AIRPORT DEVELOPMENT PLAN

GRINNELL, IOWA

1985

CGa
CONSULTING ENGINEERS
MARSHALLTOWN
IOWA

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AIRPORT AND COMMUNITY BACKGROUND

INTRODUCTION

OBJECTIVES:

The City of Grinnell retained Clapsaddle-Garber Associates to prepare an Airport Development Plan for the City of Grinnell. A grant-in-aid was obtained from the Iowa Department of Transportation with the local match provided by Greater Grinnell Development Inc. Professional Design Services of Iowa Inc. was retained by Clapsaddle-Graber Associates to assist in the preparation of aviation forecasts and other study elements.

A scope of work was designed to address the areas of aviation activity, benefit and cost, facility needs, airport site selection, development schedules and construction costs. Specific objectives of the scope of work are summarized as follows:

- To provide an effective graphic presentation of the ultimate development of the airport over a 20-year planning period, should justification for improvements be found.
- To establish a schedule of priorities and phasing for the various improvements proposed in the plan.
- To provide a plan that is consistent with other community goals and objectives of Grinnell as well as the State of Iowa DOT, and the Federal Aviation Administration.
- To provide a tool for decision making at the local level.
- To provide an ultimate development plan which is feasible, acceptable and can be implemented within existing and future financial constraints of the community.

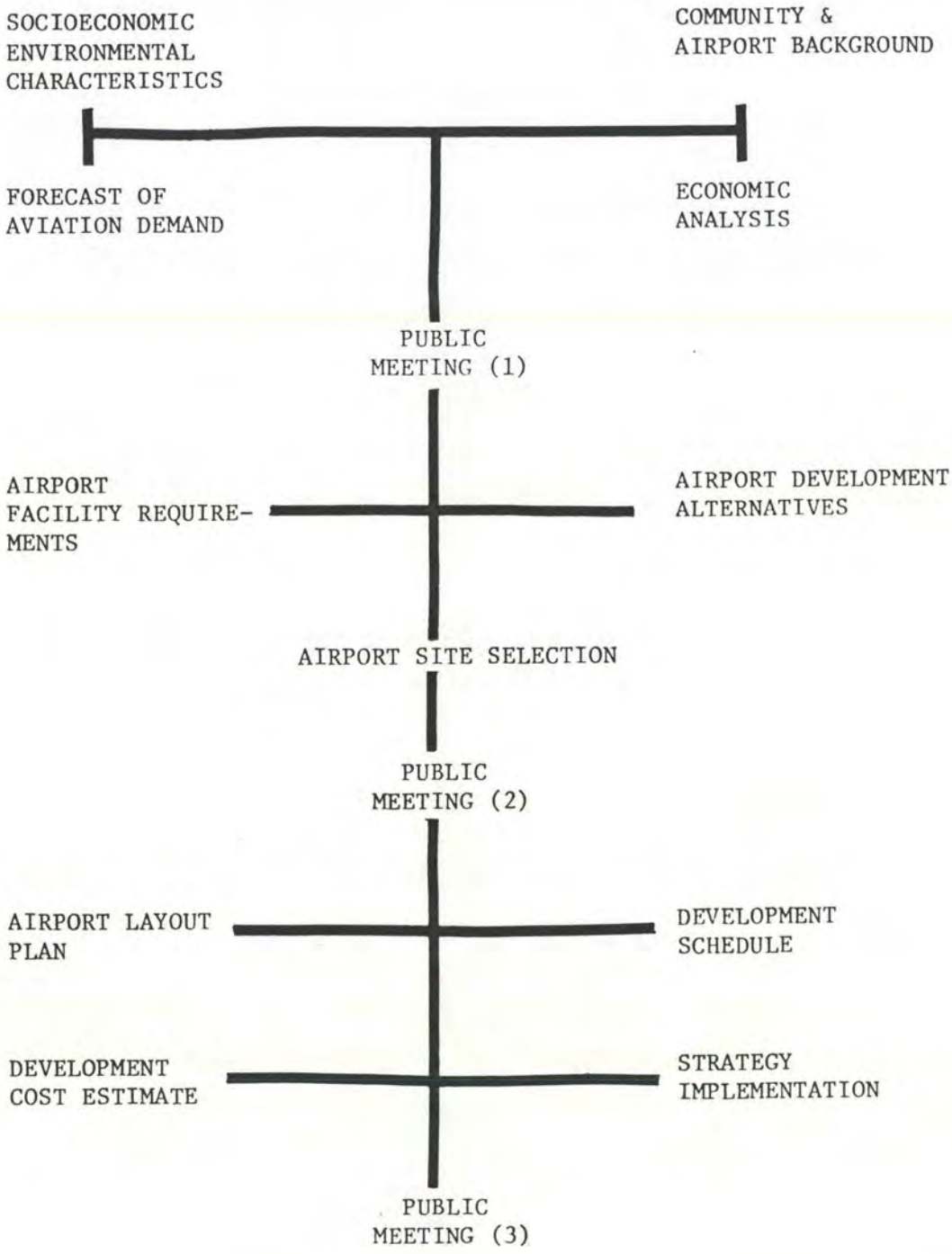


FIGURE 1-1 AIRPORT DEVELOPMENT PLAN PLANNING PROCESS

The first major decision point is found upon the conclusion of the forecast of aviation activity. The City of Grinnell, based upon the estimates provided herein, may conclude that:

1. Sufficient aviation activity exists to justify continuation of study efforts to include the selection of an airport site.
2. Estimated aviation activity and secondary benefits are insufficient to justify continued evaluation.

The ultimate decision is a local one. The Iowa Department of Transportation will provide input concerning the role a Grinnell Airport may have within the state airport system. At present, the Grinnell facility is classified as a system candidate airport.

The second major decision (should sufficient aviation activity be found) is the selection of a site which would accommodate long range airport facility needs. Upon identification of a site, a graphic layout of the airport will be prepared. A development schedule and estimate of cost will also be prepared.

To achieve the objectives previously outlined, the airport development planning process outlined in FIGURE 1.1 was developed.

COMMUNITY CHARACTERISTICS

PHYSICAL SETTING:

The City of Grinnell is located in Poweshiek County on State Highway 146 approximately three (3) miles north of Interstate Highway 80. The community is served by the Chicago and Northwestern Transportation Company and Iowa Rail. The Des Moines Metropolitan area is located fifty (50) miles west via Interstate Highway 80. Reference may be made to FIGURE 1.1.

Area topography consists of level to moderate slopes characteristic of the Tama-Muscatine Soil Association. Area drainage is provided by the Skunk River, located eight (8) miles southwest of the community and the north fork of the English River. Both streams flow in a southeasterly direction. Surface water in close proximity to Grinnell is limited to three (3) artificial lakes two of which are located within the corporate limits. Rock Creek Lake is located six (6) miles northwest of the City.

Climatic conditions are classified as humid continental with large seasonal and daily variations in temperature. The average winter temperature is 22.6 degrees Farenheit. The average summer temperature is 72.1 degrees Farenheit. The mean maximum temperature is approximately 85.4 degrees Farenheit, (Des Moines Airport).

HISTORIC SETTING:

The City of Grinnell was incorporated in April of 1856 several years after Josiah Grinnell had constructed the first dwelling. The railroad and rich agricultural hinterland provided an impetus for growth of the community.

Grinnell College, founded as the Iowa College in Davenport, moved to Grinnell in 1859. The growth and development of Grinnell College parallels the growth of the community.

While the agriculture hinterland provided for the community's development, the City has long had a manufacturing base. The Morrison Glove Factory and Morrison Trannery were the first major industries established. The Spaulding Manufacturing Company Plan, now listed on the National Register of Historic Places, was widely known for the production of horse-drawn buggies. At peak production, the company employed 300 persons producing 10,000 units per year. The retail and service sectors of the community provided goods and services to a growing trade area population.

POPULATION CHANGE:

After a brief decline in population during the 1930's, the community has shown a steady growth in population.

TABLE 1.1 HISTORIC POPULATION GROWTH, GRINNELL, 1900-1970

Year	Population	% Change	Year	Population	% Change
1900	3,860	15.8	1950	5,745 (6,828)	10.3
1910	5,036	50.5	1960	6,406 (7,347)	11.5 (7.9)
1920	5,362	6.5	1970	7,267 (8,402)	13.4 (14.0)
1930	4,949	-7.7	1980	7,636 (8,868)	5.0 (5.5)
1940	5,210	5.3			

SOURCE: Grinnell Comprehensive Plan - 1980
U.S. Census of Population, 1950-1980

The population counts noted above exclude the college population except for those numbers within parentheses which show total population. Prior to 1950, the U.S. Census did not include students in the Official Population counts.

Population change by age groups provides an indicator of economic conditions within a community.

TABLE 1.2 POPULATION CHANGE BY AGE GROUP, GRINNELL, 1960 - 1980

Age Group	1960	1970	1980	Change - 1960-80	
65+	999	1,147	1,316	317	31.2 %
55-64	608	718	709	101	16.6
45-54	690	729	715	25	3.6
35-44	780	778	863	83	10.6
25-34	726	973	1,201	475	65.4
15-24	1,652	2,062	2,377	725	43.9
5-14	1,212	1,409	1,133	-79	-6.5
0- 4	700	586	554	-146	-20.9%
Total	7,367	8,402	8,868		

SOURCE: U.S. Census of Population

The increase within the 15-24 and 25-34 age group reflects in part increased college enrollment over 1960.

The Region Six Planning Commission prepared a comprehensive plan for Grinnell in June of 1980. The plan presented a projection of needs for the City of Grinnell through the year 2000. A continued increase in population for Grinnell was projected through the year 2000. Reference may be made to Table 1.3.

TABLE 1.3 POPULATION CHANGE, GRINNELL, 1970-2000

Year	Low	Middle	High
1970	8,402	8,402	8,402
1980	8,692	8,973	9,440
1990	9,067	9,583	10,606
2000	9,209	10,234	11,916

SOURCE: Grinnell Comprehensive Plan-1980, p. 21

The official census count in 1980 found 8,868 residents within the City of Grinnell which nearly approached the middle estimate of 8,973 presented in the Comprehensive Plan. The middle estimate was identified in the Comprehensive Plan as being the best indicator of future population change. Some 10,234 persons may reside with the community by year 2000.

Table 1.4 summarizes future population change for Poweshiek County and eight area counties.

TABLE 1.4 POPULATION TRENDS, NINE COUNTIES, 1980-2000

County	Year 1980	1985	1990	2000	1980 % of Total
Mahaska	22,867	23,042	25,281	23,716	10.4
Poweshiek	19,306	19,415	19,558	19,590	8.7
Tama	19,533	18,379	18,480	18,736	8.8
Jasper	36,425	36,217	36,846	37,397	16.4
Keokuk	12,921	11,717	11,676	11,731	5.8
Iowa	15,429	15,132	15,382	15,661	7.0
Marion	29,669	28,943	29,410	29,933	13.4
Marshall	41,652	40,108	40,975	42,049	18.8
Benton	23,649	24,350	25,131	26,320	10.7
	221,451	217,303	220,739	225,133	100.0
Poweshiek as % of total	8.7	8.9	8.9	8.7	

SOURCE: Iowa Office of Planning & Programming
Provisional Population Projections - Nov., 1972

A very modest rate of population increase (1.5%) was projected for Poweshiek County through the year 2000. The period from 1960 to 1970 found a population loss while the decade from 1970 to 1980 saw a population increase resulting in an increase of six (6) persons over the 1960 population of 19,300 persons. It is interesting to note that the population of Poweshiek County has increased only 2.0% since 1880. Typical of Iowa, the rural farm population has continued to decline while the larger communities have increased in population.

Little population change within the nine (9) county region is expected through the year 2000. Poweshiek County's share of the region's population is stable to remain stable at 8.7 percent in 1980 and 2000.

Population change is attributed to three (3) components: births, deaths and migration. The out-migration of persons of child-bearing years will have a pronounced impact upon future population growth. Most persons leaving the area within this age group do so because of job opportunities. Persons of retirement age seek warmer climates. 1673 persons migrated from Poweshiek County between 1960 to 1970. This number was substantially reduced in the period from 1970 to 1980. Reference may be made to the following table.

TABLE 1.5 BIRTHS, DEATHS, MIGRATION - POWESHIEK COUNTY

Period	Births	Deaths	Out-Migration
1960-1970[1]	3,244	2,068	1,673
1970-1980[2]	2,533	1,994	36

SOURCE: 1) 1980 Comprehensive Plan - Grinnell
2) Iowa Department of Health

Although there are many factors contributing to in or out-migration, the most significant local factor relates to job opportunities within the community. Where new job opportunities can be created, the community will be able to induce a population increase from in-migration as well as from an increase in the number of persons of child-bearing age who choose to remain in the community.

EMPLOYMENT CHARACTERISTICS:

Occupation or employment by industry provides an insight into travel tendencies. The END Foundation catagorized industry by travel tendency as follows:

High Travel:

Mining, Manufacturing, Government, Business Services

Medium Travel:

Construction, Wholesale and Retail Trade, Professional Services, Finance, Insurance and Real Estate

Low Travel:

Agriculture, Forestry, Transportation, Communications, Utilities, Repair Service, Recreation, Amusement, Printing

An indication of travel tendency within the nine county region can be obtained from reference to Tables 1.6 and 1.7. Marshall County has the greatest number of persons employed in those industries having a high travel tendency. Marshall County is followed in turn by Marion, Iowa, Jasper and Poweshiek Counties. As noted, 41 percent of the employment in Poweshiek County was in those industries with a high travel tendency while 24 percent were categorized as having a medium travel tendency. Included in the low travel tendency group were in addition to the industries noted above, persons classified as domestic workers, unemployed persons and self-employed individuals.

TABLE 1.6 LABOR FORCE COMPOSITION - NINE COUNTIES - 1984

Category	Tama	Poweshiek	Jasper	Keokuk	Iowa	Marion	Marshall	Benton	Mahaska
- Civilian Labor Force	8,570	9,010	14,480	4,680	8,090	15,440	18,000	9,140	8,670
- Percent Unemployed	3.5	6.4	7.0	9.8	4.5	3.7	8.3	8.1	5.6
- Nonagricultural	5,530	6,200	10,450	2,420	5,410	12,280	13,340	5,860	5,970
- Self-employed, Domestic	1,250	1,010	1,650	620	1,120	1,710	1,950	1,110	1,190
- Manufacturing	580	1,110	5,830	70	3,050	3,820	5,200	300	1,160
- Construction	130	140	210	80	110	140	400	130	150
- Transportation, Communication and Public Utilities	210	690	390	80	80	310	580	180	140
- Wholesale Trade	470	410	610	440	350	600	660	520	370
- Retail Trade	730	1,150	1,700	350	1,220	1,550	2,800	800	1,270
- Finance, Insurance and Real Estate	270	480	410	160	160	280	570	240	290
- Service and Mining	600	1,470	1,420	380	580	1,980	2,720	620	1,280
- Government	1,070	1,010	1,770	620	770	2,380	3,190	1,220	1,010
- Agriculture	1,500	1,220	1,370	1,140	1,200	880	1,220	1,430	1,030

SOURCE: Iowa Department of Job Service, Jan. 1984

TABLE 1.7 EMPLOYMENT BY TRAVEL TENDENCY - 1984

County	High Travel	%	Medium Travel	%	Low Travel	%
Tama	2,250	26	1,600	19	3,850	55
Poweshiek	3,700	41	2,180	24	3,130	35
Jasper	7,020	48	2,930	20	4,530	31
Keokuk	1,070	23	1,030	22	2,100	45
Iowa	4,400	54	1,840	23	1,890	23
Marion	8,180	53	2,570	17	4,690	30
Marshall	11,110	62	4,430	25	2,460	13
Benton	2,140	23	1,690	19	5,310	58
Mahaska	3,450	40	2,080	24	3,140	36

SOURCE: P.D.S.

Of the nine (9) county region, 45 percent of the total civilian labor force was employed in those industries with a high travel tendency.

Employment by industry within the City of Grinnell is summarized in the following table.

TABLE 1.8 EMPLOYMENT BY INDUSTRY, GRINNELL, 1980

Industry	Number
- Agriculture, Forestry, Fisheries	58
- Mining	-
- Construction	165
- Manufacturing	748
- Durable Goods	483
- Transportation	139
- Communication and Public Utilities	323
- Wholesale Trade	96
- Retail Trade	721
- Finance, Insurance and Real Estate	288
- Business and Repair Services	67
- Personal, Entertainment and Recreation Services	162
- Professional and Related Services	1,310
- Health	302
- Education	877
- Public Administration	92

SOURCE: U. S. Dept. of Commerce, Bureau of the Census "General Social and Economic Characteristics" 1980

Within the City of Grinnell, 22 percent of the total employment was in those industries with a high travel tendency. Sixty-two (62) percent were employed by industry with a medium travel tendency with the remaining 16 percent employed in low travel industries.

TRADE AREA:

The 1980 Comprehensive Plan for Grinnell defined the community's service area encompassing some 700 square miles and containing approximately 23,500 persons. The defined zone of influence extends into Jasper, Tama and Marshall Counties.

Of the nine (9) county regional taxable sales in fiscal year 1982, Poweshiek County ranked fifth with $86,976,099 (10.0 percent) of taxable sales.

TABLE 1.9 TAXABLE SALES, NINE COUNTIES, FY82

County	Sales	Percent of Total
Poweshiek	$ 86,976,099	10.0
Marshall	186,336,681	21.5
Jasper	140,163,807	16.2
Marion	101,690,599	11.7
Keokuk	39,107,010	4.6
Iowa	72,273,222	8.3
Tama	70,289,399	8.1
Benton	73,918,719	8.6
Mahaska	95,334,054	11.0
Total	$866,089,590	100.0

SOURCE: Iowa Department of Revenue, "Retail Sales and Use Tax Report - FY82"

Retail sales within Poweshiek County by community are presented in Table 1.10 for fiscal years 1982.

TABLE 1.10 RETAIL SALES, POWESHIEK COUNTY - FY82

Place	March 31, 1982 Sales	Business
Grinnell	$55,674,234	278
Brooklyn	10,660,731	82
Montezuma	10,946,350	110
Deep River	624,058	20
Malcom	1,267,165	19
Non Permit	40,797	3
Other	7,762,764	139
County	86,976,099	651

SOURCE: Iowa Department of Revenue
Retail Sales and Use Tax Report - FY82, FY83

* 2 months at 3%; 1 month at 4%
\- Mid-May the '83 report should be ready

INDUSTRIAL DEVELOPMENT:

De Long Sportswear, Inc., a manufacturer of jackets, sweaters and baseball uniforms is Grinnell's oldest industry beginning as the Morrison Glove Company in 1856. The firm employed approximately 177 persons in 1984. Other major industries located in Grinnell are summarized Table 1.11.

TABLE 1.11 MAJOR INDUSTRIES, GRINNELL, 1984

Name	Product/Service	Employment
De Long Sportswear	Jackets/Baseball Uniforms	174
Donaldson Company, Inc.	Heavy Duty Mufflers	173
Farmland, Inc.	Farm Equipment	92
Golden Sun Feeds, Inc.	Livestock Feeds	43
Miracle Recreation Company	Playground Equipment	186
Stadiums Unlimited, Inc.	Aluminum Seating	96
Wenco of Iowa, Inc.	Wooden Windows	44
General Telephone Company	Communications	542
Grinnell College	Education - Private	420
Grinnell Mutual Reinsurance	Insurance - Reinsurance	420
Robin Tech		
Chief Alfa Inc.	Dehydrated Alfalfa	12
De Kalb Ag-Research, Inc.	Seed Corn	19
Cargill Seed Corn Company	Seed Corn	24

SOURCE: Iowa Development Commission "Community Quick Reference" Feb. 1984

Greater Grinnell Development Inc. has been instrumental in attracting a number of new industries to Grinnell. The development of a 95-acre industrial park south of the community provided an impetus for a new industrial base beginning with the location of Golden Sun Feeds in 1968 and Wenco in 1969.

Eighty-four (84) acres within the Grinnell Industrial Park are currently available for industrial development. The park site is located one mile north of Interstate Highway 80 adjacent to Highway 146. Rail service is also available.

The site is served by water, (12-inch main); sewer, (8-inch main); natural gas, (4-inch line) and electrical power (13,200 volt, 3 phase line).

AREA AIRPORT FACILITIES

STATE SYSTEM OF AIRPORTS:

The 1982 IOWA AVIATION SYSTEM PLAN identifies 80 airports which will serve the needs of the state. In addition, there are 41 publicly-owned airports that are classified as "local service airports."

A local service airport is eligible for state planning safety project funding, but not development funding. These airports could, provided there was a substantial increase in activity, be placed in a higher category of development.

The state system is based upon a hierarchy of airports each providing an increasing service capability.

Basic Utility (BU);	Those airports designed to accommodate 95 percent of all aircraft weighing 12,500 pounds or less.
General Utility (GU):	Those airports designed to accommodate 100 percent of all aircraft with a gross landing or take-off weight of 12,500 pounds or less.
Basic Transport (BT):	Those airports accommodating aircraft weighing 60,000 pounds or less and commuter airline service aircraft.
General Transport (GT):	General Transport airports will accommodate all aircraft weighing 150,000 pounds or less and major airline turbojet aircraft.

The state system consists of four general transport airports and 16 basic transport category airports. Of the 60 utility category airports, 22 are classified as general utility airports and 27 basic utility facilities.

Grinnell and Toledo classified as a local service airport, while Pella and Oskaloosa are classified as general utility facilities. Newton and Marshalltown are classified as a basic transport category airport. Des Moines Municipal is classified as a general transport category airport. Seven (7) major carriers and three (3) commuter airlines as of June, 1984 provided service to and from Des Moines Municipal Airport.

AIRPORT SERVICE AREA:

The airport service area was defined as serving the immediate area around Grinnell to include 75 percent of the land area in Poweshiek County and 15 percent of the land area in Jasper County. The remaining balance of Poweshiek County (25 percent) would more readily be served by the proposed airport development near Belle Plaine and the existing airport facility at Oskaloosa. This service area assumes that the airport would be accessible from State Highway 146 and be located south of Grinnell. Airport facilities located at Marshalltown, Pella, Newton and Tama-Toledo would be expected to serve the area beyond the immediate service area defined above. The service area would encompass 15 townships and six (6) communities. Reference may be made to Table 1.12.

In 1980, some 18,991 persons resided within the service area compared to 18,298 persons in 1960. Grinnell, with a 1980 population of 8,868 persons, contained 46.7 percent of the service area population. An additional 15.7 percent of the service area population resided in the communities of Montezuma and Brooklyn.

TABLE 1.12 AIRPORT SERVICE AREA POPULATION

POWESHIEK COUNTY	Year		
Townships:	1980	1970	1960
Chester	345	430	463
Sheridan	320	372	456
Madison	551	522	505
Bear Creek	1,883	1,826	1,883
Malcom	785	788	856
Grant	572	632	922
Washington	386	402	489
Pleasant	327	351	440
Scott	350	354	433
Sugar Creek	498	483	626
Union	589	306	306
Jackson	1,958	1,856	2,054
Communities:			
Brooklyn	1,509	1,410	1,415
Malcom	418	388	416
Grinnell	8,868	8,402	7,367
Montezuma	1,485	1,353	1,416
Searsboro	134	140	165
Total Poweshiek County	17,432	16,724	16,800
JASPER COUNTY			
Townships:			
Rock Creek	783	653	471
Richland	419	463	492
Hickory Grove	389	441	535
Communities:			
Oakland Acres	139	-0-	-0-
Total Jasper County	1,559	1,557	1,498
TOTAL AIRPORT SERVICE AREA	18,991	18,281	18,298

The service area population is expected to remain stable throughout the twenty-year planning period. The City of Grinnell is expected to increase its share of the service area population where in 1980 47 percent of the service area population resided in Grinnell. By 2000, this number is expected to reach 52 percent.

TABLE 1.13 AIRPORT SERVICE AREA POPULATION, 1980-2000

1980	18,991	1990	19,646
1985	19,340	2000	19,587

SOURCE: PDS

An expanded service area may be possible should the communities of Belle Plaine and Tama-Toledo choose not to improve or construct airport facilities. Consequently, the service area may be extended to the east and north to include the balance of Poweshiek County and portions of Tama County. For purposes of this study, the immediate service area was used for estimating potential aircraft activity.

LOCAL USE:

It should be noted that airports are also for people who do not fly. An AOPA Report entitled "The Value of Airports" reported on the benefits found at Austin, Minnesota from operation of the general aviation airport facility.

> "In Austin, where the general aviation airport is located, a 35% reduction in business by nonresidents would occur if the airport were not available for their use."

Austin is a rural community located in southeastern Minnesota. A second illustration noted that many banks use general aviation to transport checks after banking hours citing the impact upon checks "floating" in transit and the impact upon the regions money supply.

More visible benefits are noted when air ambulance services are used to transport injured or critically ill persons to larger hospitals. A number of medical doctors in Iowa use air as a means to service a number of hospital facilities.

Benefits to agriculture from aerial application of pesticides and herbicides are often taken for granted. The delivery of machine parts from the warehouse to the implement dealer may save a local crop should time be critical.

General aviation airports are more often associated with business and industry where 90% of the general aviation aircraft are sold for business purposes. An FAA survey of five (5) general aviation airports found that:

1. Local opinion considered the airport a contribution of the local economy.

2. There were increases in the rate of growth following airport development.

3. New industries stated the presence of the airport had been an important factor in locational choice.

4. Old industries were retained partly because of the airport.

5. Economic growth including airports compensated for the trend toward loss of rural employment.

6. Rapid air access improves industrial equipment maintenance capability for manufacturing companies.

7. Connections to the national airport system are important.

8. The airport can be a nucleus for industrial concentration and promote cohesive land use in the airport area.

The Donaldson Company once used general aviation to transport a late payroll issue to Grinnell employees from its corporate headquarters in Bloomington, Minnesota.

De Long Sportswear was able to demonstrate its manufacturing capability to a propective buyer which resulted in an order for 90,000 jackets. This single sale created 80,000 manhours of labor or when divided by 2,000 manhours per year, 40 jobs. It took 45 minutes for the client to fly from Minneapolis to the Newton Airport and an additional 30 minutes to travel from the Newton Airport to Grinnell for the two hour plant tour. Using an average rate of $4.25 per manhour, this single sale generated 340,000 dollars in salaries plus benefits for De Long employees. Accessibility to corporate office and manufacturing facilities is as important to the employee who never sets foot on the airport as it is to the corporate officers and managers responsible for plant operation, sale and delivery.

An occassional use often goes unnoticed until an assembly line is shut down or an employee is late in receiving his or her paycheck. When the part arrives in a timely manner and the payroll is issued on time, accessibility is viewed as insignificant or as a matter of fact.

Access to nation's airways is no more or less important than is highway and rail access. One mode of transportation compliments the other. Illustrating this point is the significance of general aviation to Van Wyke Truck Lines which uses its company aircraft for marketing. Van Wyke Truck Lines delivered on a Saturday night a load of mufflers to the Newton Airport for shipment to a Pontiac Michigan assembly plant.

Grinnell Mutual Reinsurance Company does not utilize general aviation to any great extent at the present time. However, the firm at one time maintained a private turf strip to accommodate company aircraft. The present mode of travel is via automobile and commercial airline.

The selection of a mode of transportation to transport people is influenced by the value placed upon cost of labor to include not only direct salary costs, but non payroll costs per hour as well. Commerical certificated air carrier service is the most appropriate choice for travel by a single individual over a long distance. Air taxi or corporate aircraft travel is cost effective over a long distance where two or more persons are being transported. The value of time thus is an important determinant of travel. If the total hourly cost of an employee is low, the typical mode of transport selected is the automobile.

Grinnell College would generally not be considered to major user of general aviation. The student body would not produce any significant number of trips by general aviation. Occassional trips may be made by parents of students. Aircraft ownership by parents of students is thought to range from zero to no more than ten in an average year.

The College administration would not use general aviation aircraft as a primary mode of transportation. Travel by commercial air carrier or automobile would be considered the most appropriate choice with occassional use of air taxi. The College Board of Directors on occassion travels to Grinnell by private aircraft for meetings and selected events.

The demand to use air as a mode of transportation is significant at certain times throughout the school year. Travel over major holidays and at semester break creates peak periods of demand for commercial certificated air carrier travel. Therefore, the most pressing consideration is to provide access to a regional or hub airport facility (Des Moines Municipal) where flights can be obtained to Chicago.

Students do not generally place a great deal of value upon travel time with the cost of travel being more important. Air fares between Des Moines and Chicago is a significant factor in the selection of a given transportation mode. An opportunity may exist for some air taxi operator to provide an aircraft charter to Chicago or other locations at certain times throughout the school year.

The College would support City efforts to establish a community airport. However, the College has no plans at the present time to acquire an aircraft for exlusive use. Air taxi (aircraft charter) would be the most appropriate choice to satisfy college generated air travel.

General Telephone uses general aviation on a daily basis to transport personnel throughout its service area. The aircraft (King Air E-90) is currently based at the Newton Airport. An estimated 400 total annual aircraft operations were made in 1983 to include 1,600 enplanements and deplanements.

General Telephone serves exchanges in Nebraska, Missouri, Iowa and southern Minnesota. District offices served from Grinnell are located in Kearney, Nebraska; Cameron, Missouri; Emmetsburg, Nevada, Creston and Tama-Toledo, Iowa.

