an appropriate surface preparation. Depending upon the condition of existing pavement, surface preparation may be as simple as sealing cracks and cleaning the surface or it may be as complex as recycling the old pavement. This alternative is normally cost-effective on pavements showing advanced surface deterioration, but where subgrade distress is minimal. This alternative might also be cost-effective on an otherwise serviceable pavement which needs to be strengthened due to an increase in traffic loads or operations.

Reconstruction. The reconstruction alternative might be necessary in cases where extensive subgrade distress is evident, or where a change in pavement type is desired. In the case of flexible pavement, reconstruction consists of removing existing pavement and reconditioning subgrade. Overlay of an existing pavement with a new rigid pavement is considered reconstruction for the purpose of this evaluation.

Evaluation of Features

Each feature identified in this chapter was evaluated considering the four alternatives described above. A summary of these evaluations is presented here.

Runway 14/32

This pavement feature is in good condition. Significant matters of concern are the deterioration of runway markings and the extensive random cracking caused by pavement hardening and shrinkage.

Approximately 10 percent of the random cracks are showing evidence of sub-grade deterioration due to moisture penetration. However, the condition is not sufficiently serious at this time to warrant corrective maintenance consideration.

Selection of the no action alternative would result in continued and accelerated deterioration with associated subgrade damage as the cracks widen. The runway could be become unserviceable to larger aircraft in as few as three to five years. By that time, major corrective maintenance or pavement rehabilitation would be required.

The maintenance alternative requires only consideration of preventive maintenance measures at this time. A Level 1 preventive maintenance program would consist of an ongoing program of routing and sealing random cracks exceeding 1/4 inch in width measured when the pavement temperature is 40° or less. A Level 2 preventive maintenance project would consist of an asphalt emulsion sand seal coat over the entire pavement surface to seal pavement cracks smaller than 1/4 inch wide and to reduce the rate of deterioration of the surface. Unless rehabilitation or reconstruction can be programmed within three years, the Level 2 program should be initiated as soon as funds are available and specifications can be developed. The Level 2 maintenance project should be considered only if rehabilitation or reconstruction of the runway cannot be programmed or funded within five to seven years. A conscientious Level 1 maintenance program could extend the service life of the runway to about seven years. Implementation of the Level 2 maintenance project at this time in conjunction with the Level 1 program would extend the pavement service life up to ten years.

The rehabilitation alternative would be appropriate in conjunction with extension of the runway. This alternative would serve to strengthen the pavement to accommodate larger aircraft which would be able to use the longer runway. Due to the extensive hardening and shrinkage cracking on the existing runway, surface preparation for rehabilitation should consist of recycling existing pavement to base course. Implementation of the rehabilitation alternative would significantly reduce the budget requirement for preventive maintenance and would extend the runway service life, assuming ongoing preventive maintenance as needed, to 20 years.

Finally, the reconstruction alternative would only be appropriate on this runway if the existing flexible surface were to be replaced with a rigid pavement. Using the existing pavement as a base, a rigid pavement might prove to be cost-effective in the long run since it could be expected to provide a service life, assuming proper maintenance, up to 30 years.

The turnaround at the approach end of Run 32 should be inspected periodically to determine continued serviceability. Minimum maintenance effort should be expended to keep this turnaround serviceable until the runway is extended. The turnaround should then be deleted.

Center Taxiway and Apron

This feature is in good condition. There are several severe cracks in the pavement which were not patched when similar cracks on Runway 14/32 were repaired. These cracks, defined as being in excess of 3/4 inch wide when measured at pavement temperature of 40° or less, should be repaired as soon as funds can be made available, in a manner similar to that used on the runway. Failure to make these repairs could cause the taxiway and terminal apron to become unserviceable to large aircraft in as few as two years. Once the severe cracks have been repaired, the central taxiway and terminal apron should be maintained and considered for rehabilitation or reconstruction exactly as has been described for Runway 14/32.

South FBO Ramp

The south FBO ramp consists of the refueling pad and all flexible pavement around the FBO hangar and bordered by the fence, the terminal apron pavement, and the south perimeter taxiway pavement. This feature includes several pavement structures, but has been considered as one unit because of its common purpose and the small areas of individual pavement. A summary of action alternatives considered for this feature follows.

The no action alternative would seem to offer a service life up to five years except for the approximately 1,800 square feet of deteriorated pavement in the extended approach to the hangar. This area of pavement has lower strength characteristics than the surrounding bituminous pavement in this feature. Without some form of corrective maintenance, this area may become unserviceable during periods of wet weather within about three years.

The maintenance alternative for this feature consists of two types of maintenance. A Level 1 preventive maintenance program may be implemented to seal individual cracks larger than 1/4 inch in both flexible and rigid pavement areas. A Level 2 preventive maintenance program would include application of a coal tar emulsion sealcoat over all bituminous surfaces except the extended approach section previously mentioned, to seal cracks smaller than 1/4 inch and to preserve the bituminous surface. The area in the extended approach to the hangar would be overlayed with a bituminous hot mix, or it could be replaced with new pavement. The full depth replacement would provide longer serviceability than a simple overlay. The replacement option would be similar to that procedure defined for reconstruction. However, the small

area qualifies this repair to be called a patch and be considered as a corrective maintenance item. In addition, one concrete slab immediately north of the gas pumps should be removed, the subgrade reworked and recompacted, and the slab replaced.

