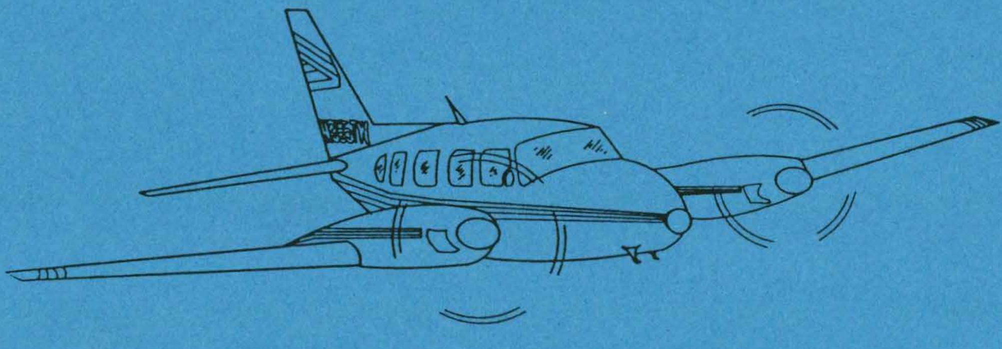
AIRPORT DEVELOPMENT PLAN

FOR

PELLA, IOWA

1990



CONSULTING ENGINEERS
MARSHALLTOWN IOWA
AMES IOWA

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FORECASTS OF AVIATION DEMAND

INTRODUCTION

The forecast of aviation demand provides a basis to estimate those airport facilities needed to accommodate future activity at the airport and the probable schedule for development. Forecasts are normally provided for the short, intermediate and long range periods, or approximately 5, 10 and 20 years. It should be recognized that as the range increases the accuracy of forecasts decreases. Therefore, a 20-year forecast is very approximate.

The aviation demand elements that are forecasted for this study include:

- Airport Operations
  - Itinerant
  - Local
- Enplaned Passengers
- Based Aircraft
- Aircraft Mix

The method of forecasting involves examination of historical trends of air-travel. Through extrapolation methods, these trends or tendencies can indicate future demand. Statewide trends are examined and used to develop projections of a more local nature. Other elements that are related to aviation activity levels are also examined and are used to influence judgement in extrapolation methods. In addition, related elements are used to develop aviation forecasts through mathematical relationships. Related elements include demographic patterns, employment trends, and geographic factors.

AIRPORT SERVICE AREA

The airport service area is that geographical area from which aviation demand can be expected to be drawn. There are a number of factors that affect the size and shape of the service area, the most significant of which are ease of access, and the facilities and services that are available at the airport. Two distinct service areas can be identified for the Pella Airport - one for Basic Utility activity levels and one for General Utility activity levels. These two service areas have been identified, based on the above described factors, and are depicted in Figure I-1. These service areas define the primary areas to be examined in preparing aviation forecasts.

POPULATION

Total population is a prime indicator of potential demand on aviation services. Numerous sources currently exist that provide forecasts of anticipated population trends. On a state wide basis, these forecasts anticipate a slight decline in population from the year 1980 to 1990, then a moderate increase of about 3% is anticipated from the year 1990 through 2010. A summary of a number of sources is presented below in Table I-1.

TABLE I-1
POPULATION PROJECTION - STATE OF IOWA

	1980	1990	2000	2010	% GROWTH 1990 TO 2010
State Demographer	2,913,808	2,913,500	2,965,000		
IDOT	2,913,808	2,853,477	2,899,700	2,929,721	
Woods & Poole	2,913,808	2,933,190	2,996,270	3,048,460	
Trend	2,913,808	2,900,056	2,953,657	3,000,000	3.5%

On a more regional basis, population is expected to increase slightly faster than the statewide average. For the purpose of this study, the region is considered to be Marion County and the surrounding Counties of Jasper, Lucas, Mahaska, Monroe and Warren. In general, a moderate increase of 1.5% is expected from the year 1980 to 1990 and an increase of 7% is anticipated from the year 1990 through 2010. This information is presented below in Table I-2.

TABLE I-2
POPULATION PROJECTION - SIX COUNTY REGION

	1980	1990	2000	2010	% GROWTH 1990 TO 2010
State Demographer	143,361	144,800	147,300		
IDOT	143,361	145,479	153,291	160,698	
Woods & Poole	143,361	146,190	151,760	157,930	
Trend	143,361	145,490	150,784	156,000	7.2%

ADDITIONAL TOWNSHIPS IN GENERAL UTILITY SERVICE AREA

COUNTY	TOWNSHIP	1980 POPULATION RURAL	CITY	TOTAL
MARION	DALLAS	449	1,404	1,853
	FRANKLIN	391	--	391
	INDIANA	813	--	813
	KNOXVILLE	2,162	8,143	10,305
	LIBERTY	384	826	1,210
	PLEASANT GROVE	859	1,633	2,492
	UNION	279	--	279
	WASHINGTON	513	--	513
LUCAS	PLEASANT	330	--	330
	ENGLISH	407	210	617
		6,587	12,216	18,803
TOTAL GENERAL UTILITY SERVICE AREA POPULATION		12,046	22,211	34,257

Projections for the service area population have been made assuming the service area trend will parallel that anticipated for Marion County. These projections are presented in Table I-5 below.