General aviation provides a convenient and cost effective mode of travel for General Telephone personnel not only within the primary surface area, but to MTO offices in Westfield, Indiana.

General Telephone has an average annual payroll in Grinnell of $13,000,000. The 542 employees reside in Grinnell or smaller communities within the airport service area.

Raffety-Hedrick Inc. conducts six (6) operations per month generating thirty (30) passenger enplanements and deplanements per month. Due to condition of the existing turf runway, approximately 25 percent of those operations were conducted at Newton. Raffety indicated that future use is expected to double with business trips accounting for 50 percent of the operations.

Aviation benefits along with costs are examined in greater detail within Section Three. Evident herein is the fact that general aviation is an important part of the daily operation of some employers and of secondary importance to others. Nearly all at one time or another have used general aviation or commercial air carriers to transport people and freight.

Section Two provides an estimate of aviation demand potential within the Grinnell airport service area.

II - FORECAST OF AVIATION DEMAND

FORECAST OF AVIATION DEMAND

INTRODUCTION

BACKGROUND

The forecast of aviation demand provides a basis by which to estimate short and long range numbers of based aircraft and operational activity within the Grinnell airport service area. The mathematical values obtained reflect changes within key variables over a period of time within the airport service area. The more significant variables influencing future numbers of based aircraft and operations are noted as follows:

I. BASED AIRCRAFT
   - A. Population (size, change and characteristics)
   - B. Economic Base (industry and employment)

II. AIRCRAFT OPERATIONS
   - A. Number of Airmen (pilots)
   - B. Economic Base (industry and employment)

In addition to the key variables noted above, there are other factors which have a pronounced impact upon present and future numbers of based aircraft and operational activity. These factors relate to the availability of services (fix base operator, air taxi operator) as well as aircraft storage facilities found at the airport.

While the need to travel can be satisfied in a number of ways and by various modes, travel by air offers a convenient, safe and cost effective way to transport personnel and cargo. The decision to travel or transport an item from one point to another is based upon a number of factors to include those summarized as follows:

- Distance
- Accessibility
- Cost Per Unit of Travel
- Reason for Making Trip, Length of Stay
- Number of Persons
- Type and Value of Cargo
- Availability of Other Modes of Travel
- Aviation Interest

The forecast of aviation activity represents a trend line along which actual occurrences are anticipated. The procedure for estimating future numbers of based aircraft is based upon a step down from a regional area projection within the State of Iowa. Operational estimates are made from findings at other facilities, local input, and methodologies developed by Iowa State University.

REGISTERED AND BASED AIRCRAFT

NATIONAL TRENDS:

Nationawide forecasts indicate a continued growth in the number of registered aircraft, registered pilots and aircraft operations. In 1970 there were 131,700 registered U.S. aircraft. By 1979, this number reached 198,000 and is projected to approach 430,000 by the year 2000.

The number of registered pilots nationwide increased from 720,028 in 1970 to 844,100 in 1979. By the year 2000, 1,331,300 persons are expected to be registered pilots.

TABLE 2.1 NATIONAL TRENDS, REGISTERED AIRCRAFT AND PILOTS: 1970-2000

	Year					
	1970	1979	1980	1985	1990	2000
Registered Aircraft	131,700	198,800	208,600	261,900	310,800	430,000
Registered Airmen	720,028	844,100	899,700	1,038,800	1,155,800	1,331,300

SOURCE: IDOT 1982 IOWA AVIATION SYSTEM

Total annual operations are also expected to increase from 134,1000,000 operations in 1980 to 290,000,000 by the year 2000. General aviation aircraft operations are expected to experience an average annual increase of 3.4 percent through the year 2000.

STATEWIDE TRENDS:

The Iowa Department of Transportation anticipates a future growth in the number of registered aircraft within the State. A continued growth in the number of registered pilots is also expected.

TABLE 2.2 REGISTERED AIRCRAFT - STATE OF IOWA: 1960 - 2000

Year	Number	Year	Number
1960	1700	1985	3400
1970	2600	1990	3800
1975	2800	2000	4500
1980	3000		

SOURCE: IDOT 1982 IOWA AVIATION SYSTEM PLAN

TABLE 2.3 REGISTERED AIRMEN - STATE OF IOWA: 1965 - 2000

Year	Number	Per 10,000 Population
1965	7,963	29
1970	12,432	44
1975	10,802	38
1980	11,731	40
1985	12,043	40
1990	12,353	40
2000	12,812	40

SOURCE: IDOT 1982 IOWA AVIATION SYSTEM PLAN

The IDOT projection of registered aircraft was based upon a simple linear regression analysis of historic trends. Projections of registered pilots were based on the ratio of average county pilots to total state population for the period 1970 - 1977. IDOT estimates of future general aviation activity in the 1982 Systems Plan are somewhat lower than the estimates presented in the 1978 Plan.

REGIONAL TRENDS:

Table 2.4 summarizes historic numbers of registered aircraft for the years 1971 through 1983 for Poweshiek, Marshall, Jasper, Marion, Keokuk, Iowa, Tama, Benton and Mahaska Counties. The number of registered aircraft within the nine (9) counties increased from 193 aircraft in 1971 to a high of 316 in 1982. There were 290 aircraft registered in the region as of June 30, 1983. The most significant increase occurred from 1971 through 1977. Relative stability with annual increases and decreases in the number of registered aircraft has prevailed since 1978.

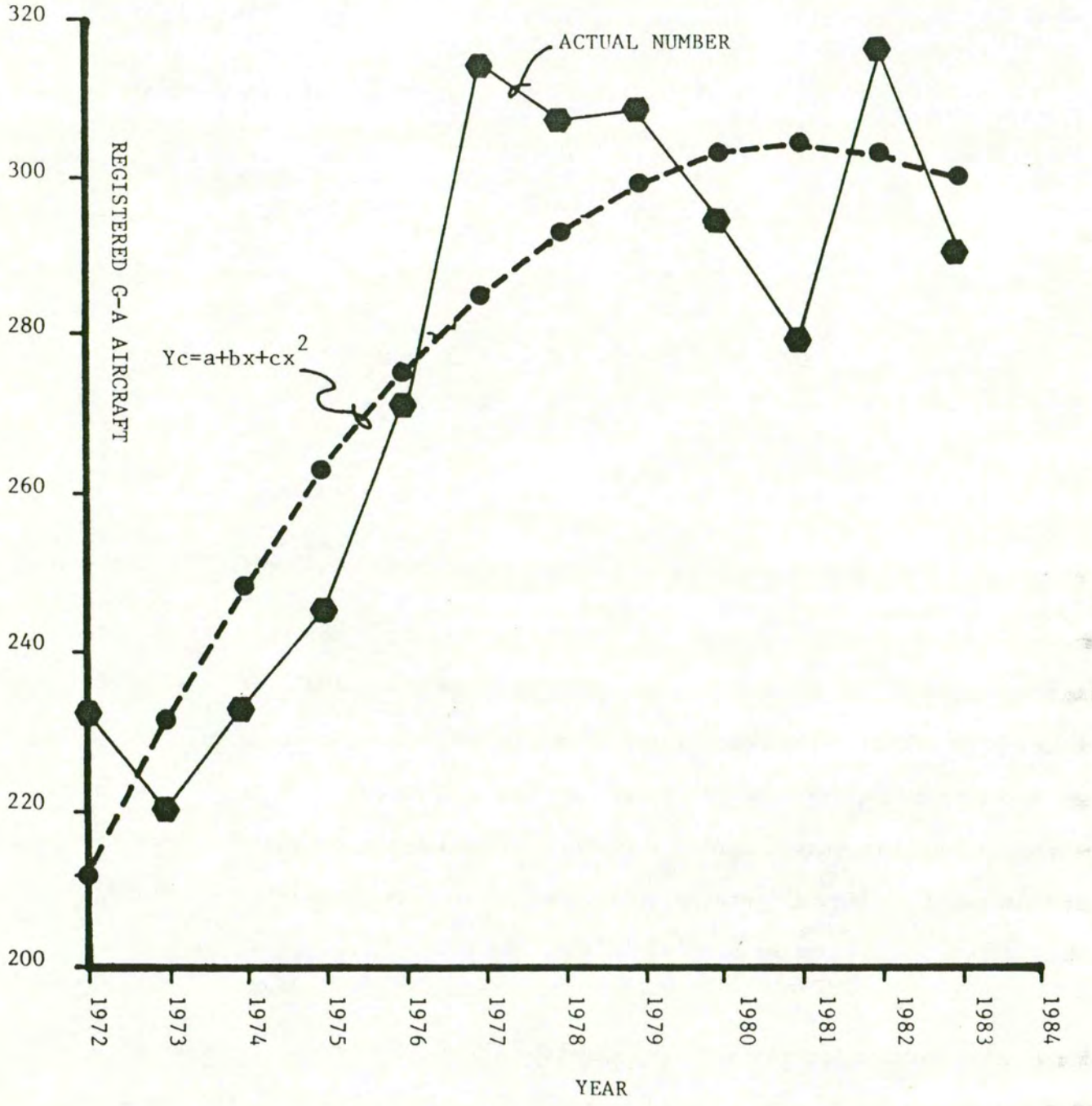


FIGURE GENERAL AVIATION AIRCRAFT
NINE COUNTIES

TABLE 2.4 REGISTERED G-A AIRCRAFT NINE COUNTIES, 1971 - 1983

Year	9 County Total	Poweshiek County	
		Aircraft	Percent of Total
1971	193	12	6.2
1972	232	14	6.0
1973	220	10	4.5
1974	232	20	8.6
1975	245	27	11.0
1976	271	27	10.0
1977	314	29	9.2
1978	307	29	9.4
1979	308	29	9.4
1980	294	25	8.5
1981	279	23	8.2
1982	316	20	6.3
1983	290	18	6.2

SOURCE: F.A.A. 1971 - 1981 (As of Dec. 31)
IDOT 1982 - 1983 (As of June 30)

An insight into past changes in the number of registered aircraft can be obtained from observing regional trends. A second degree linear equation was utilized to fit a trend line to observed data for years 1972 and 1983. Reference may be made to FIGURE 2-1, "General Aviation Aircraft, Nine County Area, 1972 - 1983." As noted in the graph, the calculated trend line approximates actual observations with considerable annual variations above and below the trend line. The trend line shows a continued increase in the number of registered aircraft through 1981 with a slight decrease noted in 1982 and 1983.

Population totals for the nine (9) counties recorded a modest increase from 1970 to 1980. There were, 216,227 persons residing in the nine (9) counties in 1970. In 1980, 221,451 persons resided in the nine (9) county area representing a 2.4 percent increase for the decade. With the exception of Tama and Keokuk Counties, the remaining seven (7) counties experienced a population increase.

Table 2.5 summarizes the ratio of registered aircraft to county population in 1980.

TABLE 2.5 RATIO OF AIRCRAFT TO POPULATION, NINE COUNTIES, 1980

County	Population	Registered Aircraft	Aircraft Per 10,000 Pop.
Mahaska	22,867	30	13.12
Poweshiek	19,306	25	12.95
Tama	19,533	26	13.31
Jasper	36,425	45	12.35
Keokuk	12,921	18	13.93
Iowa	15,429	23	14.91
Marion	29,669	62	20.89
Marshall	41,652	43	10.32
Benton	23,649	22	9.30
Total	221,451	294	13.28 Average

As noted, the region recorded an average of 13.28 registered aircraft per 10,000 population. Poweshiek County at 12.95 registered aircraft per 10,000 population was close ot the regional average. Within the State of Iowa, there were 10.29 aircraft per 10,000 population (1980 population = 2,913,808; 1980 aircraft = 3,000).

The number of registered aircraft per 10,000 population is expected to increase throughout the 20-year estimating period to 14.97 aircraft per 10,000 population by the year 2000. (2000 population = 3,004,894; 2000 aircraft = 4,500).

The number of aircraft within the nine (9) county region is expected to record only a modest increase through the year 2000. Reference may be made to Table 2.6.

TABLE 2.6 REGIONAL AIRCRAFT TRENDS, NINE COUNTIES, 1980 - 2000

	Registered Aircraft		
Year	Low	Middle	High
1983	290	290	290
1984	275	294	312
1985	260	297	333
1986	266	304	341
1987	272	311	349
1992	301	343	388
2002	337	389	441

NOTES:

1. Low: 1985 = 11.98 Aircraft/10,000 population and future population change
   1990 = 13.09 Aircraft/10,000 population
   2000 = 14.97 Aircraft/10,000 population

2. High: 9.8 percent of estimate for State of Iowa

GRINNELL AIRPORT SERVICE AREA TRENDS:

The Grinnell airport service area coincides, for the most part, with Poweshiek County and would serve in addition to the City of Grinnell, the communities

of Montezuma and Brooklyn. Within the service area, there are seventeen (17) registered aircraft. The one exception is the single aircraft registered to a Hartwick mailing address.

Table 2.4 reveals that the number of registered aircraft within the Poweshiek County experienced a modest rate of growth from 1971 through 1974. The period from 1975 to 1979 reflects stability with a modest decrease from 1980 through 1983.

Because of the data base and the small numbers dealt with, a decision made locally could drastically alter any estimates made, herein. The validity of the estimates come from the long term trend within the area. As historical data would indicate, decisions are made to relocate aircraft from one airport to another for reasons ranging from personal, to cost and services. Such events, while affecting a specific airport, do not influence overall regional trends.

To facilitate understanding of the estimates for a specific airport location, reference is made to the 1978 SASP which concludes:

> "The choice of a site for basing an aircraft is not always directly related to the residence of the owner. The choice may be affected by such factors as hangar rental and maintenance fee structure, availability of terminal services, availability of navigational aids, runway length and condition, etc. An aircraft may be based several miles from the owner's place of residence in order to have access to more attractive features. Current based aircraft figures would indicate that some airports which provide services desired by aircraft owners may attract a larger number of aircraft than are registered in the county, while in other areas the total aircraft based in the county is less than the total registered aircraft in the county."
>
> SOURCE: 1978, SASP, p. 38

The above will explain some of the annual variations of general aviation aircraft registered or based at one airport or another. Those airports which now enjoy numbers of based aircraft owned by persons from outside the community or airport service area, may in the future loose their historical dominance.

> "Ideally, as airport development improves the quality of airports throughout the state, the attractiveness of the airports will become more similar causing the number of aircraft based in a county to more nearly equal the number registered in that county."

SOURCE: 1978, SASP, p. 39

Current registered aircraft owners with a Poweshiek County mailing address are summarized in Table 2.6. Of the 18 aircraft, seven (7) have a Grinnell mailing address. Seven (7) aircraft record a Montezuma address while three (3) reported a Brooklyn mailing address. One aircraft reported a Hartwick mailing address. Annual variations in the number of registered aircraft are common at smaller general aviation airports for reasons previously discussed.

TABLE 2.6 REGISTERED AIRCRAFT, POWESHIEK COUNTY

Owner	Mailing Address	Aircraft Type	
General Telephone Company	Grinnell	Beech King Air	
De Long Sportswear, Inc.	Grinnell	PA31	
Grinnell Aviation	Grinnell	Cessna 172	
Ludwig, H; Butler, R;	Grinnell	PA 28 140	
Tango, Inc.	Grinnell	Cessna 172	
Beef Barons, Inc.	Grinnell	PA 32 301	
Grinnell Flyers Co.	Grinnell	Piper	
Sig Manufacturing Co.	Montezuma	Beech E33A	
Montezuma Flyers, Inc.	Montezuma	Cessna 177 RG	
Falkenhagen	Montezuma	Champon 0102	
Veverka, Sylvan	Montezuma	Cessna 172	
Sig Manufacturing Co.	Montezuma	Cessna	
Ludtka, Garold	Montezuma	Cessna 172	
Sig-Hester, Hazel	Montezuma	Piper J3C65	(7)
Block and Benda, Inc.	Hartwick	Cessna 172	(1)
Lavent, V.A.	Brooklyn	Beech J35	
Dayton, Larry	Brooklyn	Cessna 120	
Manatts, Inc.	Brooklyn	PA - 31 - 325	(3)

18 Total Aircraft Registered

SOURCE: Iowa Department of Transportation - May, 1984

An estimate of future numbers of aircraft registered in Poweshiek County and based at a Grinnell airport facility are presented in the following table.

TABLE 2.7 BASED AIRCRAFT, GRINNELL AIRPORT, 1983 - 2002

Year	Low	Middle	High
1983	18	18	18
1984	17	18	19
1985	16	18	21
1986	16	19	21
1987	17	19	22
1992	19	21	24
2002	21	24	27

It is expected that the number of aircraft based at an improved Grinnell airport facility would follow the middle trend line noted Table 2.7. Annual variations could be expected above and below the trend line. The airport site selected should be one that is readily accessible from Brooklyn and Montezuma.

By the year 2002, some 24 aircraft may be based at a Grinnell facility representing only a slight increase over the twenty year planning period. Should no improved public airport facility be constructed between Grinnell and Cedar Rapids, the high estimate may be more realistic as the airport service area would expand beyond that previously noted. The low estimate may initially prevail as not all aircraft owners will move their aircraft from present locations. Current leases and the availability of competitive hangar rentals at Grinnell will have some impact upon the initial number of based aircraft.

The future mix of based aircraft is expected to consist, for the most part, of single and light twin engine aircraft having a gross landing or take off weight of 6,000 pounds or less. Exceptions to the above are the aircraft operated by General Telephone, Manatts and De Long Sportswear.

The design aircraft selected from those aircraft currently registered in Poweshiek County is the Beech King Air operated by General Telephone Company. An estimated 400 annual operations were made by General Telephone in 1983 from the Newton Airport.

Beech King Air E90

Gross Take off Weight (Max.)	9,650 lbs.
Wingspan	50' - 3"
Approach Speed	100 knots

AIRCRAFT OPERATIONS

ANNUAL, ITINERANT AND LOCAL OPERATIONS:

An aircraft operation is defined as the airbourne movement of aircraft in controlled and non-controlled airport terminal areas and about given enroute fixes or at other points where counts can be made. Each movement counts as an operation. A "touch and go", for example, counts as two operations.

Total annual aircraft operations are further broken down into local and itinerant operations. A local operation is defined as one by an aircraft that:

1. operates within the local traffic pattern or within sight of the control tower;
2. is known to be departing for or arriving from local practice areas; or
3. executes simulated instrument approaches of low passes at the airport.

An itinerant aircraft operation is one that operates outside the local traffic pattern. A typical example of an itinerant operation is an air taxi operation. Aviation operations are most often discussed in terms of:

1. Total annual aircraft operations
   - Total annual local
   - Total annual itinerant
2. Peak day and peak hour operations

Aircraft operations are a function of the following elements:

1. Based Aircraft
2. Resident Airmen
3. Airport Facilities
4. Airport Management
5. Social and Economic Characteristics of the Airport Service Area
6. F.B.O. and Air Taxi Services

Without a daily log of operational activity, an estimate of total annual itinerant and local operations are most often derived from a random survey or local sources. A high degree or correlation has typically been found between aircraft operations and service area population, based aircraft and registered airmen.

Table 2.8 summarizes the historic and future number of airmen to population from 1965 through the year 2000.

TABLE 2.8 REGISTERED PILOTS - IOWA, 1965 - 2000

Year	Iowa Pilots	Pilots/10,000 Population
1965	7,963	29
1970	12,432	44
1975	10,802	38
1980	11,731	40
1985	12,043	40
1990	12,353	40
2000	12,812	40

SOURCE: IDOT 1982 IOWA AVIATION SYSTEM PLAN

The 1980 ratio of forty (40) airmen per 10,000 population was used to estimate future numbers of resident airmen in Poweshiek County. As noted in Table 2.8, the Iowa DOT anticipates the ratio of airmen to population to remain constant through the year 2000. Deviation from the state wide average will vary from

county to county with various social and economic characteristics of the population being key variables. In addition, local efforts to attract residents to aviation will also provide a basis in which local numbers may exceed the state wide average.

Reference may be made to Table 2.9 concerning future numbers of airmen in Poweshiek County. As noted, the number of airmen is expected to remain somewhat stable through the year 2002.

TABLE 2.9 AIRMEN - POWESHIEK COUNTY, 1982 - 2002

Year	Airmen	Year	Airmen
1983	77	1987	78
1984	78	1992	78
1985	78	2002	78
1986	78		

Total annual aircraft operations were computed utilizing the following equation:

$$\text{Log (Total Annual Operations)} = 2.614 + 0.501 \text{ Log (Based Aircraft X Airmen)}$$

The same variables were used to estimate itinerant operations:

$$\text{Log (Total Itinerant Operations)} = 1.865 + 0.605 \text{ Log (Based Aircraft X Airmen)}$$

The above models were obtained from the 1978 Iowa State Airport System Plan Update prepared by the Engineering Research Institute, Iowa State University. The models (equations) accounted for 88 and 95 percent of the variation respectively.

TABLE 2.10 GENERAL AVIATION OPERATIONS, GRINNELL AIRPORT

1983 - 2002

Year	Annual Operations	Annual Itinerant Operations	Annual Local Operations
1983	15,418	5,831	9,587
1987	15,944	6,072	9,872
1992	16,764	6,451	10,313
2002	17,924	6,994	10,930

Some 15,418 annual aircraft operations were estimated for 1983. A very modest growth is anticipated through the year 2002 with total annual operations placed at 17,924. The number of itinerant operations are expected to increase by 19.9 percent over the twenty year planning period to 6,994 by 2002. Local operations will increase from 9,587 in 1983 to 10,930 by 2002 or by 14.0 percent.

AIR PASSENGERS AND AIR FREIGHT

PASSENGERS:

The number of air passengers was estimated at 1.5 times the number of itinerant operations. Reference may be made to the following table:

Table 2.11 AIR PASSENGERS, 1983 - 2002

Year	Air Passengers
1983	8,747
1987	9,108
1992	9,677
2002	10,491

AIR FREIGHT:

The tonnage of air freight was estimated at eight pounds per enplaned passengers.

TABLE 2.12 AIR FREIGHT, 1983 - 2002

Year	Air Freight
1983	17.5 Tons
1987	18.2 Tons
1992	19.4 Tons
2002	21.0 Tons

COMMUTER AIR CARRIER/AIR TAXI SERVICE

The Airline Deregulation Act of 1978 provided for the phase out of the Civil Aeronautics Board (CAB) control over pricing, market entry and market exit. Consequently, there has been a pronounced effect upon air service in Iowa with the communities of Ottumwa and Clinton being served at present by commuter

air carriers. Certificated air service by major carriers is also expected to be replaced by commuter service in Fort Dodge, Mason City, Dubuque and Burlington.

The Iowa DOT concluded in the 1982 State Airport Systems Plan that commuter air carrier service to Iowa communities, other than those with prior air carrier service, appears marginal.

> "Although commuter air service has been established in several very small markets in Iowa (Clinton, Marshalltown and Spencer), the prospects for the expansion of such services in Iowa are limited."

SOURCE: IDOT 1982 IOWA AVIATION SYSTEM PLAN, p. 27

The air taxi is the most appropriate carrier of air passengers and cargo for Grinnell.

AIRPLANE DESIGN GROUP

AIRPORT SCOPE:

As previously noted, the majority of aircraft operations will be made by single and light twin engine aircraft would generally have an approach speed of less than 91 knots and a wingspan of less than 49 feet. In addition to the 400 plus annual operations by General Telephone's King Air, there may be other itinerant traffic by heavy twins. Operations by heavy twin engine aircraft could be expected to exceed 500 itinerant operations per year.

The following airport design creiteria was used to determine the scope of airport development required to satisfy aviation demand.

1. Aircraft Approach Categories:

   A. Category A Aircraft: Speed less than 91 knots
   B. Category B Aircraft: Speed 91 knots or more but less than 121 knots

2. Aircraft Design Group:

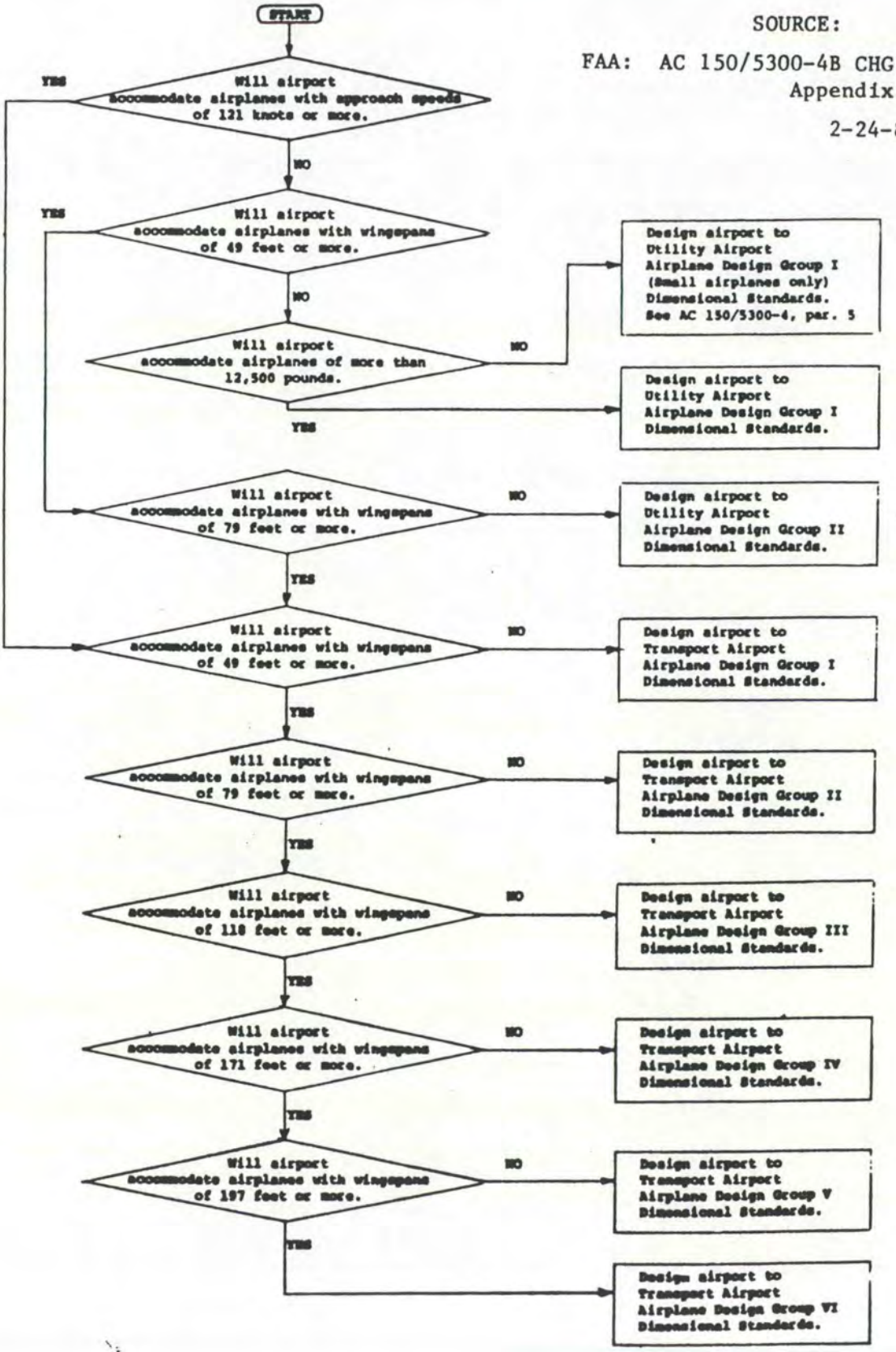
   A. Airplane Design Group I: Wingspan up to but not including forty-nine feet
   B. Airplane Design Group II: Wingspan up to but not including seventy-nine feet.

The design aircraft, King Air E90, has a wingspan of 50' - 3" and an approach speed of 100 knots. The gross take off weight is 9,650 pounds. Based upon the design aircraft and the forecast of aviation activity, the Grinnell airport facility should be developed to meet Airplane Design Group II, utility airport standards. Reference may be made to FIGURE 2-3, "Airplane Design Group Concept."

FIGURE 2-3: **AIRPLANE DESIGN GROUP CONCEPT**

SOURCE:

FAA: AC 150/5300-4B CHG 6
Appendix 1
2-24-83



III - BENEFIT-COST

BENEFIT AND COST ASSESSMENT

STATE SYSTEM BENEFIT - COST

STATE SYSTEM:

The Iowa Department of Transportation (IDOT) developed a benefit - cost procedure to consider public benefits accurring as a result of projected airport use, airport location, and public cost necessary to meet the development needs of the airport. The assessment assumes ultimate development of an airport to system standards to include the capital construction of the following:

Primary and crosswind runway

Land acquisition and clear zone protection

Landing and navigational aids

Terminal area development to include infrastructure (utility), hangars, vehicle access road and parking, apron, and FBO facility.

In addition, the cost also includes an annual operating and maintenance cost factor.

The benefit side identifies those benefits which primarily accur to the user. It does not attempt to identify direct benefits to the community from airport generated income and employment or induced benefits. The primary objective is to estimate the value of a given airport facility in terms of the entire system of airports. Benefits per aircraft operation were determined by accounting for the following:

Value of time

Travel time

Automobile operating cost

Distance to nearest state system airport

The IDOT considers those airports (basic and general utility) having a benefit - cost ratio (BCR) in excess of 0.75 to be statewide interest. Airports having a BCR value in excess of 0.75 are eligible for state development assistance. Those not are considered local service airports and candidates for inclusion in the state system.