Repair of the extended approach would be first priority in this feature. The slab replacement at the fuel pumps would be scheduled within five years, and the preventive maintenance program should be ongoing. If these maintenance procedures were implemented, the service life of the south FBO ramp would be extended to up to ten years.

The rehabilitation alternative would consist of a strengthening overlay concurrent with, or soon following, a Runway 14/32 extension, in order to accommodate heavier aircraft. Such a project should extend the service life of this feature to 20 years.

The reconstruction alternative might be considered in the event of a reconstruction of the terminal apron for the purpose of converting flexible pavement to rigid pavement.

Access Roads and Vehicle Parking

In general, the access roads are in fair to good condition and the vehicle parking areas, which includes the west end radius, are in fair to poor condition. However, this entire feature has been so frequently patched and partially overlaid that a single condition rating is impossible. An evaluation of potential action alternatives follows.

The no action alternative will result in the north access road and a significant area of the radius to become unserviceable during the spring thaw and other wet periods within two to three years. Access to the airport will still be available by the south access road. However, the appearance of the airport will be significantly degraded by the condition of this feature.

The maintenance alternative would include a regular program of preventive maintenance similar to that previously described, for pavement cracks less than 3/4 inch wide. Random cracks greater than 3/4 inch wide would be repaired through a corrective maintenance project by full depth patching, as would areas of light and moderate alligator cracking. Areas of severe alligator cracking are beyond economical repair by maintenance. Therefore, a maintenance program alone cannot extend the overall service life of this feature.

The rehabilitation alternative could improve the service life of this feature to about ten years. However, surface preparation would consist of undercutting areas of severe alligator cracking and rebuilding the foundation with new material. The actual extent of surface preparation required would be a matter for study during the design phase of the project.

The reconstruction alternative would consist of removing the existing pavement, reworking and recompactng subgrade, and rebuilding the road bed with either a flexible or rigid pavement. This alternative would extend the service life of the feature to approximately 20 years for the flexible option and up to 30 years for the rigid option.

North and South Perimeter Taxiways

These two taxiways have approximately equal functions at present, and have been included as a single feature because they are both in poor condition. The west half of the north taxiway is presently unserviceable during wet weather. The south perimeter taxiway has evidence of advanced subgrade failure and is considered to be beyond cost-effective maintenance. A no action alternative on these taxiways will result in continued gradual degradation to unserviceability in three to five years. These taxiways should be considered for rehabilitation or reconstruction in priority according to the ratio of hangar rent potential. For the present, the south perimeter taxiway would have priority for improvement. However, as the north corporate area develops, the north perimeter taxiway may develop a higher priority for attention. Both perimeter taxiways represent an element of the facilities for which hangar users pay rent. Therefore, upgrading could be accomplished in conjunction with an increase in hangar rent. The service life of both taxiways could be extended to seven to ten years by interim overlay with mimimal surface preparation. This alternative would be viable due to the low volume of traffic on the taxiways. In order for the taxiway service life to reasonably be extended beyond that period, they should be reconstructed in conjunction with widening to the ALP recommended width. Such a project would provide a 20-year to 30-year service life for these taxiways.

North FBO Ramp

This feature is in good condition. However, there are several small areas of weakened pavement for which corrective maintenance would be indicated.

The no action alternative would result in continued deterioration of the weakened pavement areas. Considering the light traffic volume on this feature, the ramp might remain serviceable for a period of two to five years.

The maintenance alternative would include corrective repairs to those areas of weakened pavement evidenced by alligator cracking. There are approximately 500 square feet of area requiring full depth patching. Preventive maintenance would include an asphalt emulsion seal coat over the entire feature following the corrective maintenance work.

The rehabilitation and reconstruction alternatives would be identical to those outlined for the south FBO ramp.

"T" Hangar Taxiways

All six "T" hangar taxiways were originally constructed of rigid pavement. Three of these have since been overlayed with a thin bituminous overlay. All taxiways are in similar condition. They are cracked and jointed and the cracks have vegetation growing in them. Although the degree of pavement

deterioration is greater in the taxiways serving the small hangers, all six taxiways are considered as one feature due to their similar function and construction.

The no action alternative would result in continued use of the taxiways for access to the hangars, even though those serving the north hangar are technically unserviceable. The light weight and infrequent use of the aircraft stored in this hangar make the no action alternative attractive until the hangar is replaced. For the other hangars, the no action alternative would not limit access to the hangar stalls. The major disadvantage of this alternative is the continued unslightly appearance of the taxiways.

The maintenance alternative would improve the appearance of the taxiways considerably, but would have little long-term effect on service life due to the rigid pavement foundation and the very limited traffic activity. Implementation of this alternative would be limited to cleaning and sealing pavement cracks.

The rehabilitation alternative would consist of surface preparation and bituminous overlay. Due to the extensive cracking of the existing pavement, recycling would be recommended for surface preparation.

The reconstruction alternative would consist of replacing the existing taxiways with new flexible or rigid pavements. Given the low traffic volume and light weight of most aircraft expected to use these hangars, this alternative would probably not be cost-effective.

Improvements programmed for the hangar taxiways should be coordinated with proportionate increases in hangar rents.

Approach pavements to individual stalls have not been included in the evaluation of this report. Maintenance, rehabilitation, and reconstruction of these approaches should be negotiated on an individual basis with renters of the associated stalls, and the cost of such improvements negotiated into the monthly hangar rent, or by special assessment.

BUILDINGS

South FBO Building

This building was constructed in about 1975 and is in excellent structural condition. It is expected to remain fully serviceable without major expense through the planning period. However, the entryway should be remodeled to provide a small waiting room with telephone for passengers and pilots who arrive at the airport at hours when the FBO is not open.

North FBO Building

This building was constructed in about 1970 and is in good condition. The administrative offices are not presently occupied, and the hangar is being used for unheated storage of aircraft. The roof over the administrative offices appears to be due for replacement. Periodic inspection of the office areas should be made for early identification of roof leaks. At the earliest

evidence of leaking, the roof should be repaired or replaced before damage to the offices occurs. At such time as the administrative offices might be rented for commercial use, remodeling of this area would seem appropriate. The cost of remodeling would be incurred by the tenant or could be financed by the Commission as part of a lease agreement.

Equipment Storage Building

This is the newest building on the airport, having been constructed in about 1980. The building should not require major maintenance expense within the planning period. However, a paved driveway to the building, and an equipment staging area, should be constructed at an early date.

Large "T" Hangars

The two easternmost "T" hangars south of the access road were constructed in about 1964. They are in very serviceable condition, and with regular routine maintenance and periodic repairs, they should remain serviceable for 10 to 15 years.

Small "T" Hangars

The oldest hangars at the airport are the two located nearest Corporal Roger Snedden Drive. They were erected at the airport in about 1950. They remain serviceable today, and provide low cost, enclosed storage for smaller aircraft based at the airport. Due to their age and small size, these hangars should be programmed for replacement in five to ten years.

RUNWAY EDGE LIGHTS

The present lighting system on Runway 14/32 was installed approximately 23 years ago. It is still serviceable, but should be programmed for replacement in conjunction with a runway extension. The lighting replacement project should include VASI installations on both ends of the runway and REIL lights at the approach to Runway 14.

NON-DIRECTIONAL BEACON

The existing non-directional beacon is a tube-type unit with a relatively high maintenance ratio and low transmission range. It should be replaced with a new transistorized non-directional beacon within five years.

STRIP MARKERS

Strip markers on Runway 14/32 should be removed and stored for use as replacement markers on Runway 2/20 until the cross-wind runway is paved, at which time all strip markers should be removed from the airport.

CHAPTER 8

COST ESTIMATES

The condition of existing facilities was addressed in Chapter 2. Alternatives for preserving existing facilities were presented in Chapter 7. New facilities expected to be needed in the next 20 years were outlined in Chapter 4. In this chapter, cost estimates for preserving existing facilities and for developing new facilities are presented. These estimates do not represent potential projects. They represent costs of individual activities which may be considered separately or in combination to prepare and justify budgets, develop requests for state and federal aid, and effectively manage airport resources.

Many of the activities are comparative. For instance, estimates are presented for maintaining, rehabilitating and reconstructing Runway 14/32. It would not be appropriate to budget for all these activities. However, depending upon the timing, it may be appropriate to budget for maintenance and either rehabilitation or reconstruction. Furthermore, the entire cost of an activity need not always be budgeted in a single year. For example, the Runway 14/32 level 1 maintenance program may be budgeted in thirds for accomplishment over a three year period. On the other hand, it might be appropriate to combine activities. A crack sealing program, for instance, may be applied to the runway, center taxiway and terminal apron as one project.

Unit prices and activity cost estimates presented here as Tables 8-1 and 8-2 are simply tools with which to manage the airport's facilities. The costs shown are estimated in 1983 dollars. They will be used in conjunction with an analysis of financing potential, to develop a program for preserving and expanding the airport.

TABLE 8-1

UNIT PRICES

Maintenance	
Seal Cracks <3/4 inch	$2.00/l.f.
Patch Pavement	$2.75/s.f.
Seal Coat Surface	$0.15/s.f.
Repair Cracks >3/4 inch	$5.00/l.f.
Runway Markings	$6000/application
Rehabilitation	
Prepare Surface	$0.05/s.f.
Recycle Bituminous Pavement	$0.20/s.f.
Bituminous Overlay per inch	$0.20/s.f.
Reconstruction	
6 inch subbase, 6 inch base, 3 inch bit.	$1.30/s.f.
6 inch subbase, 6 inch PCCP	$1.65/s.f.
5 inch PCCP on existing pavement	$1.20/s.f.
New Development	
Land Purchase (Commercial/Residential)	$5,000/Acre
Land Purchase (Agricultural)	$2,000/Acre
Land Easements	$500/Acre
Earthwork	$2.50/C.Y.
Pavement	
3 inch bituminous surface on aggregate base	$12.00/S.Y.
6 inch portland cement concrete on subbase	$15.00/S.Y.
Medium Intensity Runway Lights (MIRL)	$1,500/Station
Runway End Identifier Lights (REIL)	$4,000/Rwy End
Visual Approach Slope Indicators (VASI)	$10,000/Rwy End
Omni Directional Approach Lighting System (ODALS)	$50,000
Non Directional Beacon (NDB)	$20,000
New Approach Aid	$90,000

TABLE 8-2

ACTIVITY COST ESTIMATES[1]