It is not the intent of the IDOT assessment to account for benefits occured locally that would contribute to the local economy at the expense of an area community. The intent is to identify those airports that will provide access to the nations airways and serve the State of Iowa.

SYSTEM - BCR:

The benefit - cost ratio for a Grinnell airport facility was calculated for the years 1983, 1987, 1992 and 2002. Reference may be made to the followi table:

TABLE 3-1 BENEFIT - COST, GRINNELL, IDOT

Year	Benefits (PVB)	Costs (PVC)	Ratio (BCR)
1983	$2,085,830	$2,497,000	0.83
1987	2,156,990	2,497,000	0.86
1992	2,267,924	2,497,000	0.91
2002	2,424,855	2,497,000	0.97

SOURCE: P.D.S.

As noted, a Grinnell airport facility developed to state standards would meet system entry criteria based upon the following.

Benefit Per Operation (B) = $W \left(\frac{D}{M}\right) + X D$, where

W = Value of time for all aircraft operations = $12.50

D = Distance to nearest alternative system airport, Newton. (From intersection of U.S. Highway 6 and State Highway 146 to Newton Airport via Highway 146, I-80, E. 13 St., First Ave. E., and East 12 Street) = 22.9 miles

M = Average rural automobile speed = 45 m.p.h.

X = Average total automobile operating cost per mile = $0.28

Benefit - Cost Ratio (BCR) = $\frac{B \times \text{Number of Operations} \times 10.594}{\text{Development Cost (PVC)}}$ (PVB), where

PVB = Present value of streamline benefits over 20 years.

PVC = Present value of development costs to include maintenance.

The assessment shows that in 1987, 86 cents in benefits would be provided for each dollar of cost. The ratio would be expected to increase to 0.97 by 2002. As previously noted, the estimated dollar value of benefits do not account for airport generated revenues, employment or other induced benefits.

BENEFITS

GENERAL:

The economic airport of a Grinnell airport facility can be described by two major components, employment and income. Direct impacts consist of actual airport related employment, payroll and purchases by airport-related activities. Indirect impacts include those expenditures which occur in the process of using the facility to include for example, expenditures by transient aircraft to the local area.

In addition to the direct and indirect primary impacts described above, there are induced impacts. Induced impacts reflect those dollars added to the economy and are estimated by a multiplier. The Iowa Development Commission uses a multiplier of 2.5. Thus for each dollar of payroll spent, that dollar turns over producing 2.5 dollars.

DIRECT:

The direct economic impact would generally consist of those businesses which would lease space from the airport. At smaller general aviation airports this would generally consist of hangar rental, agricultural land, and terminal building space.

- Air taxi operator(s)
- Fixed-base operator(s) - FBO
- Tenants - Hangar Lease(s)

At other locations, airport administration, government agencies, air carriers, etc. would contribute. For purpose here, the following assumptions were made:

1. Hangar facilities would be constructed by the private sector on airport land. Typically, the ownership of the hangar is transfered to the airport owner after a period of 10 years. Thus, zero dollars would be generated from hangar leases in the initial 10 years. Hangar income could be expected in the last years of the 20 year planning period. Based upon $50 per month per hangar stall times 18 stalls, the airport may generate some $10,800 annually in hangar income after 1993.

2. So as to attract a well-qualified airport operator many smaller airports negotiate with a fixed base operator to provide airport services in return for the use of hangar and aircraft maintenance space. Often the F.B.O. will reside on the airport. Therefore, the assumption is made that the F.B.O. and/or air taxi operator will not be a source of income. The assumption is also made that no expenditure will be made for airport management.

3. Income from agricultural land is expected to be minimal. This assumption is based upon the fact that no more land than is needed for construction of the airport will be obtained. Agricultural income, based upon 24 acres at $90/acre may generate $2,160 in revenue annually.

4. Salaries paid to the employee of an F.B.O./Air Taxi Operator would be considered as income generated. Thus, the total annual payroll can be determined only after negotiations with a F.B.O. are completed. Again, the assumption is that there will be no other business tenants unless the concept of an air-industrial park is pursued. Airport generated employment may range from $18,000 to $36,000 per year.

5. Gross revenue generated by business located on the airport would consist of that by the F.B.O./Air Taxi Operator and other firms, if any. It is not evident as to how much of the gross business revenue would be spent locally for the purchase of goods and service, (by F.B.O.). An estimated 21.8 percent of the gross revenues from F.B.O. operations are typically spent locally at general aviation airports while 70 percent of the non-aviation revenue is spent locally.

6. Other gross revenue is derived in part by government agencies to include annual budgets. Such would include annual O & M expenditures, state and federal grants-in-aid.

7. Should business (non-aviation) choose to locate on the airport, the revenue (Direct) would change dramatically. For the present, this possibility is considered speculative until an airport site is selected.

INDIRECT:

The indirect economic impact is defined as those economic benefits which accrue to the community as a result of the use of the airport. Indirect benefits are those associated with the business use of the airport to include transient operations. As noted in the estimate of aviation activity, 15,418 potential aircraft operations would have been conducted in 1983 increasing to an estimated 17,924 by 2002. The estimated values of these operations was calculated to be $2,424,855 in 2002.

Other indirect impacts include many intangible aspects such as increased business efficiency, business promotion and economic development. The significance of such indirect benefits are evident from the discussion concerning "local use."

Capital investment at the airport by the private sector would include the cost of hangar construction. Indirect capital investment may result if the air-industrial park concept is developed. While there have been no definite commitments by the private sector to expand existing facilities or to construct new facilities adjacent to a new airport, there has been some expression that such would occur if the airport were located where utilities and access would be convenient.

In summary, the economic benefits would be most evident from indirect impacts. Such is considered typical of general aviation airports in rural areas.

GRANTS-IN-AID:

A grant-in-aid represents a benefit to the community as revenue (direct). The grant-in-aid will impact the community in a number of ways.

- Direct benefit as revenue from an outside source
- Induced benefit as each dollar is spent.
- Indirect benefit as operational efficiency is increased.

The cost of a grant-in-aid for airport improvements should be viewed as being generated by the airport user. It is often argued that the user should pay for the cost of airport improvements. The fact is that the user does pay indirectly the major share of the cost of airport construction through the contributions made to the aviation trust fund.

A grant-in-aid is accounted for here as a benefit since it is derived from a source outside the community service area. It represents a major infusion of money into the community having a short term impact in terms of construction expenditures (labor and materials).

At the present time, Federal assistance is limited to 90 percent of the project cost; State assistance is limited to 70 percent. With the exception of hangar facilities, vehicle parking, and terminal buildings,

the remaining airport components are eligible for assistance. The balance of the project cost must be funded locally. With the exception of the items noted above, the assumption is made that 80 percent of the capital cost will be paid for by a grant-in-aid while 20 percent will be a local obligation.

At most general aviation airports in Iowa, a general obligation bond is required to provide the local share.

COSTS

DIRECT:

Costs are most often presented in terms of annual operation and maintenance costs (O & M) and capital expenditures. Capital project costs are defined as those expenditures for major permanent airport components having a long life. Operating and maintenance costs are those expenditures made to operate and maintain the airport facilities. Capital and O & M costs are direct costs. Indirect costs are those accured by the user in the utilization of the airport.

O & M COSTS:

Annual O & M expenditures (annual average) are expected to be between $20,000 and $25,000 subject to final negotiation for the management of the airport. Items typically included in an O & M budget are as follows:

- Mangement fee
- Consultant fee
- Advertising
- Insurance
- Postage
- Telephone
- Utilities
- Office supplies
- Vehicle equipment
- Vehicle operation
- Grounds maintenance
- Building maintenance
- Radio equipment
- Travel

A survey of 1984-85 budgets of selected airports revealed a wide range of O & M costs with the airport management fee being the single largest component. A number of the budgets included major allocations for pavement maintenance. It should be noted that such major items would generally be found at 5 to 10 year intervals. A summary is provided in the following table.

TABLE3-2 O & M BUDGETS - SELECTED AIRPORTS, 1984-85

Airport	Budget	O & M Cost	Comment
Pella	$20,500	$20,500	
Boone	68,690	20,690	$10,000 Airport Plan
			25,000 Runway Repair
			5,000 Bond - G.O.
			8,000 Equipment
			$48,000 Subtotal - Boone
Perry	47,600	32,600	10,000 Capital Improvemen
			5,500 Building Improveme
			$15,500 Subtotal - Perry
Clarion	36,400	13,400	25,000 Capital Improvemen
Sioux Center	27,325	27,325	12,745 Salary
Oskaloosa	56,850	31,850	25,000 Engineering Fee
Newton	32,705	32,705	
Jefferson	29,003	22,903	6,100 Crop Expense
Albia	5,500	5,500	
		$23,052	Average O & M - 9 Airports

SOURCE: Office of City Clerk, Finance Officer

The annual budgets include various expenditures that would not necessarily be expended every year or are typical of the average airport. In the case of Jefferson, $6,100 was allocated to crop expense. The airport manager in th case, puts in and harvests the crop for the airport commission. The airport realizes approximately $12,300 in revenue from the sale of crops (1983).

Sioux Center noted that their annual O & M budget was $13,400 not including $12,745 in municipal salaries charged to the airport. At Clarion, the F.B.O. is responsible for insurance costs. Management fees for Newton, Perry and Clarion was $7,800 per year. The airport management expenditure in Pella was $5,200. There was no airport managers salary allocated in Albia or Jefferson. The average annual O & M cost of the nine (9) selected airports was $23,052 (FY 84-85 budgets).

It would appear reasonable to place the estimated O & M budget for Grinnell at $23,000 per year.

CAPITAL PROJECT COSTS:

To develop the airport to system standards, an estimated 2 million dollars in expenditures would be made. A detailed estimate of cost by item will be prepared in Phase VIII (Section 8) of the Airport Development Plan.

The airport improvements anticipated would require the acquisition of approximately 114 acres of land of which 24^{+}_{-} acres would be reserved for terminal area development. The balance would accommodate the runway and provide for clear zone protection. An estimated $285,000 budget would be required. Initial construction of a primary runway, landing and navigational aids, taxiway, apron, vehicle access and parking would require a budget of $950,000. An estimated $1,235,000 would be required in initial capital costs. Ultimate capital expenditures would include the construction of crosswind runway and required land. A crosswind runway budget of $670,000 and $132,500 for land would be required to reach an ultimate level of development.

Within the 20 year period, the construction of a conventional hangar and terminal office would require an additional $100,000. In addition to the O & M budget previously discussed, an estimated $112,000 would be expended for pavement maintenance on the initial construction. The private sector would be expected to invest $816,000 in tee hangar construction over the 20 year period.

Total capital expenditures are summarized as follows:

Initial Capital Cost	$1,235,000	
Ultimate Capital Cost	802,000	(Crosswind runway)
Conventional Hangar/Terminal	100,000	
Capital Maintenance	112,000	(In additional to ann O & M)
Private Sector Hangars	216,000	
Total	$2,465,000	(20 year development cost)

Historically, few general aviation airports have made any major improvements to their crosswind runways. It is expected that this same situation would exist at Grinnell with only a turf crosswind runway being realized through the year 2002. A more realistic budget would exclude the construction cost of a hard surfaced and lighted crosswind runway.

In summary, total expenditures for capital improvements through 2002 would be expected to range from 1.86 million to 2.46 million dollars. With the exception $328,000, the balance of the cost would be eligible for state and/or federal grants-in-aid. The local match would most likely require a general obligation bond(s). Consequently, an additional sum would be required for debt service.

SUMMARY

As previously noted, annual indirect benefits to users are expected to exceed 2 million dollars over the twenty (20) year planning period. In addition to the indirect user benefits, the community will realize an infusion of revenue from the Aviation Trust Fund for capital construction and maintenance. This amount could total $1,719,200. The private sector would be expected to invest $216,000 in the capital construction of hangars. These hangar units would become city property after a ten-year period and a source of income capable of generating $10,800 annually. Some revenue may be generated from agricultural operations. This amount is expected to be small in comparison with other airports and not exceeding $2,160 annually. The airport is not expected to directly create a great number of jobs with two positions created with the establishment of a fixed base operation. Anticipated expenditures by the F.B.O. was placed at $27,000 annually and may be somewhat conservative depending upon the F.B.O. operation.

Average annual operating and maintenance (O & M) costs were placed at $23,000. A combination conventional hangar and terminal building would be constructed requiring a capital expenditure of $100,000. Capital cosntruction costs (items eligible for assistance) are expected to total $2,037,000 over the 20-year period. General obligation bonds of $407,400 plus interest would be required to match the $1,719,200 grant-in-aid. It should be noted that $802,000 of the $2,037,000 is for the construction of a crosswind runway and associated land acquisition. As previously noted, it is doubtful that a hard surface crosswind runway

be constructed. An estimated $112,000 would be expended for capital type runway maintenance within the 20-year period. A grant-in-aid would be expected for capital maintenance leaving $22,400 as a local match requirement. Debt service (G.O. Bond principal and interest) was placed at $46,300 per year. This amount is considered high as some of the items may never be constructed as previously noted.

An average annual expenditure of $69,320 would be required over the 20 years to retire the general obligation bonds and maintain and operate the airport. In addition, $1,719,200 ($85,960 per year) would be expended from grants-in-aid.

The ultimate objective should seek to generate a sufficient amount of airport revenue to meet annual O & M expenses. Very few general aviation airports generate revenue amounts sufficient to retire major capital improvements.

In the year 2002, the airport would be expected to have direct and indirect benefits of $4,295,255 compared to a 20 year development cost (to include accumulative O & M expenditures) of $3,386,779. Thus the airport would provide $1.26 of benefit compared to $1.00 of cost.

Section Eight "Financial Plan" will provide a detailed estimate of cost based upon a 20-year development schedule. A strategy for implementation will also be prepared that can be implemented within the local financial constraints. Realistically, the airport would be developed in phases with some of the capital items being given a low priority if financial constraints exist.

IV - FACILITY REQUIREMENTS

INTRODUCTION

This portion of the study describes those facility and equipment requirements needed to accommodate the aviation demand forecasted in the previous phase. It is intended that this information be presented in a form that can be readily used in analyzing and determining the suitability of potential sites and developing the specific layout on the selected site.

The following specific items of development and requirements are addressed:

a. Runway and Taxiway - length, width, clearances, visibility, orientation and grades.
b. Terminal Area - apron, hangars, administration building, and auto parking.
c. Obstructions - navigable airspace.
d. Drainage.
e. Paving - rigid pavement and flexible pavement.
f. Marking, Lighting and Visual Aids.
g. Navigational Aids - NDB and TVOR

Information contained herein is drawn primarily from applicable FAA Advisory Circulars. Based on the Forecasts of Aviation Demand, development should be planned to accommodate a General Utility classification of aircraft.

RUNWAY AND TAXIWAY

LENGTH: Runway length requirements are a function of the aircraft type using the facility and certain conditions at the airport, including 1) temperature, 2) surface wind, 3) runway gradient, and 4) altitude of the airport. The following paragraphs describe these factors and their effect on the runway length at the Grinnell airport.

a. Temperature - The higher the temperature, the longer the runway requirements. This is due to the fact that higher temperatures reflect lower air densities. Therefore, increased air speed is required to obtain or maintain proper lift. These faster speeds require longer runway lengths for acceleration and deceleration. This study assumes a mean daily maximum temperature during the hottest month of the year to be 87^{o} F.

b. Surface Wind - The greater the headwind the shorter the runway length requirements and conversely, tailwinds require longer runway lengths. The following table approximates the effect of wind:

ACTUAL WIND (KNOTS)	% INCREASE OR DECREASE OF LENGTH WITH NO WIND
+5	-3
+10	-5
-5	+7

(Source: Planning and Design of Airports, Robert Horonjeff)

For the purpose of this study, a no wind situation will be assumed. This is a worst case situation since if their is any wind, a landing direction can be selected where there is at least some headwind component.

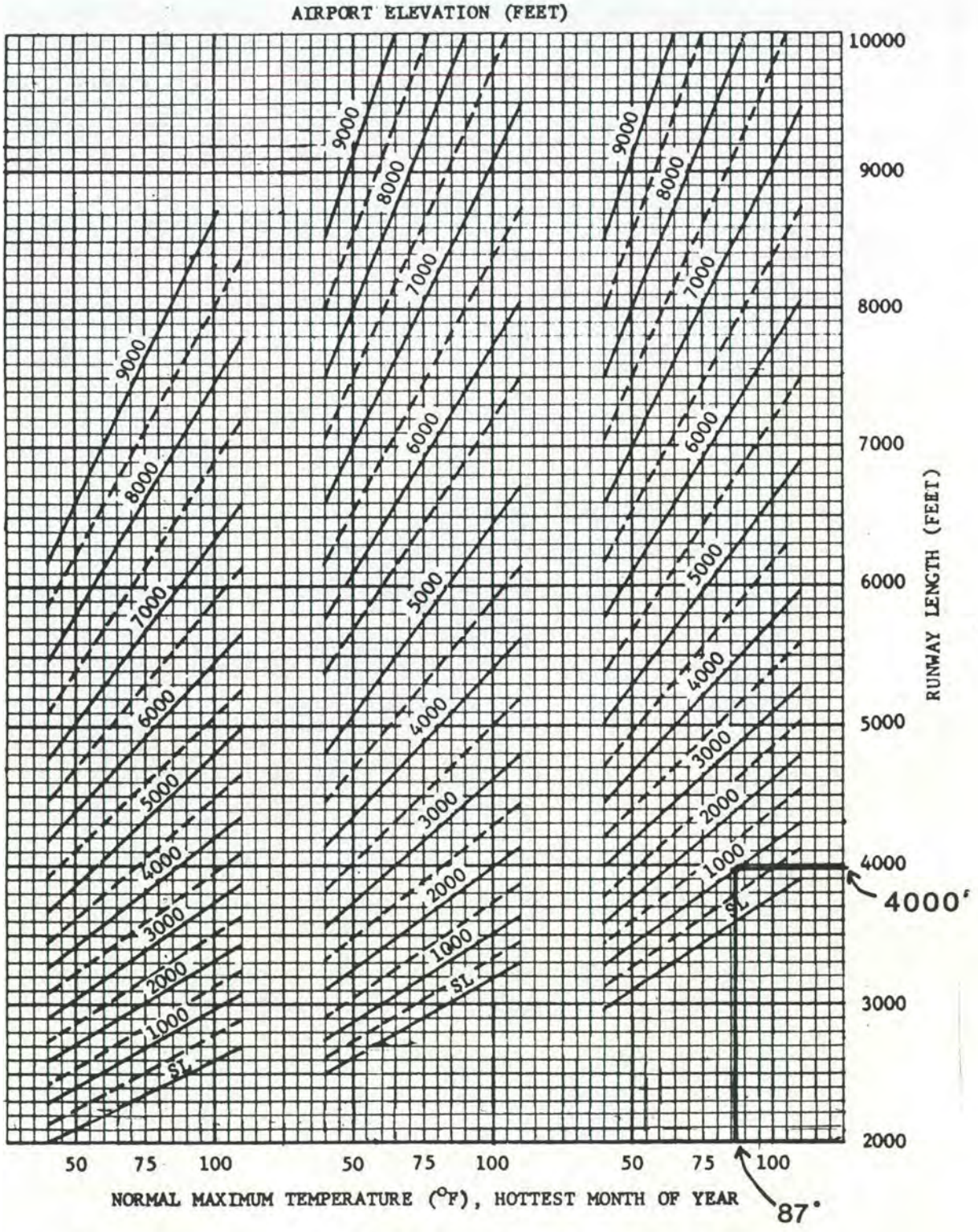
c. Runway Gradient - Runway gradient, or slope of the runway, requires additional runway length for takeoff on an uphill gradient as opposed to a level or downhill gradient. However, for general aviation aircraft operating on runways with gradients less than 2%, this effect is considered to be negligible.

d. Altitude of the Airport - The higher the altitude of the airport, the longer the runway length requirements. Higher altitudes reflect lower air densities. Therefore, higher operating speeds are required to maintain sufficient lift. In general, an additional 7% of runway length is required for each additional 1,000 feet of altitude. For the purpose of this study, an altitude of 1,000 feet above mean sea level will be assumed for the airport.

The runway length requirements for the Grinnell airport have been calculated based on the above criteria and in accordance with the guidelines of FAA Advisory Circular 150/5300-4B, Utility Airports--Air Access to National Transportation. The length requirement for the primary runway is determined to be 4,000 feet as shown in Figure IV-1. Figure IV-1 assumes zero headwind, maximum certified takeoff and landing weights, and optimum flap setting for the shortest runway length (normal operation).

If the wind analysis determines that a cross wind runway is necessary, FAA Advisory Circular 150/5300-4B recommends that its length be at least 80% of the length of the primary runway. This is based on a wind situation where the primary runway cannot be used, there should be sufficient headwind on the cross wind runway justifying a shorter length. However, if at all feasible, it is recommended here that the cross wind runway be planned equal in length to the primary runway.

WIDTH AND CLEARANCES: The dimensional requirements presented herein are based on the standards of the FAA as described in Advisory Circular 150/5300-4B. In order to recognize the applicable standards, the appropriate "Airplane Design Group" and "Aircraft Approach Category" must be determined.



RUNWAY LENGTH CURVES

FIGURE IV-1

The various applicable "Airplane Design Groups" can be summarized as follows:

DESIGN GROUP	DESCRIPTION
I (small)	Small aircraft with wingspan < 49'
I (large)	Large aircraft with wingspan < 49'
II	Approach Category A & B, wingspan < 79'
III	Approach Category A - wingspan < 118' Approach Category B - wingspan < 79'

The various applicable "Aircraft Approach Categories" are summaried as follows:

APPROACH CATEGORY	AIRCRAFT APPROACH SPEED
Category A	Less than 91 knots
Category B	Greater than 91 and less than 121 knots
Category C	Greater than 121 and less than 141 knots

For the purpose of this study, the ultimate design aircraft has been determined in the forecasts portion of this report to be in Design Group II and Approach Categories A and B. For comparison purposes, the following table lists some typical aircraft and their wingspans and approach speeds.

AIRCRAFT	WINGSPAN (FT.)	APPROACH SPEED (KNOTS)
Beech King Air B100	45.9	111
Cessna Citation I	47.1	108
Cessna 150	33.3	55
Cessna 421	44.1	94
Gulfstream I	78.5	113
Learjet 24	35.6	128
Piper Cheyenne	42.7	110
Piper Navajo	40.7	100

Dimensional standards for this category of airport are as follows:

Runway Width	75 Feet
Runway Safety Area	
Length Beyond End of Runway	300 Feet
Width	150 Feet
Taxiway Width	35 Feet
Taxiway Safety Area Width	79 Feet
Separation Distance	
Runway Centerline to Parallel Taxiway Centerline	240 Feet
Runway Centerline to Building Restriction Line	250 Feet
Taxiway Centerline to Parked Aircraft & Object	66 Feet

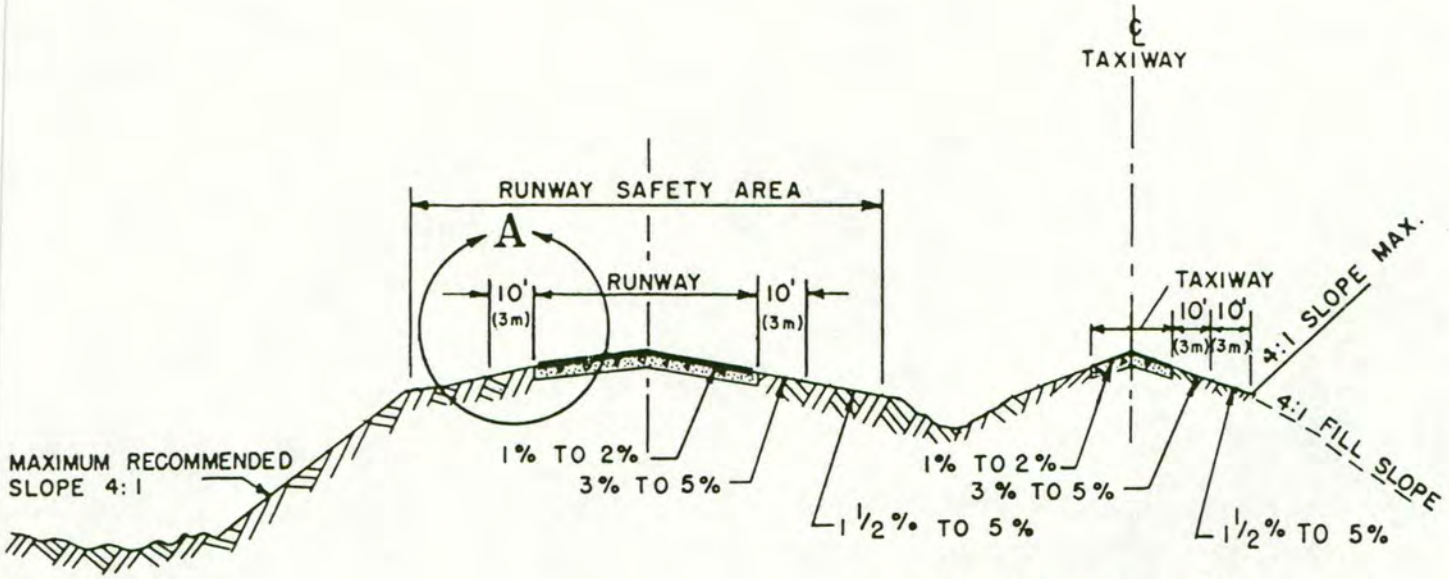
Figure IV-2 depicts a typical cross section of the runway and taxiway configuration.

The forecast of aviation demand does not justify the construction of a full parallel taxiway system based on capacity criteria. However, it is recommended here that it be planned for anyway and can be constructed should activity exceed expectations or safety reasons should justify its development.

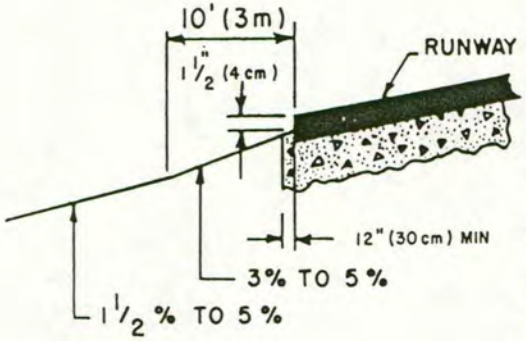
LINE-OF-SIGHT: Line of sight requirements are very important for the safe operation of the airport. Along an individual runway, grades shall be maintained such that any two points 5 feet above the runway centerline shall be mutually visible for the entire length of the runway.

Between intersecting runways, grade changes, terrain, structures and any other objects shall be maintained such that there will be an unobstructed line of sight from any point 5 feet above the runway centerline to any point 5 feet above the centerline of the intersecting runway within the runway visibility zone. The runway visibility zone is graphically depicted in Figure IV-3.

OBSTACLE FREE ZONE: The Obstacle Free Zone (OFZ) is an area of imaginary surfaces which should not be penetrated by obstructions or hazards of any sort. An obstruction or hazard is any above ground object, including



LOCATION OF DITCH, SWALE OR HEADWALL DEPENDS ON SITE CONDITION BUT IN NO CASE WITHIN LIMITS OF RUNWAY SAFETY AREA.