Obtain Property Interests	
Runway 14/32 Fee - 45 Acres±	$102,000
Runway 14/32 Easement - 2 Acres±	$ 1,000
Runway 2/20 Fee - 13 Acres±	$ 26,000
Runway 2/20 Easement - 4 Acres±	$ 2,000
Other Fee - 9 Acres	$ 45,000
Runway 14/32	
Preventive Maintenance	
Level 1	$ 14,000
Level 2	$ 34,000
Rehabilitation	$225,000
Reconstruction	$335,000
1000 Foot Extension	$345,000
Center Taxiway and Apron	
Corrective Maintenance	$ 5,000
Preventive Maintenance	
Level 1	$ 4,000
Level 2	$ 10,000
Rehabilitation	$ 63,000
Reconstruction	$ 95,000
Apron Expansion	$145,000
New Taxiways	
Partial Parallel	$450,000
Northwest End Connector	$ 60,000
Runway 2/20	
Grading and Sitework	$400,000
Paving	$450,000
South FBO Ramp	
Corrective Maintenance	
Overlay extended approach	$ 900
Reconstruct extended approach	$ 4,000
Replace broken concrete slab	$ 1,000
Preventive Maintenance	
Level 1	$ 200
Level 2	$ 750
Rehabilitation	$ 10,000
Reconstruction	$ 21,000

[1] Rehabilitation, reconstruction and new construction estimates include engineering, administration and contingency costs.

TABLE 8-2
(Continued)

Access Roads and Vehicle Parking	
Corrective Maintenance	
Crack Repair	$ 750
Repair Failed Pavement	$ 1,500
Preventive Maintenance	$ 1,000
Rehabilitation	$ 44,000
Reconstruction	$ 62,000
Perimeter Taxiways	
Interim Overlay	$ 13,000
Reconstruction	$ 37,000
Widen to ALP width	$ 18,000
North FBO Ramp	
Corrective Maintenance	$ 1,500
Preventive Maintenance	$ 1,200
Rehabilitation	$ 5,000
Reconstruction	$ 14,000
"T" Hangar Taxiways	
Cosmetic Maintenance	$ 6,000
Rehabilitation	$ 15,000
Reconstruction	$ 30,000
Develop Hangar Areas	
Site Development	$ 30,000
"T" Hangars (20 Stalls)	$300,000
Corporate Hangars (Site Work Only)	$ 20,000
Navigation Aids	
VASI Lights 2 sets	$ 20,000
ODALS	$ 50,000
New Approach Aid	$ 90,000
Runway Edge Lights	
Runway 14/32	$ 60,000
Runway 2/20	$ 52,000

[1] Rehabilitation, reconstruction and new construction estimates include engineering, administration and contingency costs.

CHAPTER 9

FINANCIAL FEASIBILITY

AIRPORT VALUE

In the broadest sense, airports in the national transportation system are essential to our very way of life. Airports are the interface of air transportation with other transportation modes. Air transportation is the most dynamic of all transportation alternatives because it is the fastest way to travel. The importance of time in the business world has long been recognized. Furthermore, as individuals and as a society, we increasingly have to deal with complex time and distance factors in our lives. Air transportation can no longer be classified as a luxury or an option. It is an essential component of our existence.

The essential nature of air transportation is acknowledged at state and federal levels through management and subsidy programs which have been described in an earlier chapter of this report. The value of air transportation to the Boone service area is discussed in this chapter.

Physical Worth

In terms of physical worth, the replacement value of assets at the Boone Municipal Airport can be shown to be approximately $1.7 million. These assets are approximately evenly divided between pavement improvements and buildings. In addition, the land value within the airport boundaries is approximately $600,000. The total value of the airport, including land and improvements, exceeds $2 million.

Economic Worth

Economic benefits enjoyed by the City of Boone are somewhat more difficult to quantify. Of course, direct revenues from farm and hangar rent are a matter of record. In 1983, revenues totaled approximately $25,000. Projecting an increase in revenue in direct proportion to operations, direct revenues on the airport can be expected to increase as follows:

Year	Operations	Revenues
1983	$20,000	$25,000
1987	$25,000	$31,250
1993	$29,500	$36,875
2003	$35,000	$43,700

In all probability, revenues will increase at a faster rate than operations. Present trends in the aviation industry indicate that the ratio of business flying to pleasure flying is increasing steadily. This trend, in combination with the fact that business aviation is steadily upgrading to larger and more sophisticated equipment, leads one to conclude that tomorrow's aircraft owners will demand improved facilities and will be willing to pay more for them.

There are significant indirect benefits related to the airport. A surprising amount of business is conducted in the City by persons who fly into the Boone Municipal Airport. Furthermore, several local companies base aircraft at Boone and use them regularly to conduct business. Of the 47 aircraft based at Boone in 1983, 18 are considered to be business aircraft. Finally, the Fixed Base Operator has a steady flow of charter flights for businesses in and around Boone. Charters average 20 to 30 per month and require virtually full-time services of one pilot and half-time services of another.

Indirect benefits to the City accrue from these business activities, many of which would not be practical without convenient access to air transportation. As local businesses grow and prosper, they contribute to the overall economic welfare of the City.

OWNER RESPONSIBILITY

Safety

The most imperative responsibility of the City is to maintain acceptable standards of safety on the airport and in the surrounding air space. Minimum safety standards are prescribed by the Federal Aviation Administration and the airport is inspected annually by the Iowa Aeronautics Division. The Boone Municipal Airport has a current certificate indicating compliance with minimum safety standards.

Maintenance

The airfield pavement at Boone has a useful service life of approximately 20 years. Assuming a 10 percent salvage value at the end of that time, the rate of deterioration can be shown to be approximately $34,000 per year. Buildings typically have a longer service life and a somewhat greater salvage value. The rate of deterioration of the buildings is approximately $17,000 per year based on a 30-year service life with a 30 percent salvage value. The annual loss of value of assets at the airport caused by normal aging and deterioration is approximately $50,000. Over the past five years, the City has invested an average of about $10,000 per year for maintenance.