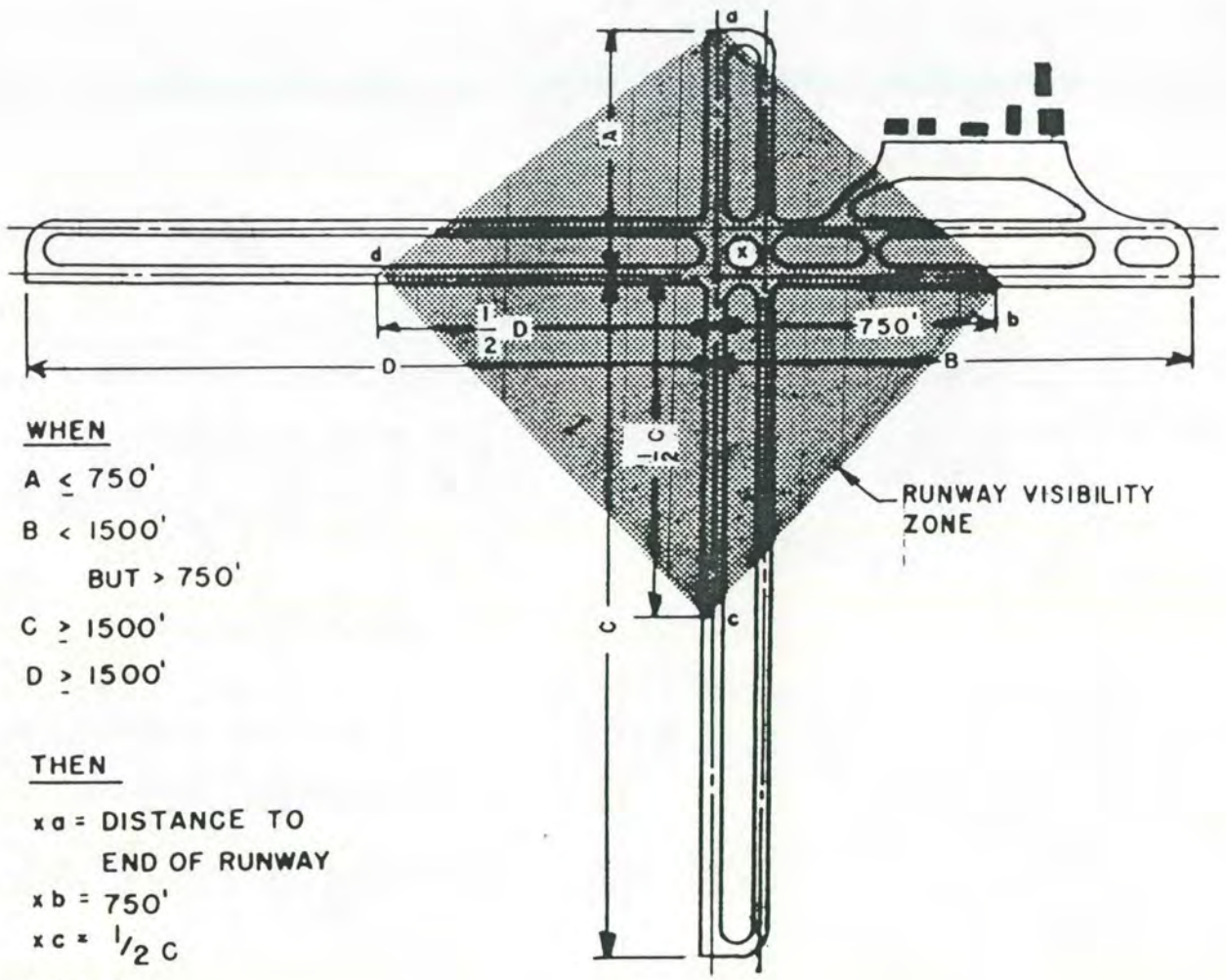


DETAIL A

TRANSVERSE SLOPES SHOULD BE ADEQUATE TO PREVENT THE ACCUMULATION OF WATER ON THE SURFACE. SLOPES SHOULD FALL WITHIN THE RANGES SHOWN ABOVE. THE RECOMMENDED $1\frac{1}{2}$" (4 cm) PAVEMENT EDGE DROP IS INTENDED TO BE USED BETWEEN PAVED AND UNPAVED SURFACES. IT IS DESIRABLE TO MAINTAIN A 5% SLOPE FOR THE FIRST 10' (3m) OF UNPAVED SURFACE IMMEDIATELY ADJACENT TO THE PAVED SURFACE.

TYPICAL CROSS SECTION

FIGURE IV-2



WHEN

A ≤ 750'

B < 1500'

BUT > 750'

C ≥ 1500'

D ≥ 1500'

THEN

x a = DISTANCE TO END OF RUNWAY

x b = 750'

x c = $^1/_2$ C

x d = $^1/_2$ D

RUNWAY VISIBILITY ZONE

FIGURE IV-3

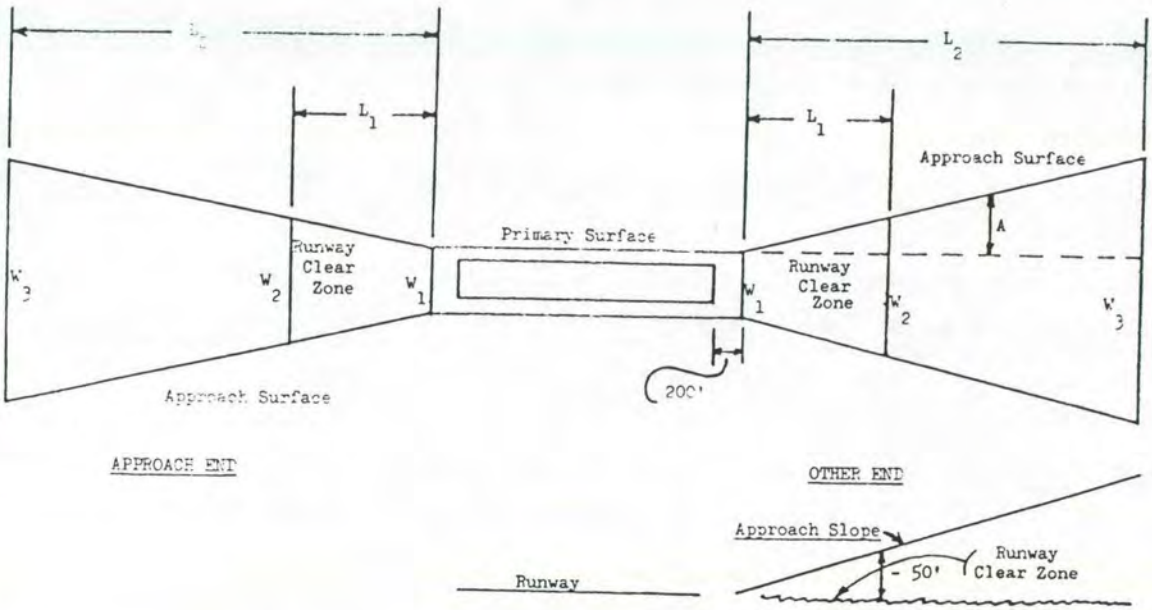
parked aircraft. Frangibly-mounted NAVAID'S are the exception since they must be located near the runway because of their function. The OFZ for the Grinnell Airport is defined in Advisory Circular 150/5300-4B as follows: "The runway OFZ is the volume of space above a surface longitudinally centered on the runway. The elevation of any point of the surface is the same as the elevation of the nearest point on the runway centerline. The runway OFZ extends 200 feet beyond each end of the runway and its width is 250 feet."

CLEAR ZONES: It is required that the airport owner have an "adequate property interest" in the clear zone area. "Adequate property interest" in order of preference may be in the form of fee ownership; a clear zone easement restricting the existence of any growths, structures or objects except normal crops; or an avigation easement restricting the height of obstructions. The dimensions and location of the clear zone are depicted in Figure IV-4.

WIND ANALYSIS AND RUNWAY ORIENTATION: As a general rule, the primary runway should be oriented as closely as practicable in the direction of the prevailing winds. Aircraft can operate safely with respect to wind as long as the cross wind component during landing and takeoff does not become excessive. For "utility" class of airports, FAA standards require that the cross wind component not exceed 12 miles per hour 95% of the time.

The orientation and number of runways required to provide the desirable wind coverage is determined graphically through the use of wind data plotted on a wind rose. The wind rose depicts the direction of the wind, its velocity and percentage of occurrence. A band is then superimposed on the wind rose, the center of which represents the runway centerline and the width represents the maximum tolerable cross wind component. The most optimum orientation for wind coverage is ascertained by totaling the percentage of wind coverage within the band.

For the Grinnell airport it has been determined that two runways are necessary to obtain the 95% wind coverage. The primary runway should have approximately a 15-33 orientation and the cross wind runway should have



R/W TYPE	SET NO.	RUNWAY END		DIMENSIONS (FEET)						R/W CZ AREA	FLARE RATIO A
		APPROACH	OTHER	L_1	L_2	W_1	W_2	W_3	SLOPE		
UTILITY RUNWAYS	1	V		1,000	5,000	250	450	1,250	20:1	.035	.1:1
			V	1,000	5,000	250	450	1,250	20:1	8.035	.1:1
	2	V		1,000	5,000	500	650	1,250	20:1	13.200	.075:1
			N.P.	1,000	5,000	500	800	2,000	20:1	14.922	.15:1
	3	N.P.		1,000	5,000	500	800	2,000	20:1	14.922	.15:1
			N.P.	1,000	5,000	500	800	2,000	20:1	14.922	.15:1

ABBREVIATIONS USED IN THE ABOVE CHART

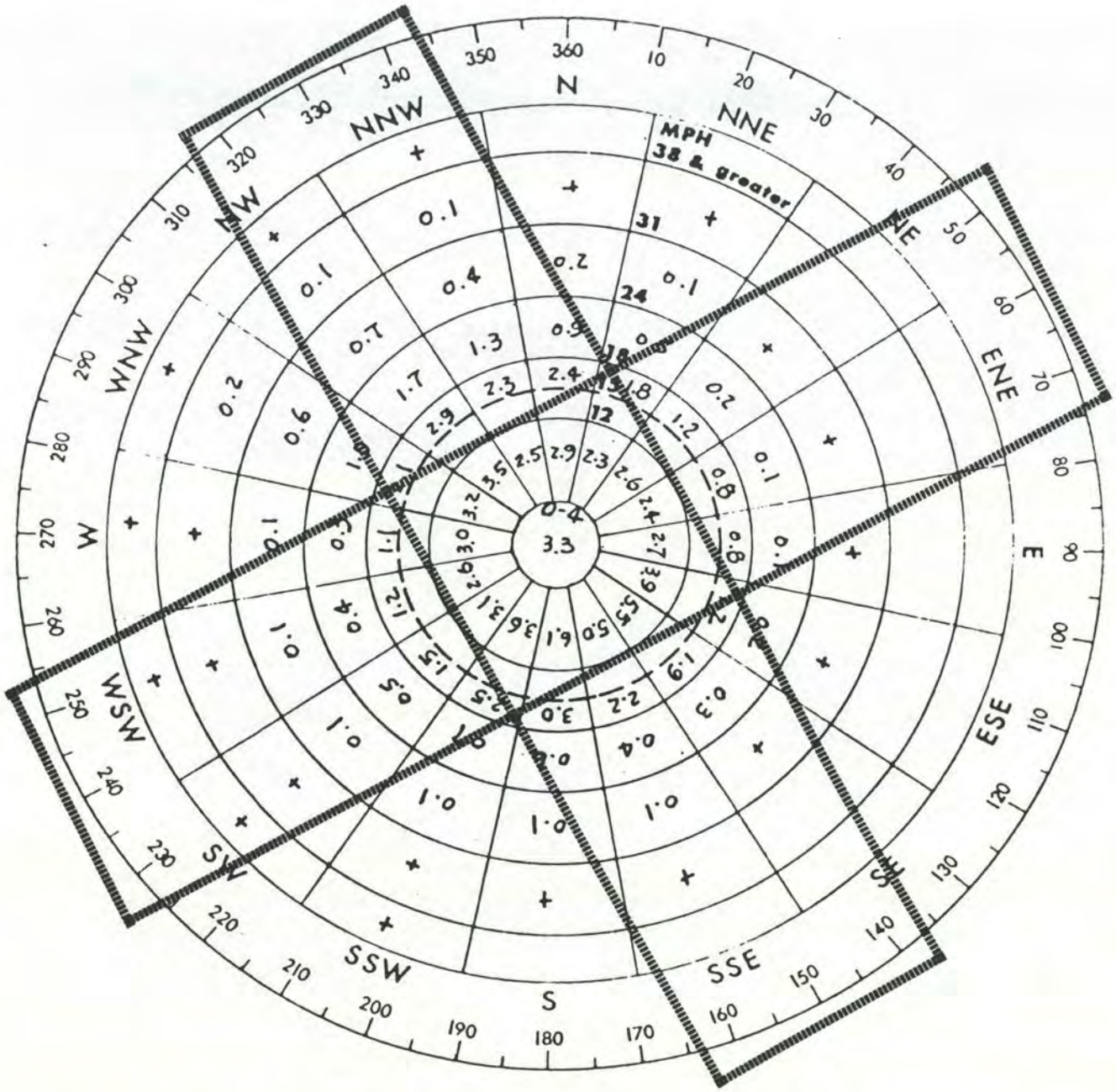
V = Visual approach
N.P. = Non-precision approach

RUNWAY CLEAR ZONE DIMENSIONS

FIGURE IV-4

approximately a 6-24 orientation. Refer to Figure IV-5. Actual runway orientations will also depend on the selected site terrain and surroundings.

RUNWAY AND TAXIWAY LONGITUDINAL GRADES: In addition to the sight distance requirements listed above, the runway and taxiway's longitudinal grades should not exceed those limitations depicted in Figure IV-6. For the first 200 feet of runway safety area beyond the runway end, the longitudinal grade needs to be such that the primary surface is not penetrated nor the grade steeper than 3%. Beyond that, the maximum allowable grade change shall be plus or minus 2% per 100 feet, and such that the ground surface does not penetrate the approach surface.

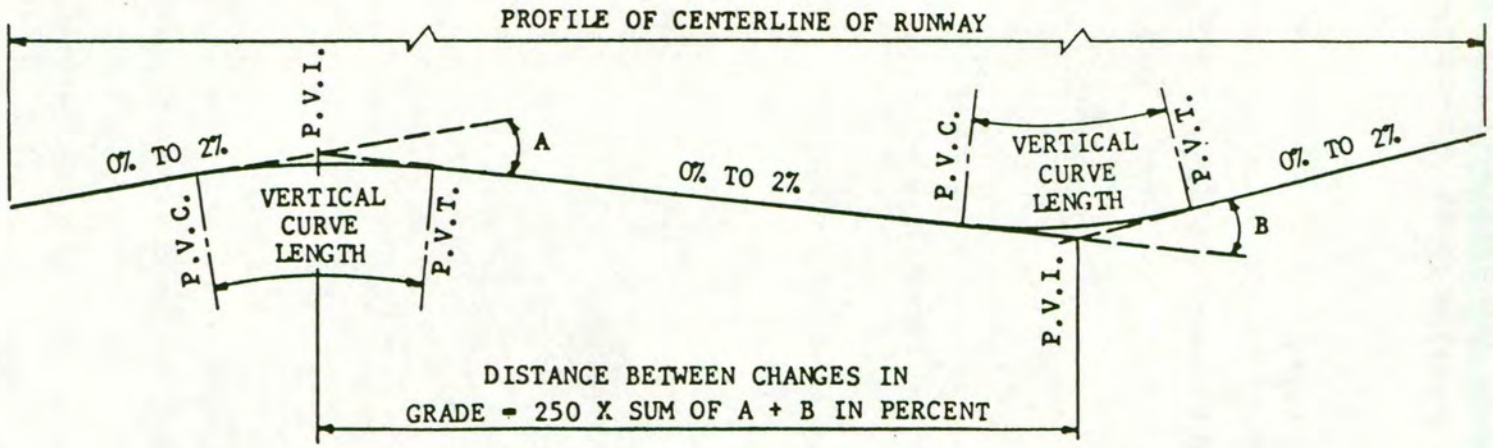


Calms = 3.3%
Ceiling and visibility group:
Greater than 1000 ft and/or 3 miles = 94.9%
Less than 1000 ft and/or 3 miles = 5.1%

Des Moines wind rose (mph), record of period 1951-1960.

WIND ROSE

FIGURE IV-5



VERTICAL CURVES

LENGTH OF VERTICAL CURVES WILL NOT BE LESS THAN 300' FOR EACH 1% GRADE CHANGE, EXCEPT THAT NO VERTICAL CURVE WILL BE REQUIRED WHEN GRADE CHANGE IS LESS THAN 0.4%.

GRADE CHANGE

MAXIMUM GRADE CHANGE SUCH AS (A) OR (B) SHOULD NOT EXCEED 2%.

LONGITUDINAL GRADE LIMITATIONS

FIGURE IV-6

TERMINAL AREA

ITINERANT APRON: The area required for parking of itinerant aircraft can be projected based on the forecasted itinerant operations. The methodology used in this projection is described as follows:

a. Calculate the total annual itinerant operations. This was done in the forecast of aviation demand portion of this report.
b. Calculate the average daily itinerant operations for the most active month. Assume the most active month is 10% busier than the average month.
c. Assume the busy itinerant day is 10% more active than the average day. This is based on data from FAA surveys.
d. Assume that a certain portion of the itinerant airplanes will be on the apron during the busy day. Fifty percent is used here.

Based on the above analysis, the itinerant apron requirements have been calculated and are presented in the following table.

YEAR	ANNUAL ITINERANT OPERATIONS	ITINERANT TIE-DOWNS REQUIRED
1983	5,831	10
1987	6,072	10
1992	6,451	11
2002	6,994	12

BASED AIRCRAFT APRON: In addition to itinerant apron requirements, a certain area will be required for the tie-down of based aircraft. This depends on a number of variables and is difficult to project. Some of the factors affecting an aircraft owner's decision to tie-down an airplane are: quality of the available hangars; cost of hangar space; value of the aircraft; and personal preference. For Grinnell it is estimated that a maximum of 15% of the based aircraft owners will choose to tie-down their

aircraft. The calculated based aircraft tie-down spaces are determined as follows.

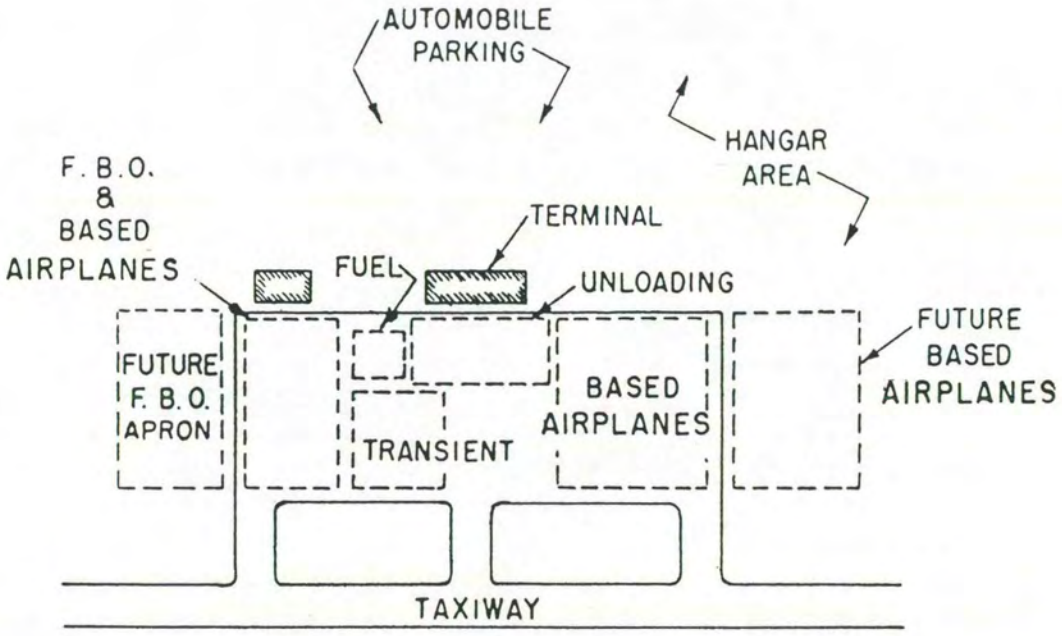
YEAR	BASED AIRCRAFT	BASED AIRCRAFT TIE-DOWNS REQUIRED
1983	18	3
1987	19	3
1992	21	3
2002	24	4

APRON REQUIREMENTS: Total apron area requirements should provide adequate space for:

a. Tie-Down of Based Aircraft
b. Tie-Down of Itinerant Aircraft
c. Temporary Parking of Transient Aircraft
d. Short Term Loading and Unloading
e. Fixed Base Operator Functions
f. Fueling

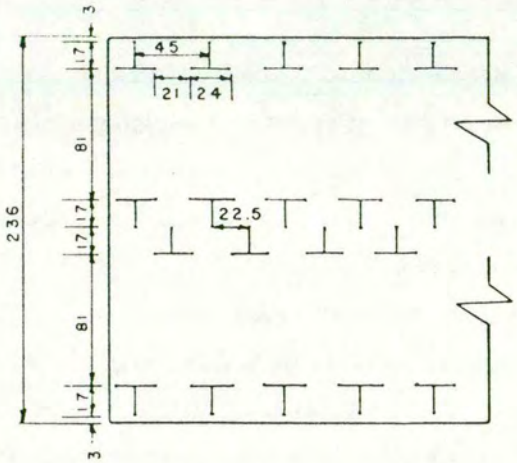
With proper planning, the apron area will accommodate the maximum number of aircraft while maintaining ease of ingress and egress. The apron area should also be planned with a certain amount of flexibility and expandability. Figure IV-7 depicts a typical layout of the space requirement of an apron while Figure IV-8 depicts tie-down configurations.

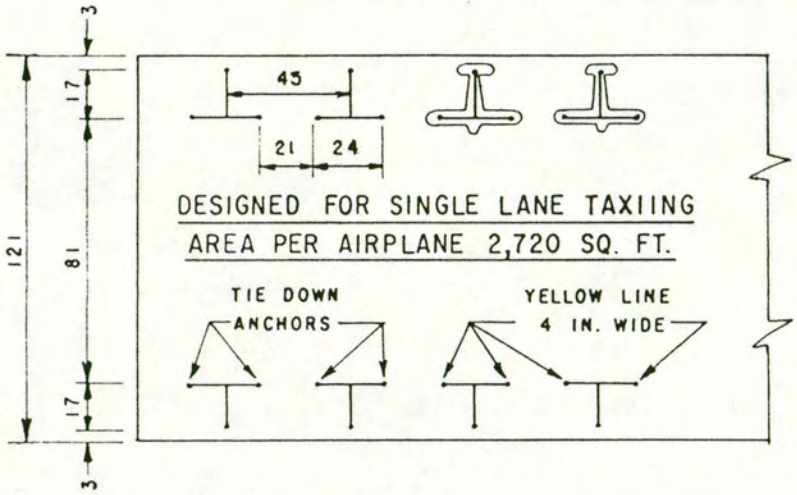
HANGARS: Hangar space requirements are in two forms - T-hangars and conventional hangars. The majority of aircraft owners will prefer to store their aircraft in T-hangars. This is the most economical form of aircraft storage for individual owners. Some aircraft owners, more specifically corporate aircraft owners, may prefer to hangar their aircraft in an individual conventional hangar. Lastly, conventional hangar space should be provided for fixed base operator facilities.



APRON LAYOUT

FIGURE IV-7





TIEDOWN LAYOUTS

FIGURE IV-8

The criteria for the number of hangar spaces that should be planned for is as follows:

a. T-hangar space should be provided for the number of based aircraft at the airport (use projected numbers for planning purposes). In addition, provide three to four spaces for itinerant aircraft which may need a space and as an attraction to new based aircraft.

b. The number of conventional hangar spaces to be allowed for is difficult to estimate. It is highly dependent on the personal preferences of the local users. In general, two to three corporate hangars are adequate for the 20-year development of a utility category airport.

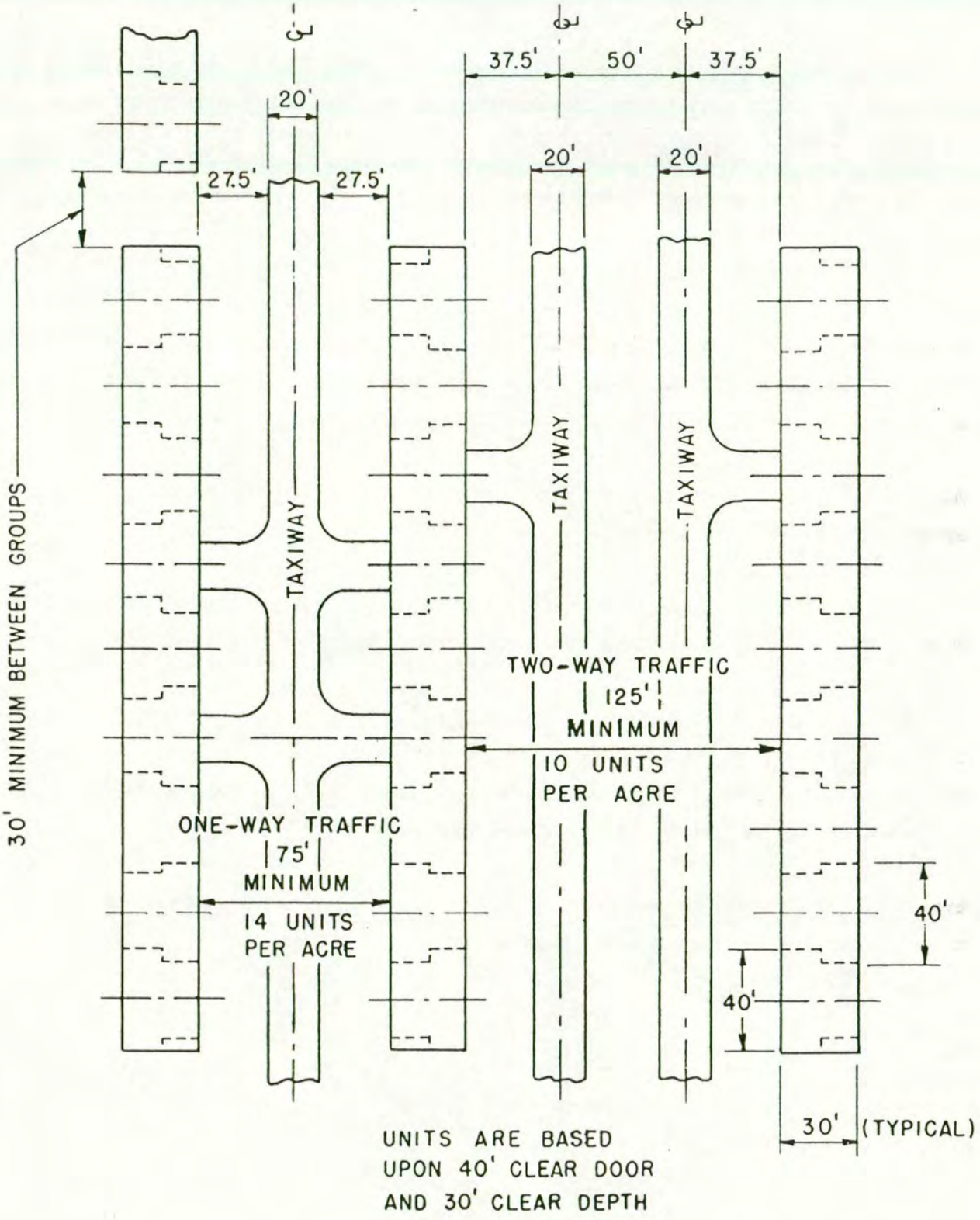
c. Conventional hangar space should also be provided for the fixed based operator facilities. Initially, one such hangar will be adequate with the potential for a second hangar in the long range development of the airport.

Based on the above criteria, the hangar requirements at the Grinnell airport are determined as follows.

YEAR	T-HANGAR SPACE	CONVENTIONAL HANGAR SPACE
1984	10	1
1989	12	2
1994	15	4
2004	20	5

Typical configurations of T-hangars and taxiways are depicted in Figure IV-9.

ADMINISTRATION BUILDING: Initially, the administration building will probably be a corner of the Fixed Base Operator hangar or a corner of a T-hangar. However, as activity and demand increases, a separate building of adequate size will be required. At a minimum the building should provide room for the following facilities.



T-HANGER LAYOUT

FIGURE IV-9

a. Waiting room
b. Manager's office
c. Public restrooms
d. Pilot ready room
e. Class rooms
f. Future offices

ROADS AND AUTO PARKING: Roads and auto parking are an important aspect in the operation of the airport. Adequate space must be planned for without limiting future building or other terminal expansion.

Four or five short term or stopping places should be provided close to the main off-field public entrance and administration building.

Employee parking can be incorporated with public parking. Ultimately, 10 to 15 employee spaces and 25 to 30 public spaces may be required.

Special events such as air shows and fly-ins may require significant amounts of parking. Although it is not practical to provide hard surface space for these infrequent events, available turf areas should be kept in mind in the layout of the terminal area.

An access drive to the ramp area for service vehicles should be provided. However, it is recommended that a gate be provided to control unauthorized access.

OBSTRUCTIONS

This section sets forth the standards for determining obstructions in the navigable air space around the proposed Grinnell airport. This information will be useful in analyzing potential sites and should be incorporated into a tall structure zoning ordinance for future protection of air space. The information should also be provided to the FAA for use in analyzing notices of proposed construction in the area of the airport.

The following sections of this report will be quoting Federal Aviation Regulation Part 77 - Objects Affecting Navigable Air Space as it Pertains to the Grinnell Airport.

OBSTRUCTION STANDARDS: An obstruction is considered to be any object of natural growth, terrain, or structures of permanent or temporary construction if it is higher than any of the following heights or surfaces:

a. A height of 500 feet above ground level at the site of the object.

b. A height that is 200 feet above ground level or above the established airport elevation, whichever is higher, within 3 nautical miles of the established reference point of an airport. That height increases in the proportion of 100 feet for each additional nautical mile of distance from the airport up to a maximum of 500 feet.

c. The surface of a takeoff and landing area of an airport or any imaginary surface established under paragraphs 77.25, 77.28, or 77.29 (FAR Part 77). However, no part of the takeoff or landing area itself will be considered an obstruction.

The height of traverse ways to be used for the passage of mobile objects are increased as follows:

a. 17 feet for an Interstate Highway.

b. 15 feet for any other public roadway.

c. 10 feet of the height of the highest mobile object that would normally traverse the road, whichever is greater, for a private road.

d. 23 feet for a railroad

e. For a waterway or any other traverse way not previously mentioned, an amount equal to the height of the highest mobile object that would normally traverse it.

The following paragraphs describe the imaginary surfaces as they would apply to the Grinnell airport. Refer to Figure IV-10 for a graphic depiction of these surfaces.