The condition of airport facilities is described in Chapter 2. It is immediately apparent that maintenance efforts have not been sufficient to counterbalance deterioration. This is particularly true in pavement areas around hangars and in the vehicle parking area. As would be expected, the first priority for preservation has been on the paved runway, center taxiway, and terminal apron.

The Boone Municipal Airport will require approximately $30,000 per year to maintain all facilities in fully serviceable condition. An additional increment will be required to restore to serviceable condition, or replace, assets which have deteriorated through neglect.

Three tables on the following pages present alternative three year maintenance budgets for the Boone Municipal Airport. The "Minimum" budget shown in Table 9-1 represents a continuation of past maintenance allocations. The "Hold the Line" budget in Table 9-2 approximates the anticipated 1984 maintenance appropriation. This budget includes some reconstruction in the second and third years to restore failed pavement to serviceable condition. The "Recovery" budget in Table 9-3 includes funds for additional rehabilitation in areas not likely to receive state and federal aid and represents substantial recovery of airport assets to serviceable condition in a three year period.

New Development

The Boone Municipal Airport has expanded from two turf runways, one commercial hangar, and two six-unit "T" hangars in 1949 to the modern facilities in use today. This expansion occurred in response to the needs of the aviation industry. Today's general aviation aircraft are larger and faster, and carry larger payloads than their predecessors. Airport facilities required to accommodate succeeding generations of aircraft must continue to be provided by the City if the airport is to maintain its role of service to the community.

In general, aircraft which dictate airport improvements are those operated for the conduct of business. The business fleet is steadily growing and becoming more sophisticated. An executive, who 20 years ago was satisfied to fly VFR in a single-engine airplane at 120 mph, today uses a light twin-engine airplane with all-weather capability and a cruise speed of 200 mph. Executives who used the light twin 20 years ago have upgraded to pressurized turboprop or business jet aircraft capable of flying over most weather systems and at speeds approaching 500 mph. Time is the driving force in this evolution. The business airplane gets an executive where he wants to go in a hurry. His choice of destination is limited only by nonavailability of airport facilities suitable for his use. The City must provide airport facilities which meet minimum performance standards of aircraft used by the businesses which contribute to the economic welfare of the community.

This Airport Development Plan examines existing facilities and anticipated air transportation demands in the Boone area, and identifies new and expanded facilities required to meet these demands. We have made our forecasts assuming that the business aircraft fleet will continue to become larger and faster during the planning period of this report. Our determination of facility requirements reflects this assumption.

Expanding airport facilities is very costly. However, state and federal aid to accomplish airport development projects has steadily increased through the years. Today, the City is eligible to receive up to 90 percent federal aid or up to 70 percent state aid for eligible airport improvements. It remains the owner's responsibility to define, initiate, and expedite projects for development of the airport. The ultimate scope of a project and its timing may depend, to some degree, on limitations in state and federal assistance, but it cannot begin without a commitment by the owner to sponsor the development.

TABLE 9-1

"MINIMUM" 3-YEAR BUDGET

Year 1			
	Runway 14/32:	Level 1 Maintenance	$ 5,000
	Center Twy./Apron:	Corrective Maintenance	$ 5,000
Year 2			
	Access Road Repair		$10,000
Year 3			
	South FBO Ramp:	Reconstruct Approach	$ 4,000
	Unspecified Corrective Maintenance		$ 6,000

TABLE 9-2

"HOLD-THE-LINE" 3-YEAR BUDGET

Year 1

Runway 14/32:	Level 1 Maintenance	$10,000
Runway 14/32:	Remarking	$ 6,000
Center Twy./Apron:	Corrective Maintenance	$ 5,000
Center Twy./Apron:	Level 1 Maintenance	$ 4,000
Access Road:	Reconstruct 2,500 s.f.	$ 4,000
Access Road:	Patch Repair 250 s.f.	$ 1,000

Year 2

S. FBO Ramp:	Reconstruct Approach	$ 4,000
	Replace Concrete Slab	$ 1,000
	Level 1 & 2 Maintenance	$ 1,000
Access Roads:	Crack Repair 160 l.f.	$ 1,000
	Seal Cracks 1,200 l.f.	$ 2,500
Vehicle Parking:	Reconstruct	$20,500

Year 3

Vehicle Parking:	Reconstruct	$18,500
S. Perimeter Twy:	Interim Overlay	$ 6,500
Unspecified Maintenance		$ 5,000

TABLE 9-3

"RECOVERY" 3-YEAR BUDGET

Year 1

Runway 14/32:	Level 1 Maintenance	$10,000
	Remarking	$ 6,000
Center Twy./Apron:	Corrective Maintenance	$ 5,000
	Level 1 Maintenance	$ 4,000
S. FBO Ramp:	Rehabilitate	$10,000
Access/Parking:	Rehab/Reconstruct	$15,000

Year 2

Access/Parking:	Rehab/Reconstruct	$35,000
Perimeter Twys.:	Reconstruct	$15,000

Year 3

Perimeter Twys.:	Reconstruct	$22,000
North FBO Ramp:	Rehabilitate	$ 5,000
Replace NDB (50% State)		$10,000
"T" Hangar Twys.:	Rehabilitate	$15,000

Service

In addition to providing and maintaining airport facilities, the City has a responsibility to offer certain aviation services to users of the airport. The types and extent of services offered have a significant bearing on the success of the facility as an asset to the community.