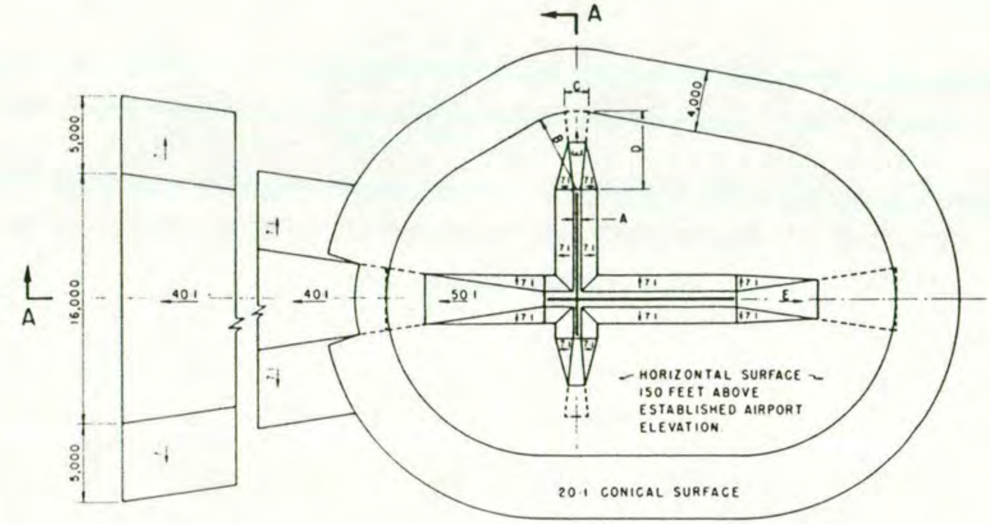
Horizontal Surface - a horizontal plane 150 feet above the established airport elevation, the perimeter of which is constructed by swinging arcs of 5,000 feet radii from the center of each end of the primary surface of each runway and connecting the adjacent arcs by lines tangent to those arcs.

Conical Surface - a surface extending outward and upward from the periphery of the horizontal surface at a slope of 20 to 1 for a horizontal distance of 4,000 feet.

Primary Surface - a surface longitudinally centered on a runway and extending 200 feet beyond the end of that runway. The elevation of any point on the primary surface is the same as the elevation of the nearest point on the runway centerline. The width of a primary surface is 250 feet for utility runways having only visual approaches and 500 feet for utility runways having nonprecision instrument approaches.

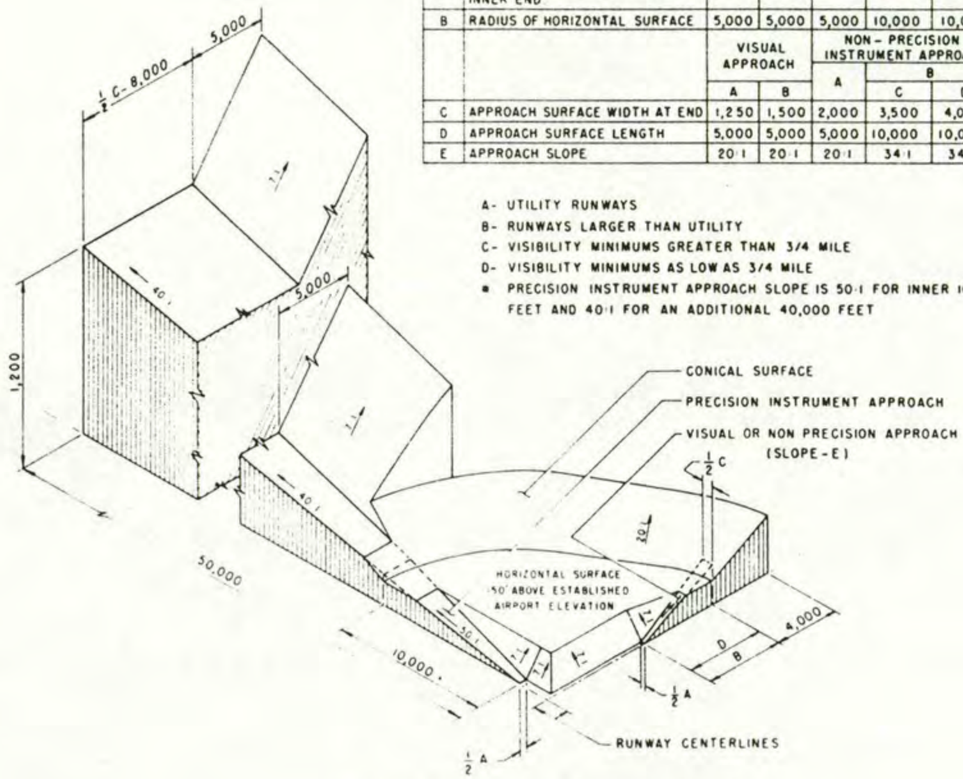
Approach Surface - a surface longitudinally centered on the extended runway centerline and extending outward and upward from each end of the primary surface. An approach surface is applied to each end of each runway based upon the type of approach available or planned for that runway end. The inner edge of the approach surface is the same width as the primary surface and it expands uniformly to a width of 1,250 feet for that end of a utility runway with only visual approaches; and 2,000 feet for that end of a utility runway with a nonprecision instrument approach. The approach extends for a horizontal distance of 5,000 feet at a slope of 20 to 1 for all utility and visual runways.

Transitional Surface - These surfaces extend outward and upward at right angles to the runway centerline and the runway centerline



DIM	ITEM	DIMENSIONAL STANDARDS (FEET)					
		VISUAL RUNWAY		NON-PRECISION INSTRUMENT RUNWAY			PRECISION INSTRUMENT RUNWAY
		A	B	A	B		
					C	D	
A	WIDTH OF PRIMARY SURFACE AND APPROACH SURFACE WIDTH AT INNER END	250	500	500	500	1,000	1,000
B	RADIUS OF HORIZONTAL SURFACE	5,000	5,000	5,000	10,000	10,000	10,000
		VISUAL APPROACH		NON-PRECISION INSTRUMENT APPROACH			PRECISION INSTRUMENT APPROACH
		A	B	A	B		
					C	D	
C	APPROACH SURFACE WIDTH AT END	1,250	1,500	2,000	3,500	4,000	16,000
D	APPROACH SURFACE LENGTH	5,000	5,000	5,000	10,000	10,000	*
E	APPROACH SLOPE	20:1	20:1	20:1	34:1	34:1	*

A- UTILITY RUNWAYS
B- RUNWAYS LARGER THAN UTILITY
C- VISIBILITY MINIMUMS GREATER THAN 3/4 MILE
D- VISIBILITY MINIMUMS AS LOW AS 3/4 MILE
* PRECISION INSTRUMENT APPROACH SLOPE IS 50:1 FOR INNER 10,000 FEET AND 40:1 FOR AN ADDITIONAL 40,000 FEET



ISOMETRIC VIEW OF SECTION A-A

IMAGINARY SURFACES

FIGURE IV-10

extended at a slope of 7 to 1 from the sides of the primary surface and from the sides of the approach surfaces.

The type of surface to be used shall be for the most precise approach existing or planned for that runway end.

DRAINAGE

An adequate drainage system is important for the safety of aircraft operations and for the longevity of the pavements. Improper drainage can result in the formation of puddles on pavements which are hazardous to aircraft landing or taking off. Improper drainage can also reduce the load bearing capacity of subgrades and the anticipated life of expensive pavement structures.

Typical pavement cross sections are shown in Figure IV-2. It is recommended here that runway and taxiway cross slopes be designed at 1 1/2%. There should be a pavement edge drop of 1 1/2 inches to the shoulder to allow for turf build-up. The shoulder immediately adjacent to paved areas should be sloped at 5% for the first 10 feet from the pavement edge to assure positive surface runoff. Beyond 10 feet, turf areas should be sloped at 2%.

Surface drainage systems should be designed on a 5-year frequency of storm. Methods of computation are contained in FAA Advisory Circular 150/5300-5B Airport Drainage.

Subsurface drainage systems are desirable where water may rise to within 1 foot of the pavement section. Water in the subgrade contributes directly to frost boil and heaving action. Also, saturated subgrades exhibit a greatly reduced load bearing capacity. For these reasons, soil conditions and subsurface water conditions play an important part in site selection and airport design.

PAVING

Airport pavement is intended to provide a smooth and safe all-weather surface free from particles and other debris that may be picked up by propeller wash. The pavement should be of sufficient thickness and strength to accommodate the anticipated loads without undue pavement distress. Pavement for the Grinnell airport should be designed to accommodate aircraft up to a maximum gross weight of 12,500 pounds and a single wheel gear.

The various pavement courses are shown graphically in Figure IV-11 and described as follows.

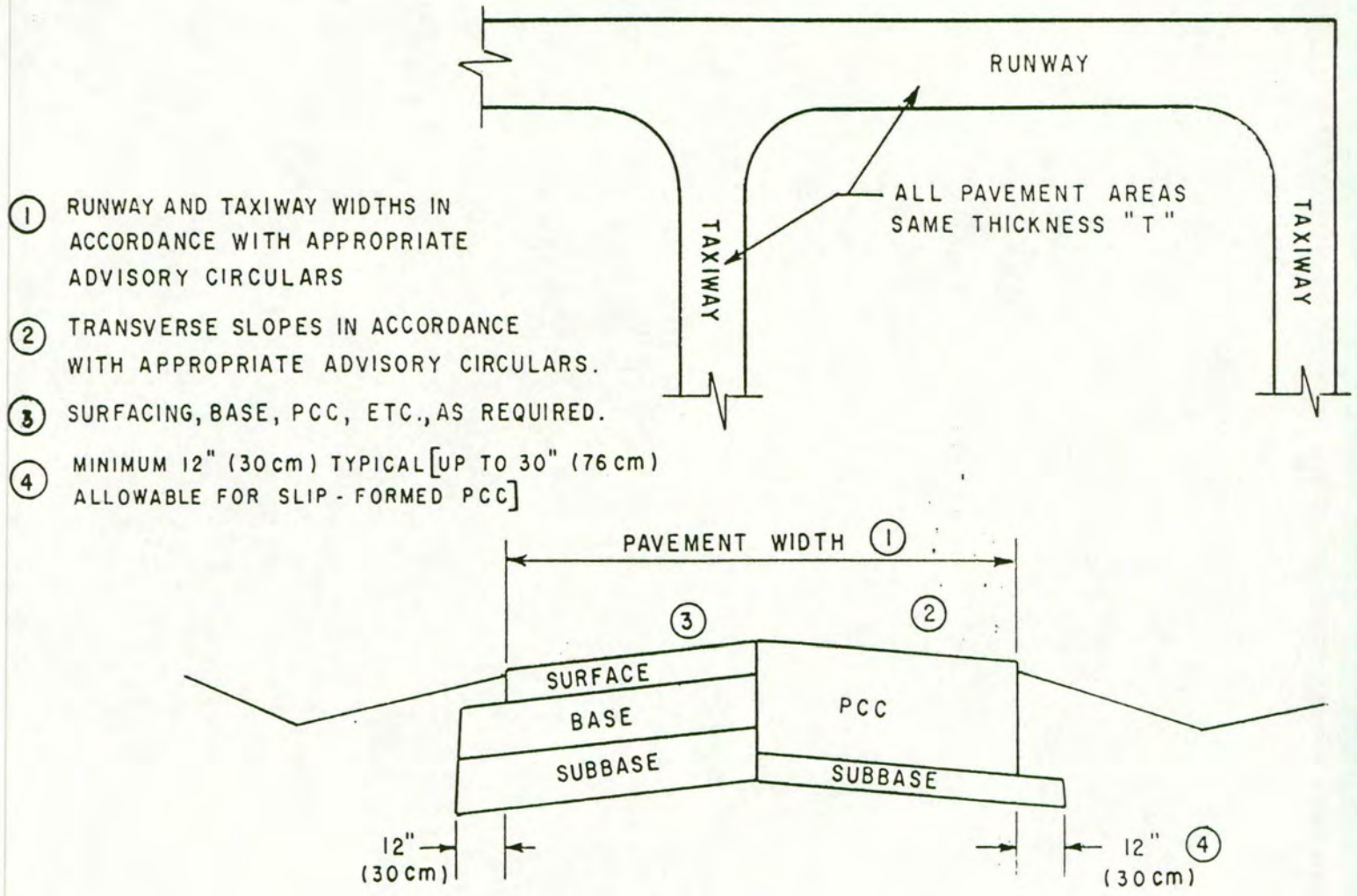
Surface Course - includes Portland cement concrete, bituminous concrete, aggregate bituminous mixtures, or bituminous surface treatments.

Base Course - consists of a variety of different materials which generally fall into two main classes, treated and untreated. The untreated bases consist of stone, gravel, limerock, sand-clay, or a variety of other materials. The treated bases normally consist of a crushed or uncrushed aggregate that has been mixed with cement or bitumen.

Subbase Course - consists of a granular material or a stabilized soil.

RIGID PAVEMENT: A rigid pavement section for the Grinnell airport would consist of a 5 inch thick Portland Cement Concrete surface course. The necessity of a base course, probably of crushed stone, is dependent on the bearing capacity of the soil on the selected site. A poor grade of soil will require a minimum 4 inch thick subbase course.

FLEXIBLE PAVEMENT: There are many combinations of flexible surface, base and subbase that could be required for the Grinnell airport. Design parameters are outlined in FAA Advisory Circular 150/5320-6C. Of critical importance in the flexible pavement design process is the bearing capacity of the existing soil.



TYPICAL PAVEMENT SECTIONS

FIGURE IV-11

As shown above, the characteristics of the soil at an airport site play an important role in the pavement design and the ultimate cost and life of an airport facility. It should therefore be considered as a factor in the site selection process.

MARKING, LIGHTING AND VISUAL AIDS

MARKING: Pavement markings are an important aid in safely guiding aircraft on runways and taxiways. The specific details of marking layout are addressed in FAA Advisory Circular 150/5340-1E Marking of Paved Areas on Airports. The following describes some of the requirements as they would apply to the Grinnell Airport. Refer to Figures IV-12 and IV-13 for details.

Visual Runway

a. Centerline marking - The runway centerline markings consist of a line of uniformly spaced stripes 120 feet in length and gaps of 80 feet. The minimum width is 12 inches.

b. Designation marking - The designation marking indicates the magnetic bearing of the runway centerline to the nearest 10 degree increment. For example, a magnetic bearing of 127 degrees would be represented by "13".

c. Fixed distance marking (if jet activity) - Two solid longitudinal bars located either side of the runway centerline 1,000 feet from the runway threshold.

d. Holding position markings (taxiways and intersecting runways) - Holding position markings consist of a painted hold line and a sign indicating the runway designation numbers.

Nonprecision Instrument Runway

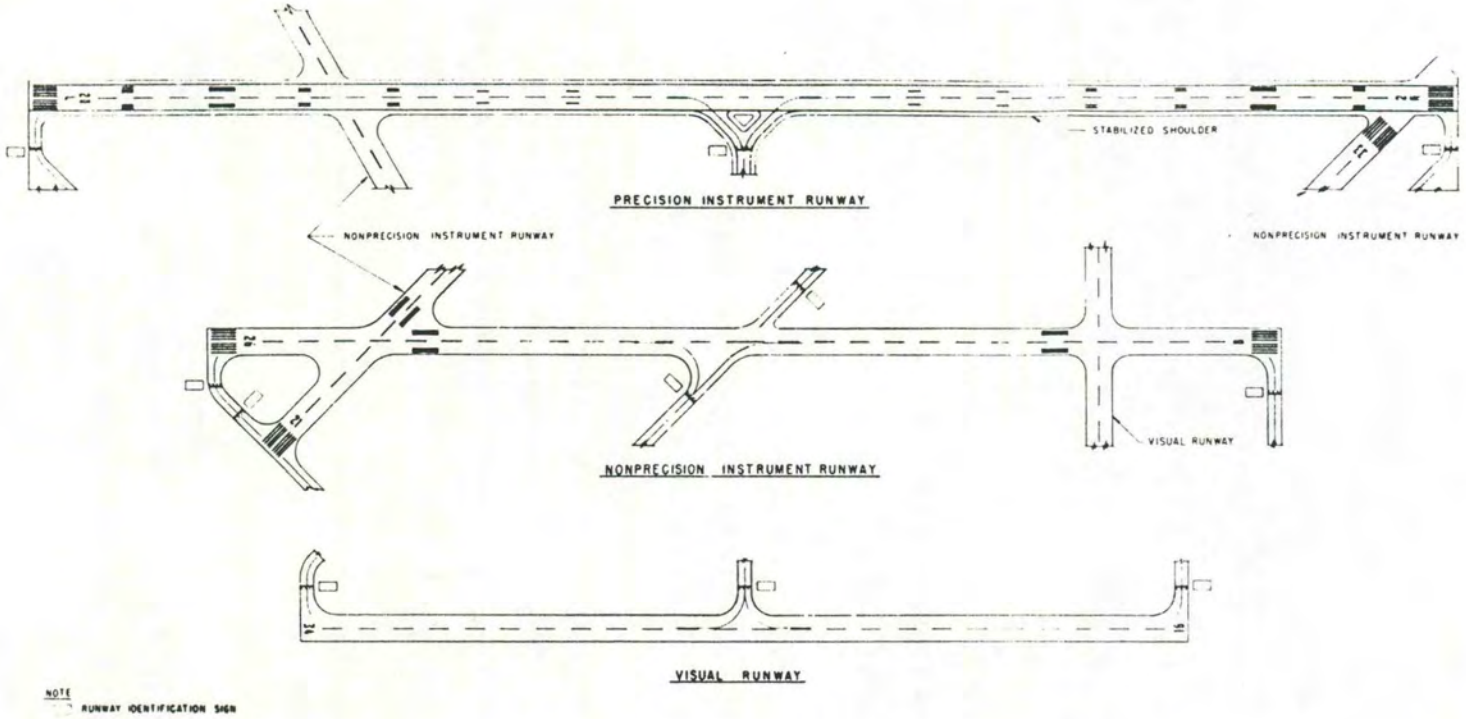
a. Centerline marking - Same as for visual runway except the minimum width is 18 inches.

b. Designation marking - Same as for visual runway.

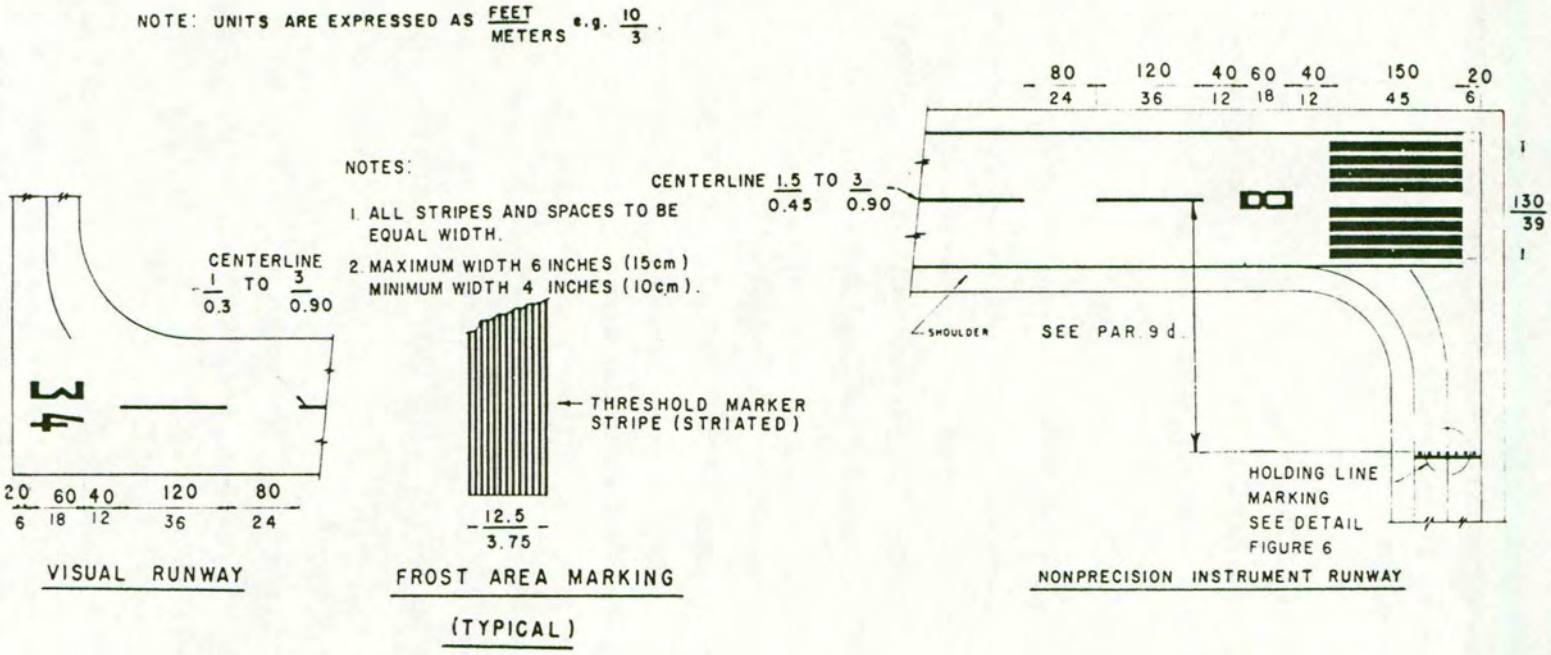
c. Threshold marking - Threshold marking consists of eight longitudinal lines symmetric about the runway centerline. The lines are 150 feet long and 6 feet wide on a 75 foot wide runway.

d. Fixed distance marking (if jet activity) - Same as for visual runway.

e. Holding position marking (taxiways and intersecting runways) - Same as for visual runway.



RUNWAY MARKINGS



VISUAL AND NONPRECISION MARKING

FIGURE IV-13

The color of marking used on runways is white, while that used on taxiways and for marking deceptive, closed or hazardous areas is yellow.

It is anticipated that visual marking will be required at Grinnell until instrument approach procedures are established. At that time, nonprecision instrument runway marking should be incorporated.

LIGHTING: Airport lighting allows nighttime operations and enhances an airport's serviceability and safety. A lighting system consists of runway and taxiway lights, rotating beacon and a lighted wind indicator.

Runway lights include edge and threshold lights. It is recommended that the primary runway and cross wind runway employ medium intensity runway lights (M.I.R.L.). Edge lights are located 10 feet from the edge of the runway pavement with a uniform spacing not exceeding 200 feet. The edge lights have clear lenses except for instrument runways where the last 2,000 feet of runway away from the approach end have amber lenses.

Threshold lights have split red and green lenses. The red half faces the runway and the green half faces away from the runway. Although the standard arrangement is to install six threshold lights on a visual runway and eight threshold lights on an instrument runway, it is recommended here that eight lights be installed in either case. Thus, if an instrument approach should be developed for a previously visual runway, it would not be necessary to modify the lights. The threshold lights are installed in two groups of four and a 10 foot spacing with the outside light in line with the edge lights.

Taxiway lights are similar to runway lights except they have a blue lens. Specific details of runway and taxiway edge lighting systems can be found in FAA Advisory Circular 150/5340-24 Runway and Taxiway Edge Lighting System.

An airport rotating beacon has two rotating beams of light. One light is green and the other white.

The wind indicator or wind sock should be installed at the center of a segmented circle and lighted for enhanced visibility. The lighting should also illuminate any traffic pattern indicators associated with the installation. Specific information on wind indicators and rotating beacons can be obtained from FAA Advisory Circular 150/5340-21.

AIRPORT VISUAL AIDS: A number of visual aids are available to assist a pilot in locating and navigating about an airport. Those recommended for the Grinnell airport are described in the following paragraphs.

Runway End Identifier Lights (R.E.I.L.) consist of two flashing lights located at the runway threshold. The lights provide positive identification of the end of the runway and are of particular use in featureless terrain or confusing surrounding lights.

Visual Approach Slope Indicators (V.A.S.I.) provide visual guidance for landing approaches. The light units are normally located on the left side of the runway as viewed on approach. Each light unit emits a red and white beam of light which enables a pilot to determine whether the approach is being made above, on or below the recommended approach. A two-box V.A.S.I. system is recommended for the Grinnell airport.

NAVIGATIONAL AIDS

A Nondirectional Beacon (NDB) is recommended for the Grinnell airport. The NDB radiates a signal which can be used by pilots to provide electronic directional guidance to the airport. A symmetrical T-antenna is recommended. This consists of two 65 foot poles spaced at approximately 350 feet with two wires strung between them. The NDB should be located on airport property but at least 100 feet away from any metal buildings, power lines or metal fences. The ground should be smooth, level and well drained. The location should take into account the obstruction standards described in this report.

Should instrument operations justify, a terminal very high frequency onmirange (TVOR) may ultimately be installed at the Grinnell airport. The TVOR provides azimuth information to the pilot. The TVOR should be near the runway intersection but at least 500 feet from a runway centerline and 250 feet from a taxiway centerline. The signal can be distorted or reflected by fences, structures, power lines or trees. The following clearances should be maintained:

Structures - No structures within 750 feet. Beyond that metal buildings should be cleared by a vertical angle of 1.2 degrees and other buildings by 2.5 degrees.

Fences - Metal fences should be at least 500 feet away.

Power and Telephone Lines - Overhead power and telephone lines should have a clearance of at least 1,200 feet.

Trees - Trees within 1,000 feet of the antenna should be removed. Beyond 1,000 feet, trees should be cleared by a vertical angle of 2 degrees.

The ground surface around a TVOR should be relatively flat and free from ravines, ditches, rocks or embankments. The ground may slope gently away from the TVOR but not toward it.

V - SITE SELECTION - SOCIOECONOMIC/ ENVIRONMENTAL FEASIBILITY

SITE SELECTION

INTRODUCTION

Background

In 1974, Clapsaddle-Garber Associates was retained by the City of Grinnell to identify an airport site which would serve the present and future needs of the community. The objective of this study is to "re-evaluate" the locations, considerations and recommendations presented in the 1974 Study.

The 1974 Study gave preliminary consideration to a number of sites. Four sites were ultimately selected which would meet the requirements of a general utility airport. It should be noted that a general utility classification of airport would also meet present day aviation activity as well. Section IV, Facility Requirements, identified present and future levels of facility development. The same "basic" facility needs that existed in 1974 have remained unchanged. Consequently, the four sites identified as suitable in 1974 may also satisfy 1984 to 2003 needs.

The 1974 Study was initiated due to the lack of development on the existing airport, Site D; and basic limitations inherent in the site of which topography was considered the most salient. There has been no development on Site D since the 1974 Study. Consequently, the basic reasons for identifying an alternative site in 1974 are also relevant in 1984.

1974 Study Requirements

The 1974 Study recommended Site A as being the most suitable. At the time the study was undertaken, Grinnell Mutual Reinsurance Company maintained a private aviation facility which presented a major obstacle to meeting airspace requirements of Site A.

Since the Grinnell Mutual Reinsurance Company site could not be closed, the site was eliminated from any further consideration. Site B was also eliminated for the same reason.

Sites C and D remained as candidate sites for future development. Site D was recommended for development provided that there were no airspace conflicts. Site C was considered the next best alternative.

Reference may be made to Figure 5-1.

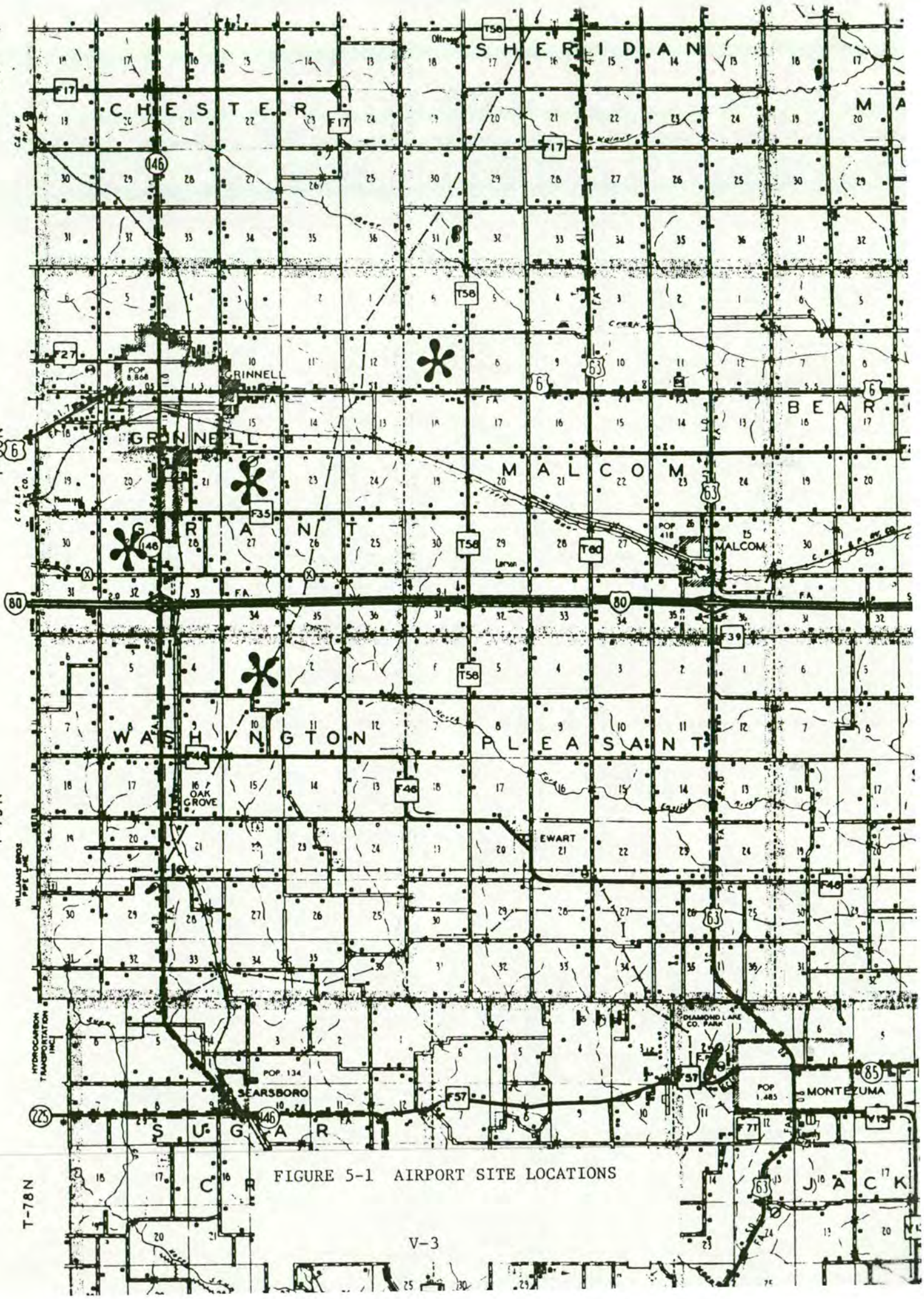


FIGURE 5-1 AIRPORT SITE LOCATIONS

EVALUATION CRITERIA

Eleven criteria were developed to evaluate each of the four candidate airport sites. Each site has certain attributes and limitations which influence the development of an airport facility. Where the concept of an air-industrial park has been advanced, the availability of municipal utilities and services become an important criteria for consideration. Other criteria, though not of lesser importance, are those having an impact upon adjacent land uses. Aircraft noise is often a concern expressed by the public and should be considered in the final selection of an airport site. The eleven evaluation criteria are noted as follows:

Accessibility:

An airport site, where possible, would be located adjacent to or within close proximity of an existing public owned highway or road. Ideally, the road should be hard surfaced.

Topography:

The airport site should be relatively level and able to accommodate two runway facilities with a minimum 60 degree separation between each runway. The terrain should be uniform for a minimum distance of 5000 feet along the proposed runway alignment.

Prime Farm Land:

The preservation of prime farm land is not only a local objective, but a national one as well. Ideally, an airport would be constructed on land having a lesser value for agricultural production. Where no alternative exists but the use of prime agricultural lands, every effort should be made to minimize the number of acres removed from production. Airports are compatible, for the most part, with agricultural land uses.

Urban Land Uses:

An airport proposed for construction near an urban area should consider the potential impact it will have upon residential neighborhoods and other places where a sensitivity to noise may become a concern. Generally, an airport is compatible with industrial and commercial type development.

Sensitive Ecological Areas:

Parcels of land located within areas supporting an unique habitat or endangered species of flora and fauna should be avoided. Where land has been used for agricultural (cropping) purposes, this concern is minimal. However, approach zones and traffic patterns located beyond the airport site may impact such areas should they exist.

Flood Plain:

Airport construction in the vicinity of existing obstructions should be avoided. While such concern generally relates to manmade structures, terrain and vegetation may also be an obstruction.

Airport Service Area:

The airport should be located as to be accessible to the greatest number of users.

Runway Alignment Alternatives:

As previously noted, the runways should be aligned as to provide a maximum level of wind coverage. However, runway alignment alternatives must be assessed not only in terms of wind coverage, but also in terms of the potential impact upon farm operations and ownership patterns. Consequently, a runway alignment alternative which may sacrifice an optimum level of wind coverage may be considered provided that the combined wind coverage is 95 percent or more at a 12 m.p.h. crosswind component value.

Soil Characteristics:

Within this scope of work, an assessment of soil characteristics shall be limited to data available from the Soil Conservation Service (SCS). The site having soils representing those with good construction characteristics should be considered over those with limitations.

Development Cost:

Airport development costs will vary with each site. Land acquisition and runway construction costs represent those components most influenced by site characteristics. The cost of other airport components (for example, beacon light, etc.) would not vary greatly.

Land acquisition costs are a negotiable item and could vary greatly from site to site. Runway, taxiway, and apron costs may vary subject to soil characteristics. Grading and drainage costs may also vary depending upon topography, soil conditions, and drainageways.

GENERALIZED SOILS

Characteristics

As review of soil characteristics on the four candidate sites revealed a great deal of similarity. Soils typically found are noted in Table 5-1. Reference may be made in Figures 5-2, 5-3, 5-4 and 5-5 concerning specific soil locations for each of the four sites.

TABLE 5-1: GENERALIZED SOILS

Symbol	Name	Slope (%)	Capability Classification	AASHTO Classificat
20C2	Killduff silty clay loam	5-9	IIIe	A-6,A-7
20D2	Killduff silty clay loam	9-14	IIIe	A-6,A-7
93D2	Shelby-Adair complex	9-14	IVe	A-6,A-7
118	Garwin silty clay loam	0-2	IIw	A-7
119	Muscatine silty clay loam	0-2	I	A-7
120	Tama silty clay loam	0-2	I	A-6,A-7
120C2	Tama silty clay loam	5-9	IIIe	A-6,A-7
120B	Tama silty clay loam	2-5	IIe	A-6,A-7
822D2	Lamoni silty clay loam	9-14	IVe	A-6,A-7
11B	Colo-Ely silty clay loams	2-5	IIw	A-7

Source: Soil Survey of Poweshiek County

Soils represented by symbols 93D2, 20D2, 82202, 11B, 2062 and 120C2 are generally found on side slopes of natural drainageways and stream channel. The runways would be constructed primarily upon Class I and II soils which are represented by symbols 118, 119, 120 and 120B.

Soil with a classification of I and II are considered prime farm land. These soils dominate the ridge land upon which the runways would be constructed. An effort would be made on the site selected to minimize the removal of Class I and II soils from agricultural production.

11B Colo-Ely Silty Clay Loams

This complex consists of black, poorly drained soils. Ely soils

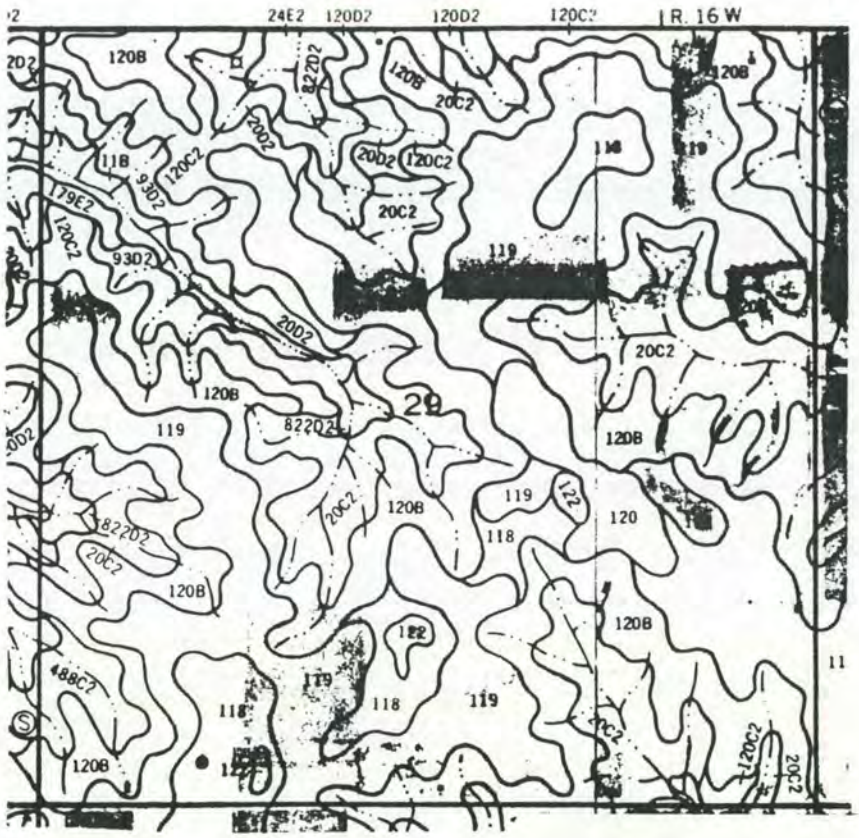


FIGURE 5-2 SITE A - SOILS

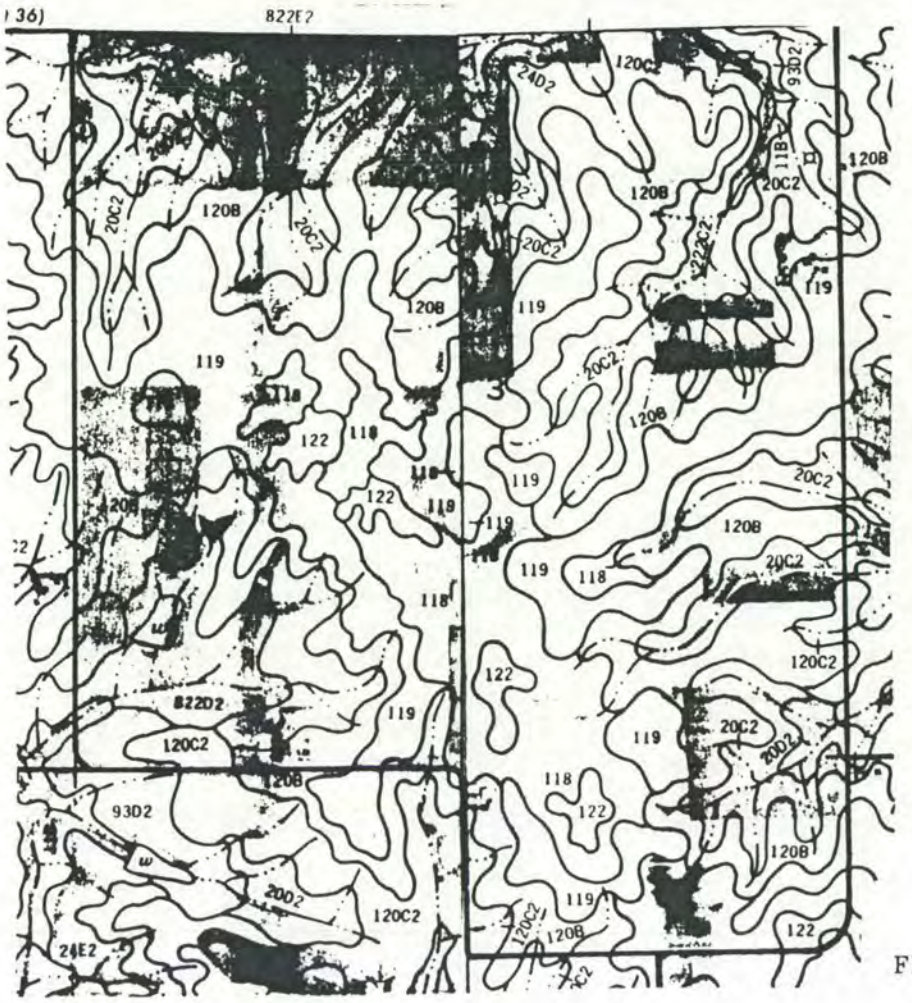


FIGURE 5-3 SITE B - SOIL

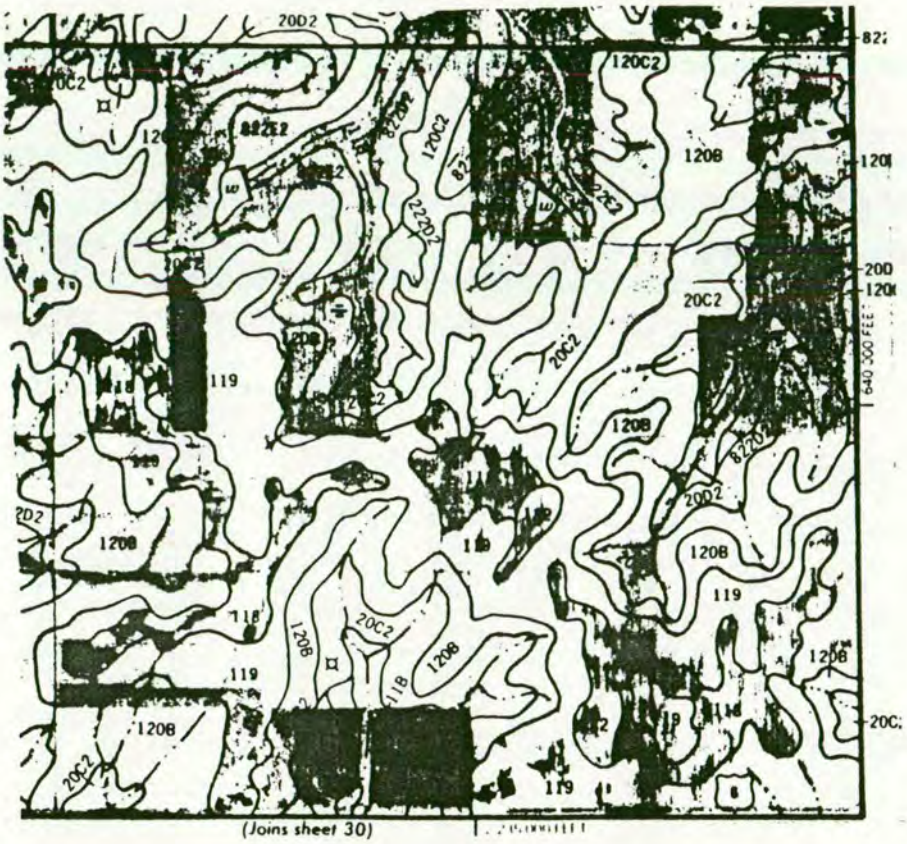


FIGURE 5-4 SITE C - SOILS

FIGURE 5-5 SITE D - SOILS

are found along the upper reaches of the tributaries. Colo silty clay loam is found on the low lying flood plain and is subject to flooding. These soils have a seasonal high water table and runoff is low or medium.

20C2 Killduff Silty Clay Loam, 5-9%; 2002, 9-14% slope

This moderately sloping, well-drained and moderately well-drained soil is found on convex side slopes and in upper coves of drainageways. Surface runoff is medium. The shrink-swell potential is moderate.

93D2 Shelby-Adair Complex, 9-14% slope

The Shelby-Adair complex is found on convex side slopes and is well-drained to somewhat poorly drained. The soil follows the contour of the side slope in a ribbon pattern. Permeability is moderately slow in the Shelby soil and slow in the Adair soil. Surface runoff is medium.

118 Garwin Silty Clay Loam, 0-2% slope

This nearly level, poorly drained soil is found in the heads of drainageways and on broad divides. Permeability is moderate. Surface runoff is slow and the shrink-swell potential is high.

119 Muscatine Silty Clay Loam, 0-2% slope

The Muscatine soil is described as nearly level, somewhat poorly drained soil on moderately wide divides. Permeability is moderate. Surface runoff is slow. The soil has a seasonal high water table and the shrink-swell is moderate.

120 Tama Silty Clay Loam, 0-2% slope

This soil is described as well drained. It is found in upland areas. Permeability and the shrink-swell potential is moderate.

120B Tama Silty Clay Loam, 2-5% slope

This gently sloping, well drained soil is on moderately broad, convex ridgetops and side slopes. The shrink-swell potential is moderate.

120C2 Tama Silty Clay Loams, 5-9%

This soil is moderately eroded, sloping, well drained soil found on narrow, convex ridges and side slopes. The shrink-swell potential and permeability is described as moderate.

822D2 Lamoni Silty Clay Loam, 9-14%

This soil is moderately eroded and somewhat poorly drained. It is found in the coves of the upper reaches of drainageways. Permeability is slow. The shrink-swell potential is high.

Pavement Design (Preliminary):

Based upon generalized soils data, a pavement thickness of 11 inches would be required to support aircraft with a gross weight of 12,500 pounds. Soil boring will be required prior to final pavement design.

AIRPORT DEVELOPMENT UNIT COSTS

PAVING:

8000 Lb. Flexible:		
2" Surface (.110 Tons/S.Y. @ $42/Ton)	$ 4.62	
2" Base (.1066 Tons/S.Y. @ $38/Ton)	4.05	
6" Subbase (.315 Tons/S.Y. @ $10/Ton)	3.15	
	$11.82	/S.Y.
12500 Lb. Flexible:		
2" Surface (.110 Tons/S.Y. @ $42/Ton)	$ 4.62	
3" Base (.1333 Tons/S.Y. @ $32/Ton)	5.07	
6" Subbase (.315 Tons/S.Y. @ $10/Ton)	3.15	
	$12.84	/S.Y.
A.C. Overlay - 2" minimum Thickness		
2" Overlay (.110 Tons/S.Y. @ $42/Ton)	$ 4.62	/S.Y.
5" Rigid Pavement (12500 + lbs.)		
5" P.C.C. Pavement	$12.00	
4" Subbase (.2132 Tons/S.Y. @ $10/Ton)	2.13	
	$14.23	/S.Y.

SITE PREPARATION:

Excavation & Grading (Average)		
5.5 C.Y./L.F. @ $1.5/C.Y.	$ 8.25	/L.F.
or on a square yard basis	$ 1.00	/S.Y.
Subgrade Preparation	$ .50	/S.Y.
24" R.C.P. Culvert	$25.00	/L.F.
Fencing	$ 2.00	/L.F.

LIGHTING AND MARKING:

M.I.R.L. System	$10.00	/L.F.
Taxiway Edge Lights	$10.00	/L.F.
Radio Control	$1500.00	
V.A.S.I.	$8000.00	/Set
R.E.I.L.'s	$2000.00	/Set
Marking		
Basic	$1000.00 + $0.20	/Ft.
N.P.I.R.	$4200.00 + $0.30	/Ft.

NAVAIDS:

N.D.B.	$6000.00	/Each
Rotating Beacon	$5000.00	/Each
Lighted Wind Cone	$3000.00	/Each

Summary:

Little or no variation in cost is expected between the four sites for paving, lighting and marking, navigational aids, terminal area development, fencing and subgrade preparation. Site development costs will vary by site for two development components:

1. Excavation, Grading and Drainage Costs
2. Land Acquisition Costs (Fee title and avigation easements)

Since the development concepts prepared for each of the four candidate sites assume the runways will be constructed on ridge lines, excavation, grading and drainage costs are considered comparable.

Land acquisition costs may vary from 2500 dollars per acre on Sites B, C and D to 4000 dollars per acre on portions of Site A. It is generally assumed that the total development cost of Site A would be greater than at the other sites due to the development potential inherent in those parcels of property located along Highway 146.

SITE A

Background

As previously noted, the 1974 Study concluded that Site A was the "best site for the new Grinnell Airport " (1974 Study Page 29). Site A was eliminated from consideration due to an airspace conflict with a private strip located at Grinnell Reinsurance Company. Supplemental findings added in 1974 to the original study also concluded that it was not feasible to construct a 5000 foot runway at Site A. Reference may be made to Figure 5-6 concerning the development concept proposed in the 1974 Study.

Evaluation

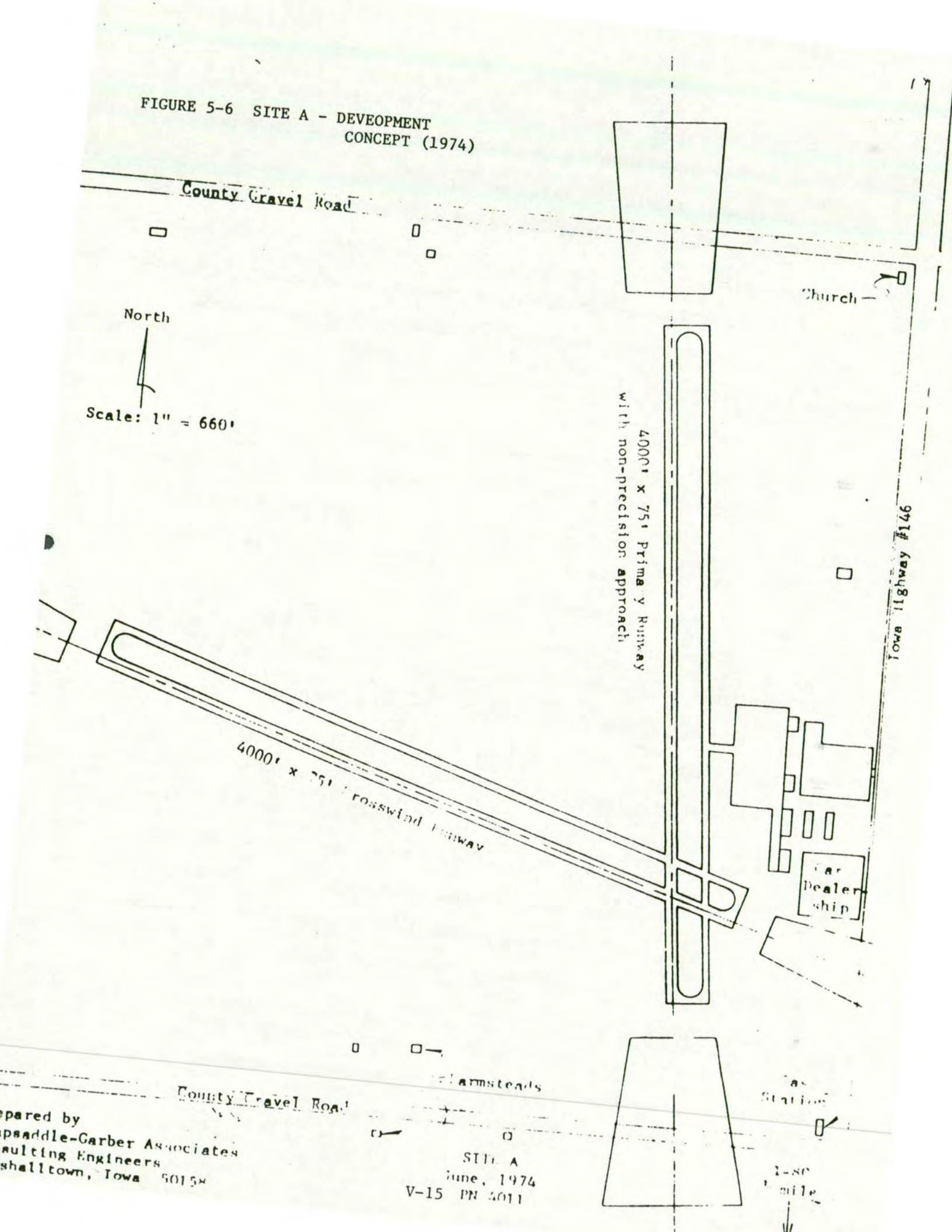
Site A is located in Grant Township, Section 29 approximately two miles south of the City of Grinnell. The site is accessible via State Highway 146 and Interstate Highway 80.

Natural drainage patterns begin at the interior of the site and extend to the east, northwest, southeast and west. A ridge extends across the site in a northwest to southeast direction. A relatively level area also extends across the site in a north-south direction.

Land uses in the immediate vicinity of the site consist of commercial/ industrial development along Highway 146. The balance of the site is under cultivation. Three farmsteads are located within Section 29 along with two residential units, the First Friends Church of Grinnell and the Grinnell Christian Childrens Home. There are 13 property owners within Section 29.

Potential conflicts may exist along a northwest-southeast runway alignment in the northwest quarter of the northwest quarter of Section 29 where two dwelling units have been constructed. It does appear that a runway orientation could be selected which would mitigate potential

FIGURE 5-6 SITE A - DEVEOPMENT CONCEPT (1974)



epared by
psaddle-Garber Associates
sulting Engineers
shalltown, Iowa 50158

SITE A
June, 1974
V-15 PN 4011

conflicts. A similar potential for conflict may exist along a north-south alignment. As with the northwesterly alignment, a slight change in alignment may mitigate potential conflict.

Proposed construction of two towers south of the site may compromise airport airspace and constitute an obstruction as defined by FAR Part 77.

The City's sewage treatment plant would be located under the approach to the northwest runway end. The City owns 142 acres in the southeast quarter of Section 19. A portion of the clear zone would fall over land currently owned by the City.

The approach to the crosswind runway along a north-south alignment would encompass a small area of Abor Lake County Park. The south most boundary of the park would be located approximately 4700 feet from the threshold. No negative impact would be expected due to the distance of the park from the proposed airport.

Residential development is concentrated well beyond the site with no significant residential development within 6500 feet of the site. Land use activities between the higher density urban development to the north and the site consists of open space, agriculture and highway oriented commercial/industrial land uses. The airport development proposed on Site A is compatible with the future land use plan depicted in Figure 5-7.

Soils on Site A are representative of those found in the four candidate sites. There are no known archaelogical sites. Since the site is under cultivation, the occurrence of endangered species of flora and fauna would appear remote. Beyond the site, there are no known habitats that would be impacted in a detrimental manner.

The most significant constraint to the development of Site A is the proposed tower construction in Sections 32 and 4. Should the airspace be compromised to the point where the site is found unacceptable by the FAA,

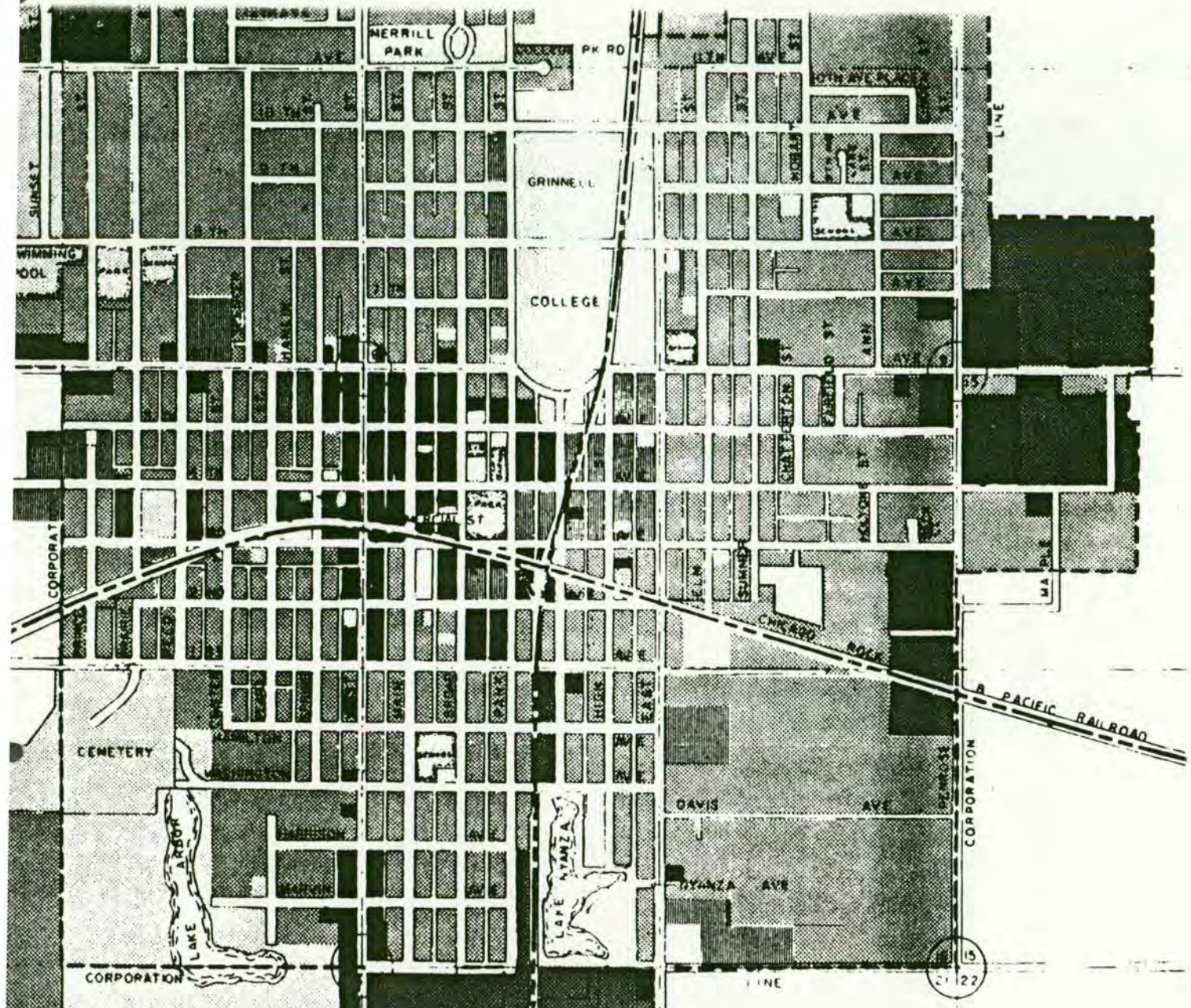


FIGURE 5-7 FUTURE LAND USE - GRINNELL

Site A will have to be eliminated from further development consideration.

SITE A - ASSESSMENT OF ALTERNATIVES

As previously noted in Figure 5-6, the proposed alignment of the primary runway was N71°W. The crosswind runway had an orientation of N 4°W. Figure 5-8 proposed a development concept which would follow a northwest-southeast ridge. The crosswind runway has a north-south orientation with a 48 degree separation between runway facilities. The IDOT standard requires a 60 degree separation between facilities so as to minimize the duplication of wind coverage.