Services typically offered at airports include fuel sales, aircraft maintenance, storage facilities, flight instruction, air charter service, aircraft rental, and aircraft sales. Of course, the owner seldom provides these services directly. They are nearly always provided by a Fixed Base Operator (FBO), who rents facilities from the owner and offers aviation services to users of the airport. In his capacity as a businessman offering aviation services at the airport, the FBO is a tenant of the owner. As such, he is subject to certain restrictions and requirements established by the owner.

At general aviation airports, the Fixed Base Operator often performs a variety of management functions for the owner in addition to his FBO activities. This dual function can be beneficial to both owner and FBO. The owner obtains services of a person who has a personal interest in keeping the facilities in safe, serviceable, and attractive condition. The FBO typically receives a supplemental income for his management and maintenance duties.

SOURCES OF REVENUE

The Boone Airport Commission receives revenue from leasing airport facilities and land and from other charges imposed for use of the facilities. Primary sources of revenue are the land and buildings. Additional revenue can be obtained by individual assessments on users through such means as fuel flowage and tie-down fees. Still other sources of revenue may be available through innovative applications such as providing advertising spaces on the airport for sale to local businesses.

The Commission has an obligation to establish rates and fees which will ensure optimum revenue from the facilities. At the same time, it has a responsibility to establish policies and offer services which will encourage continued growth at the airport.

Farm Lease

The existing lease for use of farmland on airport property is arrived at through competitive bidding at periodic intervals. An alternative management option would be to negotiate a "share cropping" lease in lieu of a "cash" lease. Advantages of "share cropping" are that the Commission can share in the actual revenues produced by the land. A major disadvantage is that the Commission also shares in the risk. The major advantage of the "cash" option is that the Commission's responsibility for managing the lease is minimized. Since the Commission is not in a position to provide close supervision of the farming operation, the "cash" option seems preferable at Boone.

Fixed Base Operator Lease

The Fixed Base Operator lease should deal only with the relationship between the Commission and the FBO as a tenant. The lease should establish minimum standards of conduct for the FBO and should specify minimum services to be offered to airport users. Where the FBO performs airport managment and maintenance services, a separate written agreement should be negotiated to describe these duties and prescribe fair compensation for the services. The Commission should charge reasonable rates for use of facilities provided to the FBO. The lease should be written so that the Commission and the FBO share proportionately in revenues generated on the airport. The lease should not contain language or grant privileges that would, by implication or intent, make it impossible for another FBO to offer competitive services on the airport subject to the same minimum standards prescribed for the first FBO.

On the other hand, the Commission must realize that services performed by the FBO contribute in a very major way to the role the airport plays in the community. The FBO must be allowed to prosper in his business or the business, and the service, will be lost. In any FBO negotiation, it is first necessary to determine services to be required and compensation for facilities. It is also important to build in certain longevity assurances to allow the FBO to recover his initial investment in aircraft, tools, and equipment. Rent for use of facilities should be related to activity. Fuel sales is perhaps the best indicator of activity on the airport. Therefore, the amount of rent may be determined in relation to the amount of fuel sold. If the owner makes improvements in the facilities so that the aviation activity is increased significantly, the owner should be compensated on the basis of that increase in activity. Conversely, if the activity at the airport is reduced by economic conditions, the owner should share with the FBO in the reduction of revenues.

Rent and Fees

The FBO is normally the major user of the facilities on a general aviation airport. As such, he provides most of the revenues to the Commission. Other users are also sources of potential revenue. Aircraft owners who rent hangar spaces should pay rent to the Commission. Other users of the facilities can contribute through various means. It is common for owners to charge the FBO a fuel flowage fee as a way to obtain revenue from transient users of the facilities. Fees are commonly charged for overnight tie-down of aircraft on the airport apron. At some larger airports, landing fees are charged as the most direct way to charge users for facilities use. Use of landing fees is not recommended at Boone for two principle reasons. First, administrative procedures for collecting landing fees are quite complex and can lead to inconsistent collection. Secondly, payment of landing fees is not well accepted by the flying public, and would probably have a detrimental effect on airport activities.

There is no standard for deciding hangar rental rates or user fees. A telephone survey of several comparable airports in the vicinity of Boone and throughout the State of Iowa indicates that "T" hangar fees in use at Boone are competitive. The fact that all hangars are full and that several aircraft

are stored in common hangars indicates that a modest increase in hangar rent would be acceptable. The Airport Commission does not, at present, realize revenue from fuel sales. Fees between two and five cents per gallon of fuel sold are common and should be considered by the Commission. Rental rates for corporate hangars at comparable airports vary so widely that no valid comparison can be made. However, the rate should be comparable to rental rates for similar shop space in the community.

Iowa Army National Guard

The Iowa Army National Guard maintains a helicopter facility at the Boone Municipal Airport. Until recently the Guard annually contributed a lump sum fee to the Commission for use of the facilities. In 1983, that contribution was suspended. The reason given was that the contribution was originally established when the facility operated fixed wing aircraft and made use of taxiways and runways for their operations. Since the operation has subsequently changed over to helicopters, taxiways and runways are no longer used. However, that rationale ignores the fact that the helicopters continue to use the navigation aids, wind indicators, runway lights, instrument facilities and air space. In fact, the helicopters do use the runways in performing touchdown autorotations, an activity which contributes to pavement wear far more rapidly than do landings by fixed wing aircraft.