The primary runway depicts an ultimate length of 5000 feet with a non-precision instrument approach. The primary runway orientation is N48°W. The terrain has a 10 foot ± increase in elevation off the northwest threshold and is relatively level 1800 feet beyond the southeast threshold. A potential problem exists off the northwest threshold where the vertical distance between the gravel road and approach slope does not meet the minimum criteria of 15 feet. Since the terrain decrease rapidly beyond the road, it may be possible to lower the road elevation to meet minimum criteria. Also, the proposed layout may require the removal of an existing set of structures. The clear zone to the southeast would extend across Highway 146 and include a farmstead and commercial structures along Highway 146. It should be noted that the clear zones assume a non-precision approach with visibility minimum greater than 3/4 mile for a runway classification greater than utility. Construction of a 5000 foot runway is possible based upon terrain consideration. However, the acquisition of clear zone easements off each runway end may require the removal and displacement of a residential structure to the northwest. Provided that the existing structures did not penetrate the approach slope, relocation may not be necessary. The exact extent of the limitations noted and alternatives to mitigate such will be more evident upon site topographic mapping.

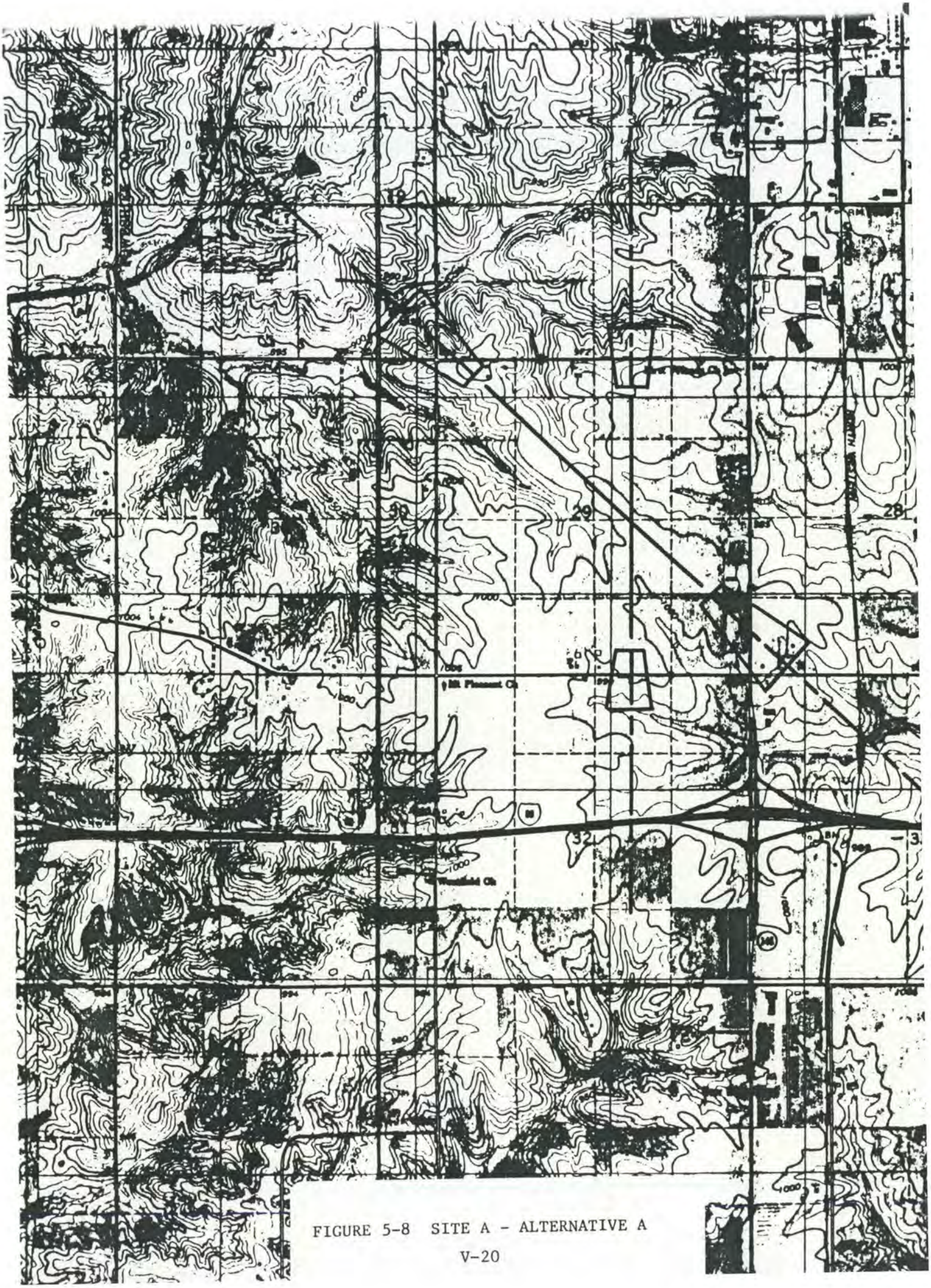


FIGURE 5-8 SITE A - ALTERNATIVE A

The 4000 foot crosswind runway has an orientation of N0°, This alignment should be N12°E so as to meet IDOT minimum criteria. A non-precision instrument approach is proposed. Clear zones beyond the runway (500' x1000' x 800') would extend across existing gravel roads. The vertical separation can be obtained. Power lines existing in the immediate vicinity of the clear zones should be placed underground or relocated. Should the crosswind orientation be changed to N12°E, the required clear zones would fall close to an existing farmstead and church.

In summary, it would appear that Site "A" could accommodate an extension beyond 4000 feet or the primary runway. However, a number of problem areas regarding clear zone protection and associated obstruction(s) will require more in depth study with the completion of topographic mapping.

4000 Foot Runway Scenario

Where the above assessment was undertaken to examine the possibility of extending the primary runway to 5000 foot, it should be noted that the Facility Requirements Section of this study recommends construction of a 4000 foot primary and crosswind runway facility. This recommendation is also supported by the Forecast of Aviation Activity Section.

Should a 4000 foot facility be proposed, many of the potential conflicts noted in the 5000 foot scenario would be eliminated. Reference may be made to Figure 5-9 which depicts a more modest development scenario for the Grinnell Airport Service Area and one which is supported by recommendations set forth within previous elements of this study.

The clear zone requirements for a non-precision instrument runway (14.922 acres) are considerably less than the 48.978 acres required off each primary runway end in the 5000 foot scenario. In addition, a visual approach would most likely be established on the crosswind runway.

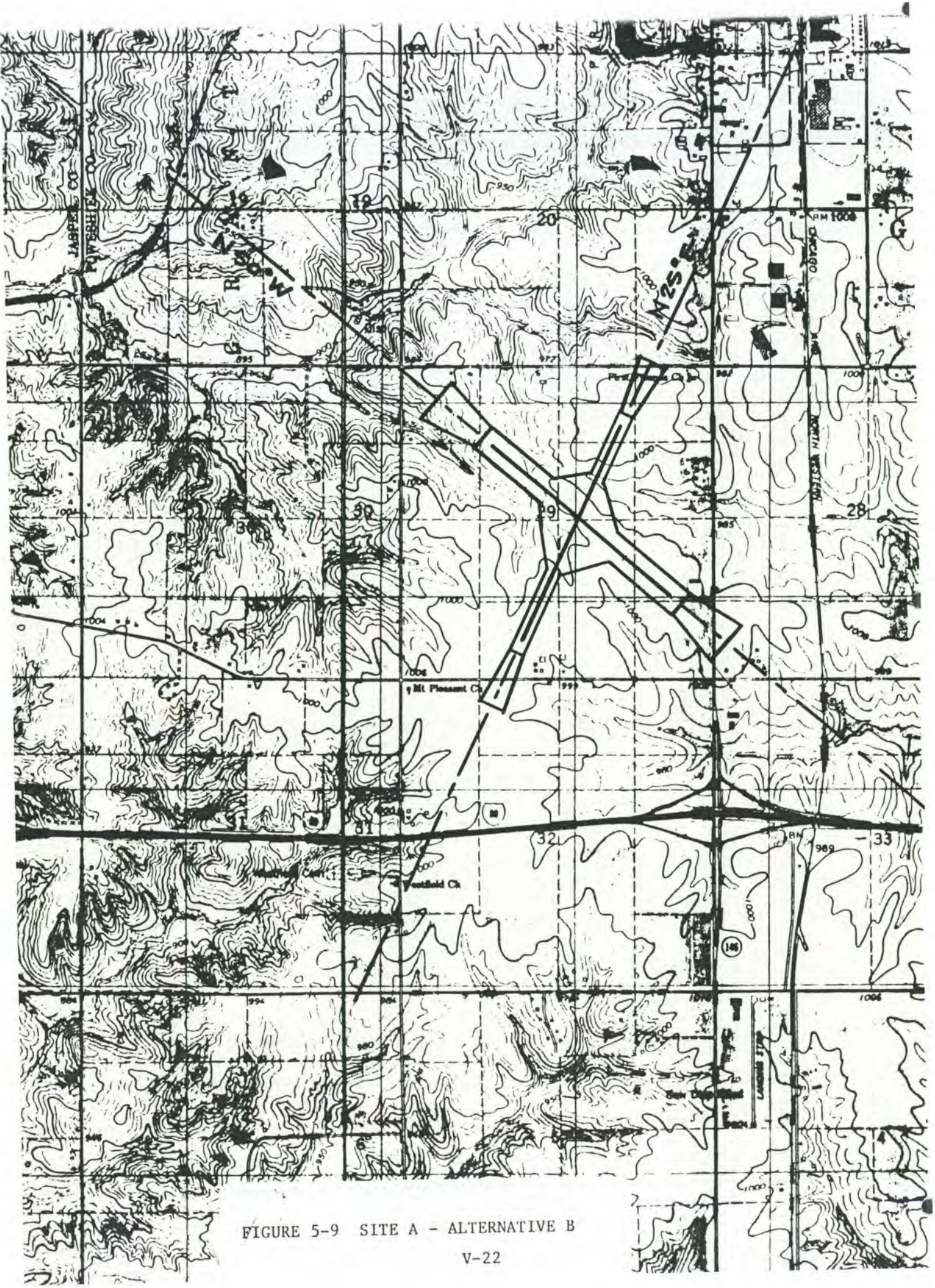


FIGURE 5-9 SITE A - ALTERNATIVE B

Consequently, the clear zone need on the crosswind runway would find 8.035 acres of land required at minimum.

The gravel road off the northwest threshold would present a similar constraint as found under the 5000 foot scenario. Development contraints associated with the clear zone off the northwest runway end would exist as in the 5000 foot scenario. Alternatives to mitigate the constraint may be more attainable since the land area and approach slope requirements would be less. One alternative may be to move the centerline (runway) to the southwest and thus changing the alignment slightly to provide more distance between the dwelling unit and runway.

For purposes of the study, requirements for a 5000 foot primary runway will be examined. The need for such a facility is considered beyond the 20 year planning period upon which this study is based. However, now is the time to consider such needs should they be found to exist beyond the year 2000.

Terminal area development needs were discussed within Section IV. The most appropriate terminal area location would be near the intersection of the two runways with an airport access road constructed from Highway 146.

The balance of the site not used for airport needs could be developed as an air industrial park. The land area west of the crosswind runway should remain under cultivation. Commercial/industrial and agricultural land uses are generally compatible with airport development.

Airport Airspace

Both scenarios discussed above must satisfy the requirements of FAR Part 77. Constraints associated with clear zone protection were noted. There are two towers proposed for construction and are noted as follows:

Tower One (Proposed) (Approved)

Height - 265 feet
Location - 600 feet west of Highway 146, Section 32

Tower Two (Proposed) (Approved)

Height - 180 feet
Location - Grinnell Reinsurance, Section 4

Tower Three (Approved)

Height - 490 feet; above MSL 1500 feet
Location - Latitude, 43°45'53"; Longitude 92°44'05"

It would appear that Towers One and Two would compromise airport airspace at Site A. The extent to which such would impact airport airspace is unknown. The FAA has been requested to conduct an airspace evaluation of Site A. The evaluation is scheduled for completion on November 1, 1984.

SITE B

Background

The 1974 Study rated Site B as favorable because of the lack of obstructions and potential for expansion. Site B was however eliminated from consideration for the same reason as was Site A. Reference may be made to Figure 5-10.

Evaluation

Site B is located four miles south of Grinnell and three miles east of Highway 146. The site is located in Section 3, Township 79 North, Range 16 West. The site is accessible from the airport service area via Highway 146 and Interstate Highway 80. Accessibility to the proposed terminal area is provided by a gravel road (two and three quarter miles east of Highway 146).

The land area is described as flat sloping gradually in a southeasterly direction. Beyond the relatively large flat area, the site slopes to a drainageway on the northeast and southwest. The site could accommodate two runways of 4000 feet. The primary runway could be extended beyond 4000 feet if necessary at some future point.

The land area is currently under cultivation. Twelve farmsteads are located in the immediate vicinity of the site. Seven parcels of property are located within Section 3. A pipeline is located in the Southeast Quarter Section of Section 3. (Source: County Highway Map) County plat books also reveal a 50-foot railroad right-of-way within Section 3 although the right-of-way has apparently been abandoned.

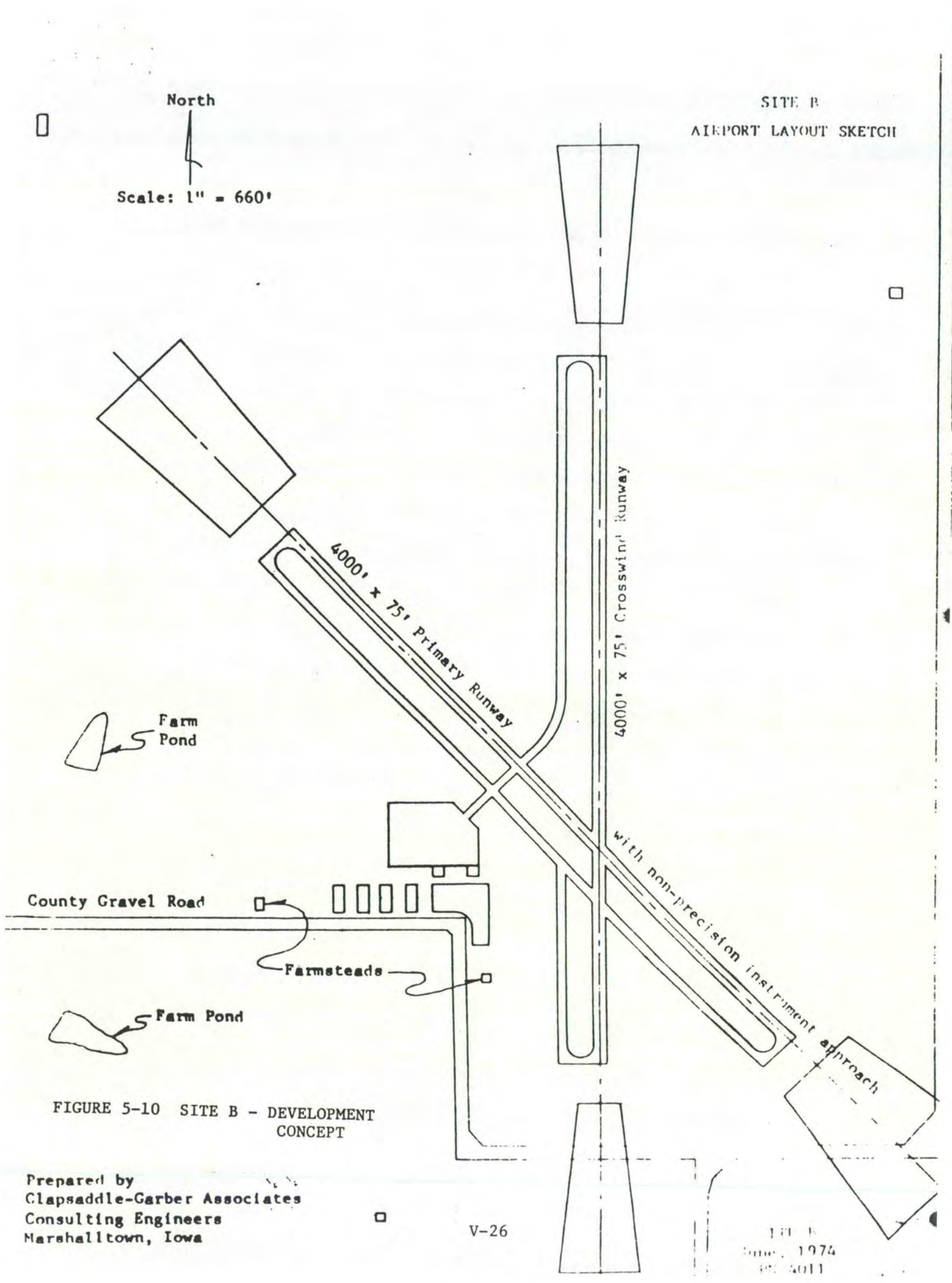


FIGURE 5-10 SITE B - DEVELOPMENT CONCEPT

Prepared by
Clapsaddle-Garber Associates
Consulting Engineers
Marshalltown, Iowa

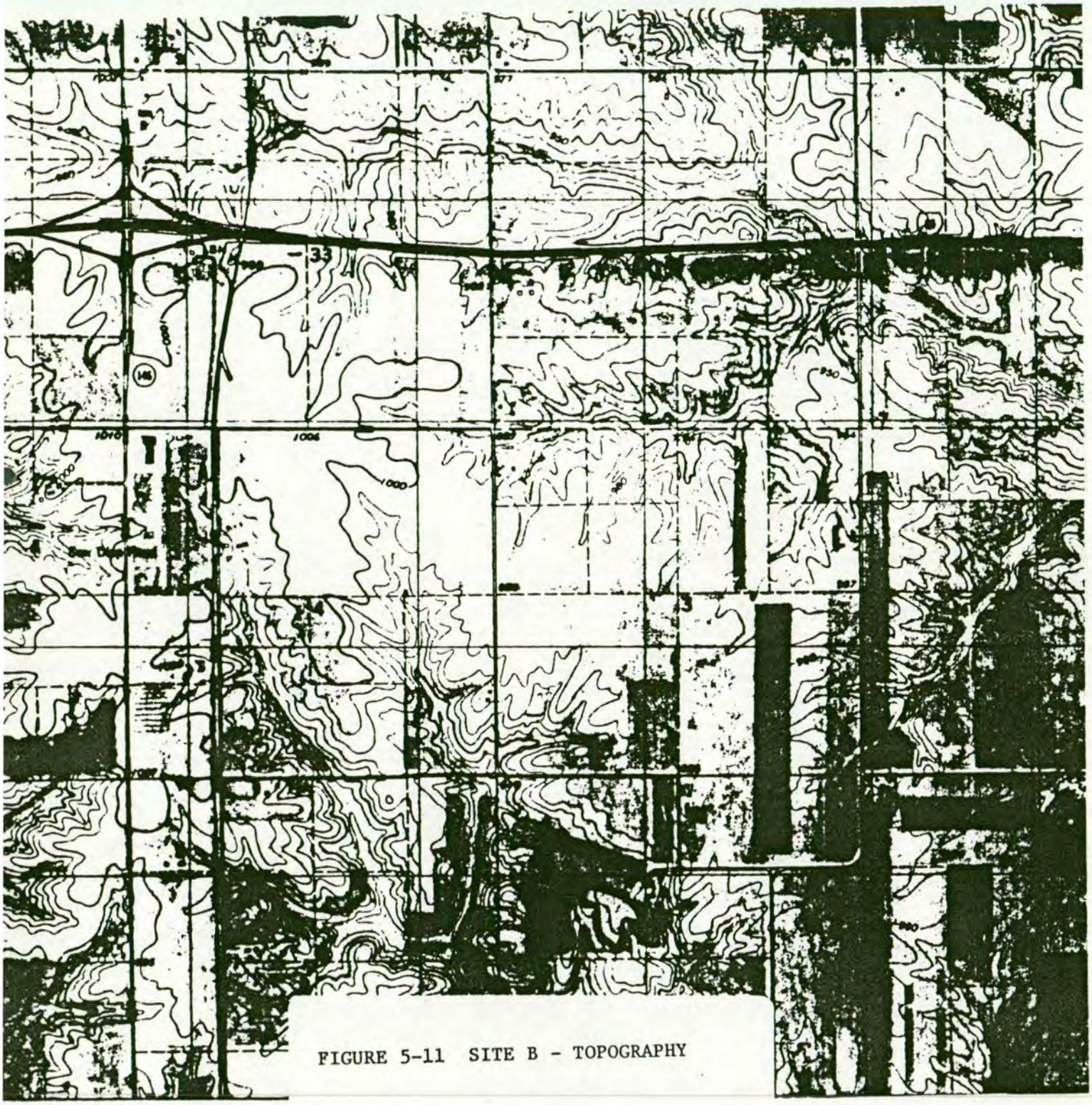


FIGURE 5-11 SITE B - TOPOGRAPHY

There are no known on site obstructions. The proposed towers to be constructed in Sections 4 and 32 may present a hazard to air navigation, however, the impact of these towers would appear considerably less than expected at Site A. An airspace analysis by FAA should be conducted prior to final site selection.

Site accessibility is less desirable than that of Site A anc C. There are no urban land uses located near the site. Agricultural land uses are generally compatible with airport development. The site does support soils classified as prime farmland. The proposed layout does cut across land lines and consequently may impact present cropping patterns.

There are no knownhistorical or archaelogical sites located in Section 3. There are no known species of flora and fauna that may be impacted as a result of proposed construction.

Site B attributes are summarized as follows:

1. Runway construction beyond 4000 feet
2. Relatively level terrain
3. Minimal grading
4. Land use compatibility

Site B limitations are noted as follows:

1. Accessibility via gravel road
2. Airspace compromise from proposed tower construction

SITE C

Background

Site C was considered for development only if airspace conflicts found on Sites A, B and D could not be resolved. Site C was considered a second choice to Site D in a supplement to the original study. The 1974 Study also reported that Site C was the former site of the Grinnell airport prior to relocation in Section 22 (Site D).

Evaluation

Site C is located in Section 7, Range 15-W, Township T-80N. The terrain was described in the 1974 Study as relatively flat with a number of ravines existing around the perimeter of the site. "Two-4000' runways are possible but a significant but not excessive, amount of earthwork may be required in their construction." (p. 20 1974 Study)

On site land uses have changed little since 1974. Agricultural land uses predominate. Fifteen farmsteads are located within one-half mile of the site. A seed corn plan is located adjacent to U.S. Highway 6 south and east of the proposed runway facilities depicted in Figure 5-12.

Accessibility to the site is considered good via U.S. Highway 6 from Grinnell and Brooklyn. Accessibility from Montezuma is also considered good via U.S. Highway 63.

Montezuma - 15 miles

Grinnell - 4 miles

Brooklyn - 12 miles

Malcom - 7 miles

There are no known historical or archaelogical sites. There are no known endangered species of flora and fauna. As with Sites A and B, a certain amount of prime farmland would be removed from production.

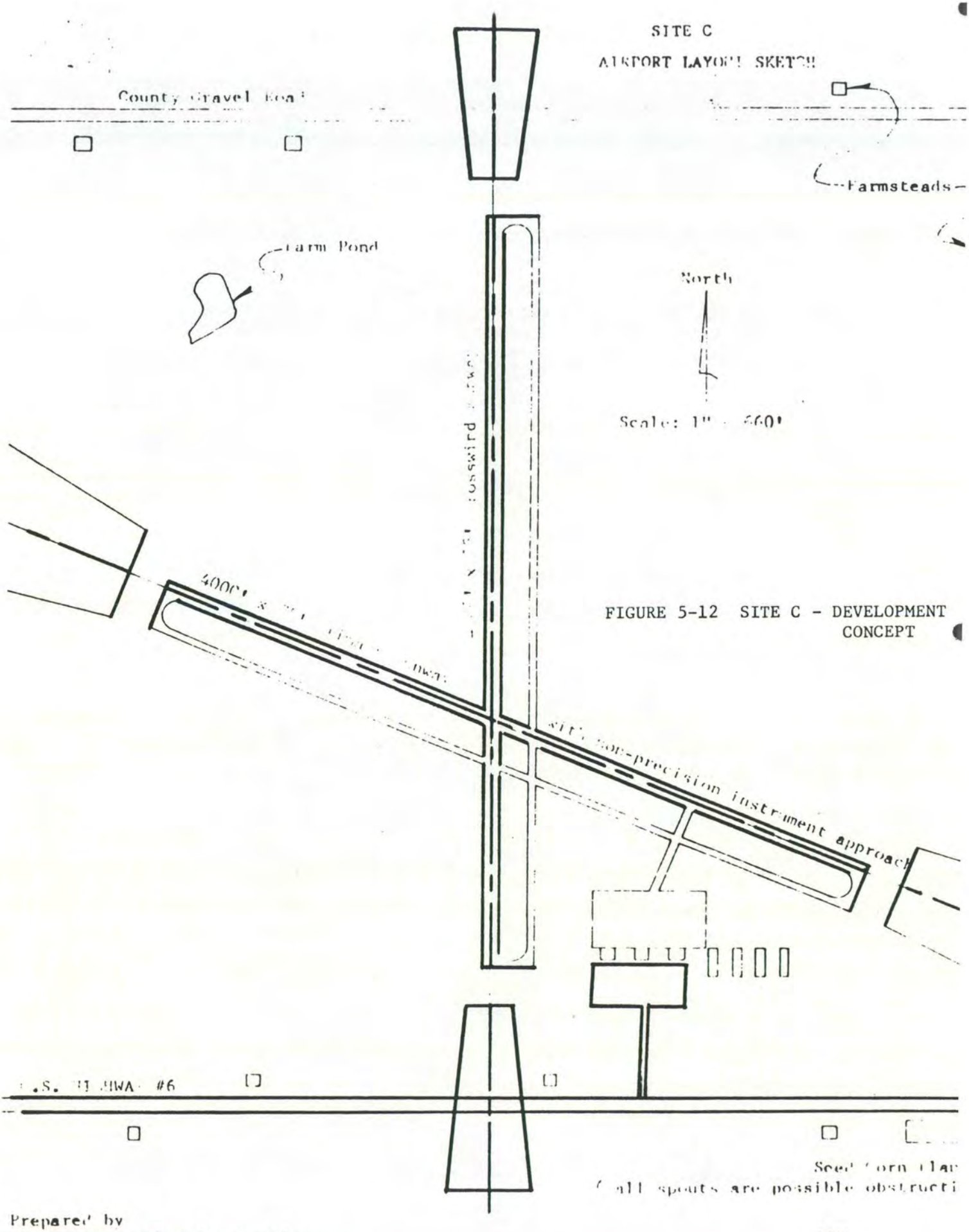


FIGURE 5-12 SITE C - DEVELOPMENT CONCEPT

Prepared by
Clapsaddle-Garber Associates
Consulting Engineers
Marshalltown, Iowa 50158

SITE
June, 1974
PN 4011

There are no known obstructions with the possible exception of the seed corn plant (Cargill, Inc.) located in the northeast corner of Section 18. A slight change in the primary runway alignment may mitigate any potential conflicts should they exist.

The proposed terminal area location adjacent to U.S. Highway 6 is more accessible than that of Site B. The primary runway could also be extended beyond 4000 feet.

SITE D

Background

Site D is the present airport site consisting of a turf runway facility 2650 feet in length and 195 feet in width. Two development alternatives were advanced for Site D in the 1974 Study with Alternative A ultimately recommended for development. Reference may be made to Figures 5-13 and 5-14.

Evaluation

Site D lies in Section 22, Range 16-W, Township T-80N at an elevation of 1003 feet above sea level. The site slopes from north to south. Construction of a 4000 north-south runway would require extensive grading. Approximately 30 feet of fill would be required if the runway were extended to the south.

Site drainage is from north to south and in a southeasterly direction via a natural drainageway to the North English Creek.

Agricultural land uses surround the existing site. Twelve farmsteads are located within one-half mile of the airport site. There are no urban land uses in close proximity of the site with urban development found to the northwest and west. (Approximately three-quarter mile)

Accessibility to Site D from Grinnell is provided by a hard surfaced county road extending from the corporate boundary east to the terminal area. Accessibility from Montezuma would not be as favorable as the other sites under consideration based upon the assumption that travel would be by hard surfaced roads. The site lies one mile south of U.S. Highway 6 via a gravel road.

There are no known historic archaelogical sites within Section 22. There are no wetland areas nor unique forms of vegetation known. There

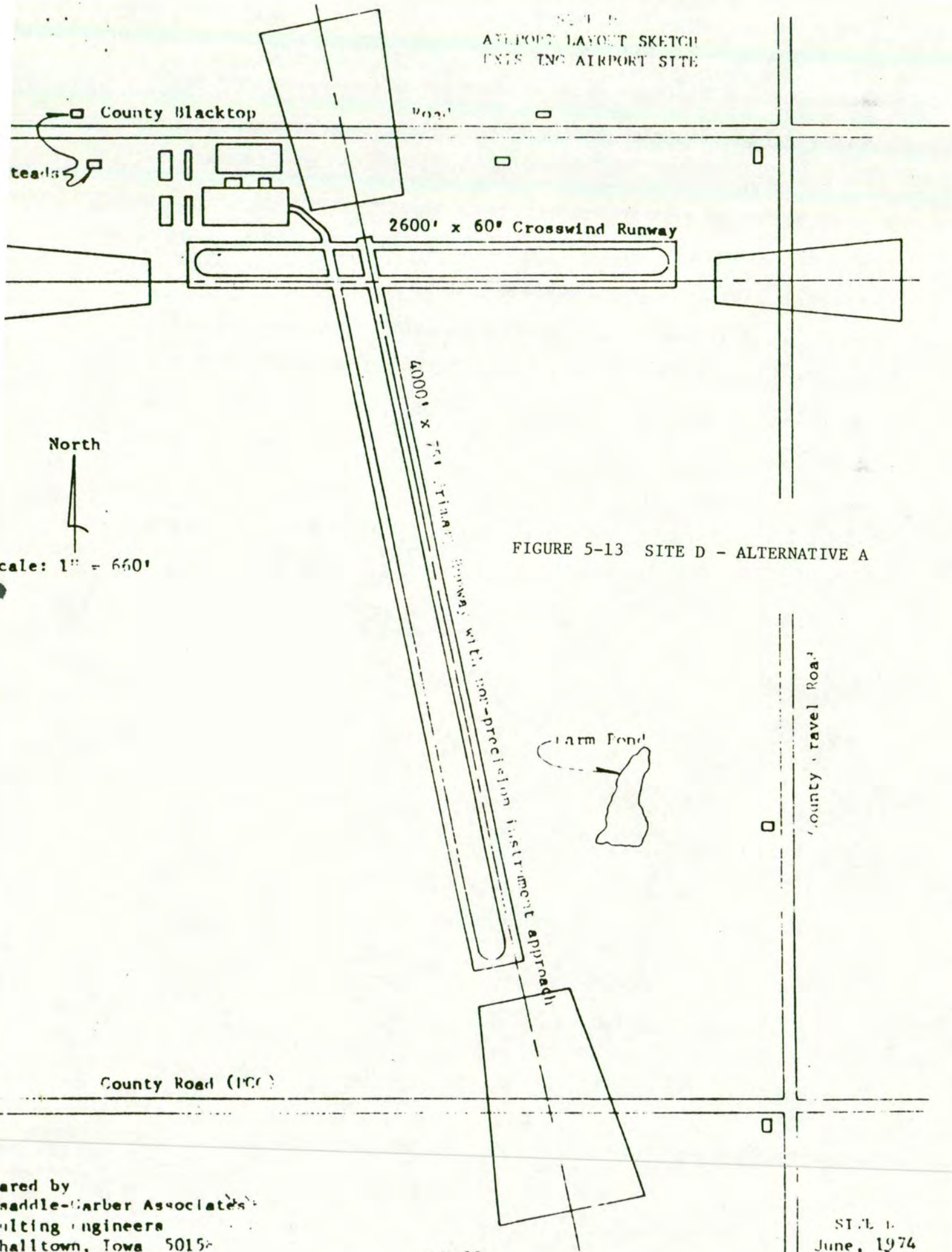


FIGURE 5-13 SITE D - ALTERNATIVE A

Prepared by
Sapsaddle-Garber Associates
Consulting Engineers
Marshalltown, Iowa 50158

June, 1974
PN 4011

are no known endangered species of flora and fauna. A farm pond is located in the southeast quarter of Section 22.

As with Sites A, B and C, a certain amount of prime farmland would be removed from production.

The development concept presented in Figure 5-14 presents an ultimate level of development at the existing airport site. The primary runway alignment would extend along the same alignment as the existing turf strip. The terminal area was proposed for relocation to a site east of the primary runway. A 4000 foot crosswind runway was proposed in an east-west direction. It was noted that the extension beyond 4000 foot could be accommodated on the crosswind runway. Extension of the north-south runway beyond 4000 foot would not appear to be a realistic alternative.

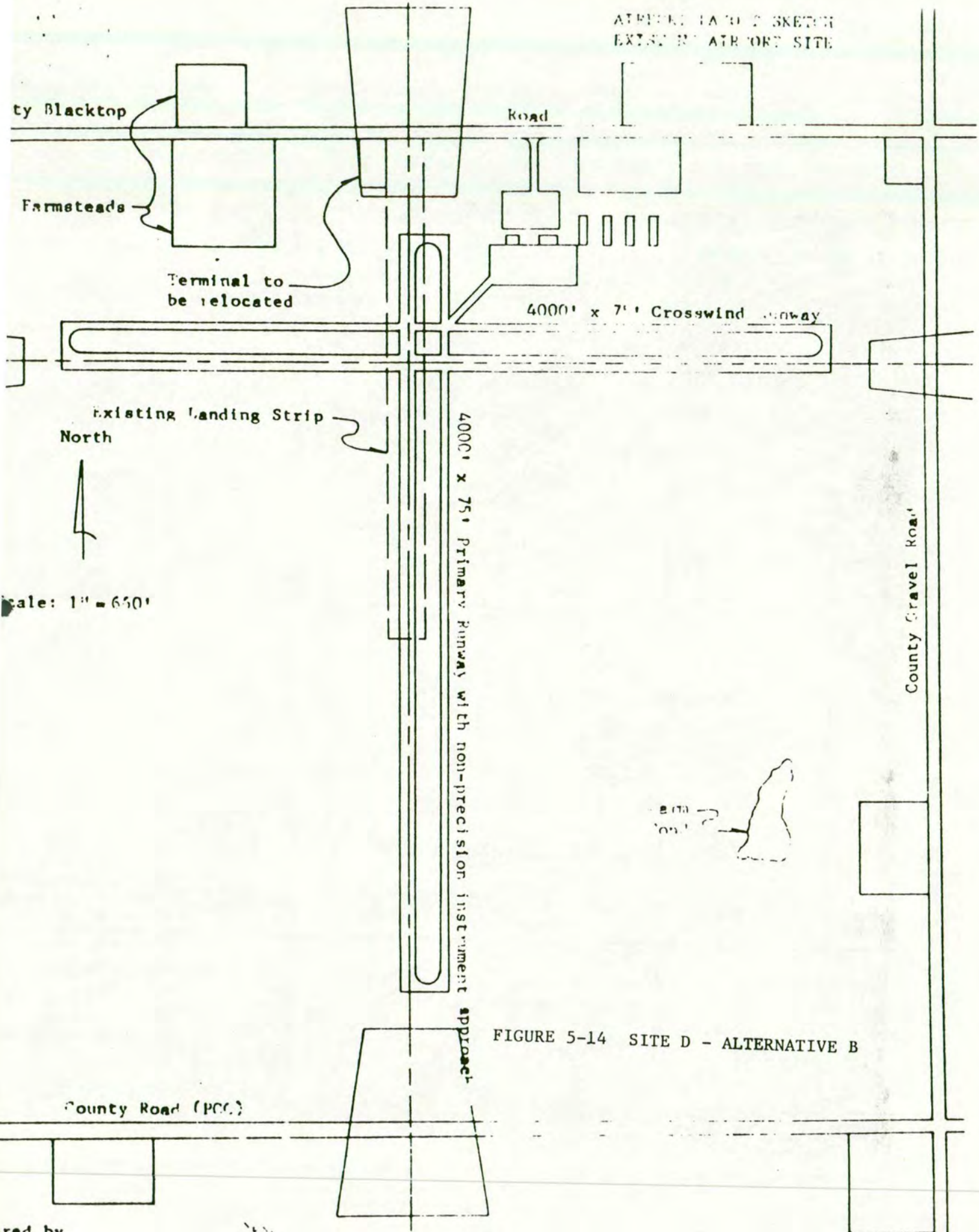


FIGURE 5-14 SITE D - ALTERNATIVE B

ared by
addle-Garber Associates
ulting Engineers
halltown, Iowa 50158

FIGURE 5-15 SITE D - TOPOGRAPHY

RECOMMENDATION

SUMMARY:

Each of the four candidate airport sites have certain limitations and attributes. In consideration of all factors, Site A offers a distinct opportunity to provide an impetus for aviation and non-aviation development on and in the vicinity of the airport. The most significant development may be the creation of an air industrial park.

Municipal services could be extended to the site. The site would interface with Interstate Highway 80 and is adjacent to the existing industrial park area. The site is also accessible via Interstate 80 to users located in the communities of Malcom, Montezuma and Brooklyn. With the exception of Site C, it is the most accessible via existing hard surfaced roads.

The single most significant attribute of the Site A is the opportunity for development of an air-industrial park. Visibility from Interstate Highway 80 and State Highway 146 together with the ability to extend community services makes the Highway 146 corridor area an ideal location for business and industry. The airport is expected to provide an impetus for development. Consequently, the airport will not only satisfy projected aviation demand; it will also contribute to the economic development of the community.

The recommendation herein is the selection of Site A for further assessment. Should Site "A" be found unacceptable, Site "D" is recommended for consideration along with Site "C". The potential airspace conflicts from the tower locations proposed in Sections 4 and 32 would probably eliminate Site B from consideration as well.

DECISION POINT:

The Airport Committee is requested to select one of the following alternatives:

1. No project alternative - Terminate Study
2. Site A pending FAA airspace review
3. Site B pending FAA airspace review
4. Site C
5. Site D

Upon selection of a site, the site will be mapped. The greater mapping detail will provide an opportunity to examine site development constraints in greater depth. Alternatives to mitigate site constraints will be offered and may include a slight change in runway alignment.

ENVIRONMENTAL OVERVIEW

Background

A cursory overview of the four candidate sites is summarized in terms of known environmental consequences. Each of the environmental concerns noted below are to be examined in greater detail within the environmental assessment phase.

Overview

Noise: FAA Order 1050.16 Appendix 6, Chapter 5, Paragraph 47, Page 26 states: "No noise analysis is needed for proposals involving utility or basic transport type airports whose forecast of operations do not exceed 90,000 annual adjusted propeller operations or 700 annual adjusted jet operations."

Compatible Land Use: In general, industrial, agricultural, and open space land uses are compatible with the operation of the airport. The proposed actions are consistent with such community planning as has been carried out.

Social Impacts: The proposed actions are not expected to cause the displacement of any existing residence or place of business. The proposed actions will require the removal of crop land from production at all four sites. Specific impacts have not been fully investigated.

Induced Socioeconomic Impacts: The proposed actions will have a positive impact upon industrial development in the community.

Air Quality: The proposed actions are not expected to have any negative impact upon the Clean Air Act Amendments of 1977.

Water Quality: Provided mitigating measures to control erosion during construction are followed, the proposed actions will have no significant detrimental impact upon water quality.

DOT, Section 4(F): There are no Section 4(F) lands proposed for acquisition.

Historical, Architectural, Archaelogical, and Cultural Resources: There are no known historical or cultural resources which would be affected by the proposed actions.

Biotic Communities: The proposed actions will have no significant impact upon biotic communities.

Endangered and Threatened Species of Flora and Fauna: There are no known endangered or threatened species in the vicinity of the four airport sites.

Wetlands: There are no major wetland areas on the four sites. Exception to the above are farm ponds on Site B and D.

Flood Plain: None of the sites under consideration lie within a designated flood plain area.

Prime and Unique Farmland: The proposed actions will remove certain amounts of farmland from production.

Energy Supply and Natural Resources: The proposed actions are expected to have no significant impact upon energy supplies and other natural resources.

Light Emissions: No detrimental impacts are expected.

Solid Waste: No detrimental impacts are expected.

Construction Impacts: Such impacts resulting from construction are of a short term nature and should have no detrimental impact provided mitigating measures are employed.

The above outlines subject matter typically contained within an Environmental Assessment. As previously noted, the Iowa DOT does not require a full-blown Environmental Assessment. As such, no indepth

analysis was accomplished for items above. Should any of the above have an impact or be impacted by the proposed actions, detailed evaluation of the impact should be accomplished prior to proceeding with implementation.

VI - AIRPORT LAYOUT PLAN

AIRPORT LAYOUT PLAN

The Airport Layout Plan (ALP) is a graphic presentation to scale of the proposed facility and existing features. It provides pertinent information on dimensional requirements, clearances and facility locations in order to comply with applicable standards.

The ALP is presented on 22" x 36" drawings. Because of the size the drawings are bound separately from this report. The drawings include:

	SHEET
Cover Sheet	1
Airport Layout Plan	2
Airport Imaginary Surfaces	3
Plan & Profiles	4-5

VII - FINANCIAL PLAN

PROPOSED IMPROVEMENTS

The improvements which will bring the airport to its ultimate development in the next 20 years are divided into three stages, for short, intermediate and long range periods. The stages can then be accomplished through phases, each designated as a project and usually lasting one construction season.

Stage One (1 to 5 Years): Stage One involves development of initial facilities to establish a serviceable airport. The first phase of this development is acquisition of all the necessary land in fee and easement for the primary runway and terminal facilities.

The second phase involves grading of the initial development items. This includes the primary runway safety area (4600' x 150'), apron area, connecting taxiway entrance road and parking lot.

Third phase development provides the paving and lighting of the runway, connecting taxiway and a portion of the apron area. Navigational aids to be installed with the lighting includes a rotating beacon, lighted wind cone and non-directional radio beacon.

Support facilities included in Stage One development includes a buried fuel tank and 10 stall T-hangar. A typical nested T-hangar has a half stall in opposing corners. One of these could be used for the terminal building until activity justifies development of a separate and larger terminal building.

Stage Two (6 to 10 Years): Projects in the second stage of development should be undertaken as demand justifies. The anticipated projects include expansion of the apron to provide additional tie-downs, T-hangar construction and development of a Terminal/FBO building.

Stage Three (11 to 20 Years): Projects in the third stage of development may or may not be constructed. They primarily involve improvements to increase operational efficiency and capacity, and to accommodate increased

itinerant and based aircraft. These improvements should be constructed as the need dictates.

Third stage projects include land acquisition for and construction of a cross wind runway. This runway will increase the utility of the airport by increasing the wind coverage from 84.0% to 97.1%.

Also included in the third stage is the development of parallel taxiways. Parallel taxiways increase the capacity of the runways by allowing aircraft to be taxiing while other aircraft are using the runway for landings or takeoffs.

Lastly, the third stage of development provides for additional hangar space and tie-down areas.

STAGE DEVELOPMENT COSTS

Based on the above described improvements, estimated costs have been calculated for the stage development of the airport. The unit costs used represent an average for current 1985 pricing. Actual project costs may vary depending on several parameters such as construction conditions, specification requirements and time of construction. Future costs can be estimated by comparing Engineering News Record construction cost indexes and applying those to the costs included herein. The ENR Construction Cost Index Value for February 28, 1985 is 4180.75.

The following are the estimated costs for the stage development.

STAGE I DEVELOPMENT (1 TO 5 YEARS)

Item No.	Description	Quantity	Units	Unit Price	Total Price
1.	Land in Fee	100	Acres	$2,500.00	$250,000.00
2.	Land in Easement	8	Acres	750.00	6,000.00
3.	Fencing	15,000	L.F.	3.50	52,500.00
4.	Appraisals		L.S.		10,000.00
5.	Land Survey & Description		L.S.		6,000.00
6.	Negotiations		L.S.		5,000.00
7.	Legal, Recording & Admin.		L.S.		2,500.00
8.	Contingencies		5%		18,000.00
					$350,000.00

RUNWAY, TAXIWAY & APRON GRADING

Item No.	Description	Quantity	Units	Unit Price	Total Price
1.	Excavation & Grading	40,000	C.Y.	$ 2.50	$100,000.00
2.	Drainage Structures		L.S.		20,000.00
3.	Erosion Control		L.S.		2,500.00
4.	Seeding & Fertilizing	50	Acre	650.00	32,500.00
5.	Driveway & Parking Surfacing	750	Tons	10.00	7,500.00
6.	Miscellaneous Construction		L.S.		15,000.00
7.	Contingencies		10%		17,750.00
8.	Engineering, Legal & Admin.		17%		33,250.00
					$228,500.00

RUNWAY, TAXIWAY & APRON PAVING

1.	Subgrade Preparation	44,000	S.Y.	$ .30	$ 13,200.00
2.	4" Granular Base	9,300	Tons	9.00	83,700.00
3.	5" P.C.C. Paving	44,000	S.Y.	12.00	528,000.00
4.	Shouldering		L.S.		5,000.00
5.	Seeding & Fertilizing	10	Acres	650.00	6,500.00
6.	Marking	28,000	S.F.	.35	9,800.00
7.	Tie-Down Anchors	15	Each	50.00	750.00
8.	Contingencies		5%		31,820.00
9.	Engineering, Legal & Admin.		17%		115,430.00
					$794,200.00

LIGHTING & NAVIGATIONAL AIDS

Item No.	Description	Quantity	Units	Unit Price	Total Price
1.	Basic Edge Lighting System	1	Only	$40,000.00	$ 40,000.00
2.	VASI	2	Sets	3,500.00	7,000.00
3.	REIL'S	2	Sets	2,000.00	4,000.00
4.	Radio Control	1	Only	2,500.00	2,500.00
5.	Electrical Vault	1	Only	2,500.00	2,500.00
6.	Rotating Beacon	1	Only	4,000.00	4,000.00
7.	Lighted Wind Cone	1	Only	2,500.00	2,500.00
8.	Non-Directional Radio Beacon	1	Only	4,000.00	4,000.00
9.	Contingencies		10%		6,250.00
10.	Engineering, Legal & Admin.		17%		12,450.00
					$85,200.00

HANGAR DEVELOPMENT

1.	Site Preparation		L.S.		$ 3,000.00
2.	10 Stall T-Hangar	10	Stall	$12,500.00	125,000.00
3.	Taxiway Paving	1,200	S.Y.	20.00	24,000.00
4.	Contingencies		10%		15,200.00
5.	Engineering, Legal & Admin.		17%		28,500.00
					$195,700.00

BURIED FUEL TANK

1.	12,000 Gal. Buried Tank		L.S.		$16,000.00
2.	Dispenser & Misc.		L.S.		3,000.00
3.	Contingencies		10%		1,900.00
4.	Engineering, Legal & Admin.		17%		3,600.00
					$24,500.00

STAGE II DEVELOPMENT (6 TO 10 YEARS)
APRON EXPANSION

Item No.	Description	Quantity	Units	Unit Price	Total Price
1.	Excavation & Grading	2,500	C.Y.	$ 2.50	$ 6,250.00
2.	Subgrade Preparation	7,000	S.Y.	.30	2,100.00
3.	4" Granular Base	1,500	Tons	9.00	13,500.00
4.	5" PCC Paving	7,000	S.Y.	12.00	84,000.00
5.	Seeding & Fertilizing	1	Acre	650.00	650.00
6.	Tie-Down Anchors	15	Each	50.00	750.00
7.	Contingencies		10%		10,725.00
8.	Engineering, Legal & Admin.		17%		20,125.00
					$138,100.00

HANGAR DEVELOPMENT

1.	Site Preparation		L.S.		$ 3,000.00
2.	10 Stall T-Hangar	10	Stall	$12,500.00	125,000.00
3.	Taxiway Paving	1,200	S.Y.	20.00	24,000.00
4.	Contingencies		10%		15,200.00
5.	Engineering, Legal & Admin.		17%		28,500.00
					$195,700.00

TERMINAL/FBO BUILDING

1.	Site Preparation		L.S.		$ 3,000.00
2.	Terminal/FBO Building	8,000	S.F.	$ 25.00	200,000.00
3.	Contingencies		10%		20,300.00
4.	Engineering, Legal & Admin.		17%		38,000.00
					$261,300.00

STAGE III DEVELOPMENT (11 TO 22 YEARS)

Item No.	Description	Quantity	Units	Unit Price	Total Price
	*** LAND ACQUISITION ***				
	Land Acquisition in Fee and Easement for Crosswind Runway.				
	*** RUNWAY GRADING ***				
	Grading for Crosswind Runway.				
	*** RUNWAY PAVING ***				
	Paving 4000' x 75' Crosswind Runway.				
	*** LIGHTING ***				
	MIRL for Crosswind Runway.				
	*** PARALLEL TAXIWAYS ***				
	Grade, Pave and Light Parallel Taxiways for both runways.				
	*** HANGAR DEVELOPMENT ***				
	Develop 10 Stall T-Hangar.				
	*** APRON EXPANSION ***				
	Expand apron to provide additional tie-downs				

FINANCING

There are a number of sources of finances available to the City of Grinnell for airport improvement projects. The sponsor should thoroughly investigate alternative sources in planning individual projects.

Government Grants: The Iowa Department of Transportation currently participates in airport improvement projects through grants of up to 70% of the project cost with the remaining 30% to come from local sources. The D.O.T. has approximately $800,000 to $900,000 per year for such projects. In general, eligible projects include any improvements serving public aviation. Projects not eligible for participation include hangars, aprons within 20 feet of a hangar, parking lots and driveways. The state also maintains a reserve for safety equipment on a 50-50 matching basis. The safety program has approximately $60,000 available annually.

The Federal Aviation Administration also participates in similar general aviation airport improvement projects. The current legislation provides for participation in projects at the rate of 90% of allowable project costs. This appropriation bill expires in 1987. At that time congress must enact a new appropriation bill. Refer to Figure 7-1 for amounts and sources of D.O.T. and FAA grant funds.

Other grants are sometimes available through such agencies as the Economic Development Administration and HUD. Such grants are not very common, however, their possibility should not be overlooked.

Private Financing: Private financing may be practical for construction of hangar facilities. Such facilities can be constructed with private capital on airport property with the hangar to be deeded to the City in trade for a long term lease for the facility. The advantage of such an arrangement is that it relieves the sponsor of the burden of financing private hangar facilities while retaining possession and control of all real property on the airport.

FIGURE 7-1

IOWA AIRPORT IMPROVEMENT PROGRAM
ESTIMATED RESOURCES AVAILABLE [1]
$000's

AIR CARRIER	1984	1985	1986	1987	1988	1989
Federal (90%) [2]	2,500	2,893	3,119	3,360	3,495	3,633
Local Match (10%) [3]	277	321	346	373	388	403
Total	2,777	3,214	3,462	3,733	3,883	4,036
GENERAL AVIATION &						
OTHER COMMERCIAL SERVICE						
Construction						
Federal-formula (90%)	1,326	1,512	1,686	1,686	1,686	1,686
-discretionary (90%)	1,000	800	800	800	800	800
Local Match (10%) [3]	258	256	276	276	276	276
Subtotal	2,584	2,568	2,762	2,762	2,762	2,762
State (70%)	849	820	840	865	890	913
Local Match (30%) [4]	364	351	360	370	381	391
Subtotal	1,213	1,171	1,200	1,235	1,271	1,304
Total Construction	3,797	3,739	3,962	3,997	4,033	4,066
Safety						
State (50%) [4]	60	60	60	60	60	60
Local Share (50%)	60	60	60	60	60	60
Total	120	120	120	120	120	120

Notes: [1] This does not include possible federal-aid discretionary funds for reliever airports.
[2] This amount is the sum of the allocations for 4 locations.
[3] Includes only estimates of local funds needed to match federal and state funds. Does not include 100% locally financed improvements.
[4] State funds reserved for cooperative safety improvements, 50% state; 50% local.

SOURCE: IDOT Improvement Program - 1984 to 1989

Also, some communities have had successful industrial fund drives soliciting private funds to help defray the local share of government participation projects.

Revenue Bonds: Revenue bond financing can be used for some airport improvements such as hangars. The advantage of revenue bonds is that it provides a method of financing necessary improvements without a direct burden to the taxpayer.

General Obligation Bonds: General obligation bonds have historically been the most common method of financing the local share of government participation projects. The bonds are backed by the taxing power of the municipality. However, the amount a municipality can bond is limited and airport improvement costs must be budgeted along with all other essential public works.

Airport Generated Revenues: The airport itself generates some revenues through F.B.O. and operators fees, hangar rentals and income from airport farmland. These revenues, however, must first pay for normal operating and maintenance costs of the airport.

Implementation: Development of the proposed improvements will probably involve many of the above sources of funding. Some projects such as planning, engineering and land acquisition can be accomplished with local funds and used later as a credit toward the local match of a funded project. The following table presents one possible scenario for financing of the proposed Stage One development.

PROJECT	LOCAL SHARE	FEDERAL SHARE	STATE SHARE	TOTAL COST
Land Acquisition	$ 35,000	$ 315,000	$	$ 350,000
Runway, Taxiway & Apron Grading	65,700		153,300	219,000
Runway, Taxiway & Apron Paving	79,420	714,780		794,200
Lighting & Navigational Aids	8,520	76,680		85,200
Hangar Development	195,700			195,700
Buried Fuel Tank	24,500			24,500
	$408,840	$1,106,460	$153,300	$1,668,600

APPENDIX

4068.03

U.S. Department
of Transportation
**Federal Aviation
Administration**

Central Region
Iowa, Kansas,
Missouri, Nebraska

601 E. 12th Street
Kansas City, Missouri 64106

Mr. William R. Grabe, P.E.
Clapsaddle-Garber Associates
16 East Main
P.O. Box 754
Marshalltown, Iowa 50158

Dear Mr. Grabe:

Feasibility Study - Grinnell, Iowa
CGA PN 4068.03
FAA Airspace Case No.'s
84-ACE-087-NRA; 84-ACE-088-NRA;
84-ACE-089-NRA; 84-ACE-090-NRA

The following are feasibility studies for Grinnell, Iowa.

84-ACE-087-NRA Site A

VFR Feasible. However, standard traffic to Runways 13 and 18 could pass over the city causing noise complaints. Nonstandard traffic patterns (right traffic) would solve this problem.

IFR Feasible. An instrument approach to Runway 18 would fly over the western part of the city. If this site is developed the city should review its zoning ordinances and if necessary, revise them so as to prevent residential development in the approach to Runway 18.

84-ACE-088-NRA Site B

VFR Feasibile.

IFR Feasible.

84-ACE-089-NRA Site D

VFR Feasible. Traffic to Runways 09 and 34 should be right-hand (nonstandard) to avoid congested areas over the city.

IFR Feasible. However, instrument approaches to Runways 09 and 16 would pass over the city.

84-ACE-090-NRA Site C

VFR/IFR Feasible from the standpoint of obstructions shown on the Chicago Sectional Aeronautical Chart. However, there is an uncharted grain elevator located in the northeast corner of Section 18 which might make both VFR/IFR approaches from the south unfeasible. In addition, there is a power line located along the E/W road which borders the site on the south, and this might be a problem for an approach from the south.

If this site is selected, additional information and study will be needed in order to make a final determination on this site.

If you have any questions regarding these studies please contact Mr. Elton Ohlman (316) 374-6623.

Sincerely,

Lyle D. Barber

Lyle D. Barber
Airspace/Airport Data Specialist

H.E. Hedrick
Poweshiek County Zoning Administrator
Box 177, Courthouse
Montezuma, Iowa 50171
(515) 623-3061

May 28, 1985

William R. Grabe, P.E.
Clapsaddle-Garber Associates
16 E. Main, P.O. Box 754
Marshalltown, Iowa 50158

RE: Grinnell Airport Development Plan

Dear Mr. Grabe:

I have examined your plans for Grinnell airport.

Due to the fact that I am not an engineer or architect, I do not feel I can make an honest judgement. But knowing the Grinnell City Officials, like Ted Clauson, I am sure if there were any problems, they would call your attention to same.

Please note that after July 1, 1985 the Poweshiek County Zoning Administrator will be Mr. Fred Diers with office at Poweshiek County Courthouse, Montezuma Iowa 50171. Phone number (515) 623-3762.

Should I be able to help you in any way before July 1, please feel free to call.

Thank you.

Yours truly,

H.E. Hedrick dz

H.E. Hedrick

HEH/dz

REGION SIX PLANNING COMMISSION

Suite 10, Woodbury Building, 8 North First Avenue ;
Marshalltown, Iowa 50158; Phone: 515-752-0717

DATE: May 29, 1985

TO: Gary Goddard, William Grabe

FROM: Dennis D. Darnold, Director

SUBJECT: Areawide Review Notice

Region Six Planning Commission has had an opportunity to perform an "areawide intergovernmental review" for a grant application submitted by:

Applicant:	City of Grinnell
Funding Agency:	Not Applicable
Purpose:	Study of Proposed Development of Grinnell Airport
Ident. Number:	06-85-041

It is the reviewers observation that the proposed project is consistent with accepted planning principles which provides for necessary community facilities/services without duplicating existing or planned federally assisted programs or projects. This notice is to inform you and the federal funding agency that clearance without comment is being provided in response to your request for review. You are advised to proceed with the next step in the application process.

RESOLUTION NO. 1105

A RESOLUTION OF FINAL ACCEPTANCE OF AIRPORT DEVELOPMENT PLAN

WHEREAS, on Nov. 5, '84 Grinnell, Iowa, entered into a contract with Clapsaddle-Garber Associates, Consulting Engineers, for the preparation of the Grinnell Airport Development Plan, and,

WHEREAS, said Consultant has completed the Grinnell Airport Development Plan in accordance with the terms and conditions of said contract,

NOW, THEREFORE, BE IT RESOLVED, by the City Council of the City of Grinnell, Iowa, that said Grinnell Airport Development Plan is thereby approved and adopted.

PASSED AND APPROVED this 3rd day of June, 1985.

David E. McConnell

David E. McConnell, Mayor

ATTEST:

Gary Goddard

Gary Goddard, City Clerk