Given these facts, it would seem appropriate for the Commission to petition to the Iowa Army National Guard for a reinstatement of the contributions for use of airport facilities. On the other hand, the National Guard is a major industry in Boone and contributes to the economic welfare of the community through employee payrolls as well as use of local businesses, suppliers, and contractors for operations and facilities. In the interest of community relations, the Commission may concede that, as a government agency, the Iowa Army National Guard is entitled to free use of the airport facilities.

COMMUNITY SUPPORT

Local Subsidy

Almost all utility airports in Iowa rely upon some form of local subsidy to meet operating expenses. A recent survey by the Iowa Aeronautics Division confirms that most utility airports receive from 25 percent to 100 percent of their operating capital from the annual City budget. Often, airport revenues are retained exclusively for use in operating the airport. This is typical of airports administered by Commissions. Another common procedure is for all airport revenues to be absorbed into the City's general fund with operating capital allocated back to the airport through the budget process. This procedure is more typical of airports administered directly by the City's governing council.

The amount of subsidy required depends on several factors. However, the deciding factor is the attitude of the governing body toward the local airport. If the airport is a controversial issue, or if it receives a low priority in the budgeting process, it will lose its vitality and deteriorate, not only physically, but operationally. On the other hand, if the community takes pride in its airport, and sees the airport as a vital asset, then adequate funding will be appropriated and the airport will thrive. Either way, the airport facilities

will reflect the community's attitude. In almost every instance, the appearance and serviceability of an airport accurately reflects the community's attitude toward progress and growth.

Bonding

The annual airport operating budget is derived from a combination of airport revenues and local subsidy. This budget is intended to maintain existing facilities in safe, serviceable, and attractive condition. The annual budget cannot accommodate periodic major expenditures which occur when an expansion is required to modernize the facility, or when a primary feature such as a runway has to be rehabilitated. In these instances, a supplemental appropriation must be made. The most common method for obtaining such appropriations is by bonding. Revenue bonds can be sold for such revenue producing assets as hangars. However, unless the community is very near its bonding limit, general obligation bonds can serve the same purpose at lower rates of interest. In the case of public use facilities such as runways, taxiways and administration buildings, general obligation bonding is almost always a preferable alternative. General obligation bonds can be sold to finance airport improvements by resolution of the governing council. Public approval by referendum vote is not required.

Joint Ownership

Of course, most benefits realized from an airport accure within the city limits of the owning community. However, the service area of the airport is much larger than the community boundaries and the airport serves a considerable population outside the city.

In Iowa, nearly all publicly owned airports are city airports. There is however provision in state law for counties to own airports, and for joint ownership among cities or counties.

At present, the entire tax burden of the Boone Municipal Airport rests with the citizens of Boone. A more equitable distribution of subsidy would be realized if Boone County and perhaps other cities in the airport service area, such as Madrid and Ogden, were to become joint owners.

CHAPTER 10

DEVELOPMENT PROGRAM

SUMMARY

1984 - 1988

The primary development goal of the first five years of the plan is to construct a 1,000 foot extension to Runway 14/32. Along with this runway extension, the existing runway, center taxiway and terminal apron would be rehabilitated to a condition equivalent to the runway extension. Land acquisition can be a tedious and time consuming process and should be initiated as early as possible. This is particularly true of those parcels which are imperative to the runway extension.

Other project items which are important in the first five years of the program include a new ten unit T-hangar and reconstruction of the perimeter taxiways to the hangars, reconstruction of portions of the vehicular access and parking areas, and a new Nondirectional Beacon to replace the existing unit. Also, the Runway 14/32 edge lighting system should be replaced in conjunction with the runway extension.

Assuming no delays in funding, the earliest year in which completion of the Runway 14/32 extension and rehabilitation can be expected is 1987. In order to maintain the schedule, the environmental assessment must be initiated in 1984, and the land acquisition must be initiated as soon as possible and completed no later than early 1986. Thereafter, grading for the runway extension would take place in 1986. Paving of the runway extension and rehabilitation of the existing runway could then be accomplished in 1987 or 1988.

All T-hangar units on the airport are presently full. In addition, nearly 20 aircraft are stored in the common hangars. The Commission should solicit interest among based aircraft owners and others in the airport service area to obtain firm commitments for rental of hangar spaces in a new T-hangar. Following this, a new ten unit T-hangar should be constructed without delay. The earliest reasonable schedule for the hangar construction would include site development and grading in 1984, with hanger construction in 1985.

1989 - 1993

The major development goal in the second five years of the program is construction of a parallel taxiway to Runway 14/32. This construction would be accompanied by an expansion of the terminal apron and installation of a new type of instrument approach aid.

In addition, the service life of the two small T-hangars is expected to end during this five year planning period. Therefore, provisions have been made to replace those two hangars with new ten unit T-hangars.

1994 - 2003

In Chapter 3, limitations of long-range planning were emphasized. The last ten years of this planning period constitute the long-range plan. Major construction anticipated in the final ten years of the plan include paving of Runway 2/20 and replacement of the existing large T-hangars with two new ten unit T-hangars.

An itemized cost estimate of required improvements, by planning period, is shown in Table 10-1. These estimates are based on 1983 dollars and are subject to change at time of design.

DEVELOPMENT SCHEDULE 1984-1988

Improvements programmed for implementation in the first five-year period of the plan are based on existing need and forecasts having a high degree of reliability. Therefore, it is appropriate to examine improvements in this period in greater detail.

Table 10-2 presents improvements in the period from 1984 through 1988 in chronological order by year. In addition, a suggested funding distribution is presented. This distribution does not represent maximum federal and state participation, nor does it minimize the local share of project cost. It is, however, a balanced distribution of funding which would seem to be reasonably attainable assuming full cooperation of all agencies. The years 1987-1988 are combined because of the magnitude of federal aid required and because scheduling of the amount of construction proposed could easily take two years.

Table 10-3 is a summary of federal, state, and local funding by budget year.

TABLE 10-1

PROPOSED SCHEDULE OF AIRPORT IMPROVEMENTS

Improvement	1984 - 1988	1989 - 1993	1994 - 2003
Property Aquisition	$ 176,000	$	$
Runway 14/32			
Rehabilitation	225,000		
Extension	345,000		
Runway 2/20			850,000
Taxiways			
Parallel 14/32		450,000	
NW Exit		60,000	
Perimeter	37,000		
Terminal Apron			
Rehabilitation	63,000		
Expansion		145,000	
Site Development	30,000		
Hangers			
New (10 units)	150,000		
Replacement			
Small "T" (20 units)		300,000	
Large "T" (20 units)			300,000
Access and Parking			
Reconstruction	25,000		
Maint. Bldg. Access	5,000		
Navigation Aids			
Runway 14/32 MIRL	60,000		
Runway 2/20 MIRL			53,000
VASI (2 sets)	20,000		
ODALS		50,000	
NDB	20,000		
New Approach Aid		90,000	
TOTAL	$1,156,000	$1,095,000	$1,203,000

TABLE 10-2

RECOMMENDED DEVELOPMENT SCHEDULE (1984 - 1988)

Year	Improvement	Total	Federal	State	Local
1984	Site Development	$ 30,000	$	$ 21,000	$ 9,000
	New NDB	20,000		14,000	6,000
1985	Land Acquisition	176,000	158,400		17,600
	New Hanger (10 units)	150,000			150,000
	Maint. Bldg. Access Road	5,000			5,000
1986	Runway 14/32 Grading	225,000		157,500	67,500
1987-	Runway 14/32 Paving	345,000	310,500		34,500
1988	Runway 14/32 Lighting	80,000		56,000	24,000
	Terminal Apron and Center Taxiway Paving	63,000	56,700		6,300
	Perimeter Taxiway Paving	37,000	33,300		3,700
	Vehicle Access and Parking	25,000	22,500		2,500
		$1,156,000	$ 581,400	$ 248,500	$ 326,100

TABLE 10-3

ANNUAL FUNDING DISTRIBUTION (1984 - 1988)

Year	Total	Federal	State	Local
1984	$ 50,000	$	$ 35,000	$ 15,000
1985	331,000	158,400		172,600
1986	225,000		157,500	67,500
1987-88	550,000	423,000	56,000	71,000

APPENDIX A

BASED AIRCRAFT

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BASED AIRCRAFT
BOONE MUNICIPAL AIRPORT
May 6, 1983

	N Number	Aircraft	Engine
1.	N3805E	King Air C-90	Twin Turboprop
2.	N66504	Baron B-55	Twin Piston
3.	N6890F	Seneca PA-34 200T	Twin Piston
4.	N5066J	Cessna 310R	Twin Piston
5.	N3405P	Apache PA-23-160	Twin Piston
6.	N7905Y	Twin Comanche PA-30	Twin Piston
7.	N5481F	Alon A2A	Single
8.	N7680W	Cherokee PA-28-180	Single
9.	N3909K	Cherokee PA-28-140	Single
10.	N1887C	Cessna C-170	Single
11.	N1308C	Pacer PA-20	Single
12.	N3952H	Ercoupe 415	Single
13.	N9636L	Traveler AA-5	Single
14.	N79359	Mooney M-20E	Single
15.	N52101	Cardinal 177RG	Single
16.	N71077	Skylane 182	Single
17.	N3608Q	Musketeer A23-24	Single
18.	N6959Q	Musketeer A23A	Single
19.	N9573T	Cessna C-210	Single
20.	N6421P	Centurian P210	Single
21.	N8620T	Skylane C-182	Single
22.	N5042E	Citabria 7ECA	Single
23.	N7619D	Tri Pacer PA-22	Single
24.	N6570H	Tiger Moth	Single
25.	N9318E	Aeronica Chief 11AC	Single
26.	N1909N	Cessna C-140	Single
27.	N21305	Aeronica Chief 11AC	Single
28.	N3656A	Tri Pacer PA-22	Single
29.	N3966J	Cessna C-150	Single
30.	N5068Y	Citabria 7ECA	Single
31.	N21KC	Home-built KR-1	Single
32.	N4764B	Skywagon C-180	Single
33.	N81774	Saratoga PA-32-301	Single
34.	N8229A	Lance II PA-32RT-300	Single
35.	N9650L	TR-2 AA-1B	Single
36.	N8237D	Bonanza C-35	Single
37.		Home-built original	Single
38.	N36788	Warrior PA-28-161	Single
39.	N9958U	Cheetah AA-5A	Single
40.	N33263	Cardinal 177RG	Single
41.	N11HN	Swift	Single
42.		Cessna C-150	Single
43.	N28335	Tiger AA-5B[1]	Single

N Number	Aircraft	Engine
44. N28532	Tiger AA-5B[1]	Single
45. N1486R	Trainer AA-1B[1]	Single
46. N4242F	Cessna C-172	Single
47. N4701U	Cessna C-180	Single

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