TABLE I-5
POPULATION PROJECTION - PELLA AIRPORT SERVICE AREA

	1980	1990	2000	2010	% GROWTH 1990 TO 2010
Basic Utility	15,454	16,271	17,409	18,543	14.0%
General Utility	34,257	36,067	38,592	41,105	14.0%

EMPLOYMENT TRENDS

A community's economic characteristics offer a good indicator of its propensity for travel. In particular, certain types of employment tend to generate more air travel than others. Manufacturing and certain service types of industries tend to generate a high demand on air travel while other industries such as mining and certain agricultural related industries have a low demand for air travel. In general, travel tendency by occupation can be summarized as follows:

<u>High Travel</u>: Manufacturing, Services, Federal Government, and State Government.

<u>Medium Travel</u>: Construction, Wholesale, Retail, Finance.

<u>Low Travel</u>: Mining, Farming, Ag. Services, Transportation, and Federal Military.

A summary of employment by travel tendency is presented in Table I-6 below. On a statewide basis, employment in low travel tendency occupations is anticipated to decline by the year 2010, while employment in medium to high travel tendency occupations is anticipated to increase on a statewide basis. The total labor force employed in high travel tendency occupations is anticipated to increase from 52% to 55% of the total labor force from the year 1990 to 2010.

The regional forecast includes the six county area of Jasper, Lucas, Mahaska, Marion, Monroe and Warren Counties. Regional forecasts indicate a decline of low travel tendency occupations over the 20 year planning period, while medium and high travel tendency occupations are anticipated to increase. In the six county region, the labor force employed in those industries with high travel tendency is expected to increase from 52% to 55% of the total labor force over the planning period.

Marion County is expected to show a decline in low travel tendency occupations, maintain relatively constant employment in the medium travel

REGISTERED AND BASED AIRCRAFT

The total number of based aircraft at an airport is an important factor in determining the size, type or number of facilities necessary to accommodate the airport's activity.

State Trend: Statewide forecasts anticipate future growth in the number of registered aircraft in the State of Iowa. According to the 1985 Iowa Aviation System Plan, "Aircraft registrations were found to be closely tied to the manufacturing, transportation and public utilities sectors and the Real Gross State Product." This in conjunction with national trends indicates the anticipated Iowa registered aircraft as follows:

TABLE I-7
REGISTERED AIRCRAFT - STATE OF IOWA

1970	1980	1990	2000	2010
2,565	3,500	3,200	3,800	4,400

SOURCE: Statistical Profile of Iowa 1987-1988 (1970-1980)
IDOT 1985 Aviation System Plan (1990-2000)
CGA (2010)

The statewide forecasts indicate an increase from 11 registered aircraft per 10,000 population in 1990 to nearly 15 registered aircraft per 10,000 population in 2010.

It should be noted that actual I.D.O.T. registered aircraft in 1989 shows a greater decline than projected in the 1985 study. However, in comparing the State list of registered aircraft with actual known aircraft at selected airports, a number of discrepancies are noted. In general, there are usually more actual based aircraft at an airport than are indicated by the State list.

Regional Trend: Table I-8 presents the number of registered aircraft in each of the six counties surrounding Pella and the ratio of the aircraft per 10,000 population. At the present time the region averages 9.5 aircraft per 10,000 population.

TABLE I-10
MARION COUNTY REGISTERED AIRCRAFT

OWNER	CITY	MODEL	HANGARED
KRAMER	PELLA	BELL 47G-2	
R & R COPT.	PELLA	BELL 47G-2A	
CORE	KNOXVILLE	ROTEX 65	Private Strip
HUSTED	ST. CHARLES	CESSNA 172	Private Strip
HUTCHINSON	PELLA	AERONCA 7A	Private Strip
MATHIAS	KNOXVILLE	HOME BUILT	Private Strip
MATHIAS	KNOXVILLE	STINSON 10	Private Strip
NUTTER	SWAN	BELLANCA 7	Private Strip
PATTERSON	OSKALOOSA	PA22-135	Private Strip
ZECK	KNOXVILLE	CESSNA 140	Private Strip
BINGLEY	KNOXVILLE	PA28R-200	Knoxville
BROWN	KNOXVILLE	PA24 260	Knoxville
KLYN	PELLA	PA24 260	Pella
KRAMER	PELLA	CESSNA 177	Pella
LENGER	LOVILIA	MALL M/4	Pella
R & R COPT.	PELLA	CESSNA 172	Pella
R & R COPT.	PELLA	PA28-180	Pella
R & R COPT.	PELLA	PA28-140	Pella
SATELLITE	PELLA	PA28-140	Pella
SCHMITZ	DES MOINES	EXP. RV/4	Pella
TYSSELING	PELLA	CESSNA 120	Pella
VAN VARK	PELLA	PA28 180	Pella
VAN WYK	PELLA	BEECH K35	Pella
VANDEKIEFT	PELLA	PA28R 180	Pella
VERMEER	PELLA	MOONEY M20	Pella
VERMEER	PELLA	BEECH BON	Vermeer
VERMEER	PELLA	BEECH V35B	Vermeer
VERMEER	PELLA	CESSNA A18	Vermeer
VERMEER	PELLA	BEECH V35B	Vermeer

In addition, it has been indicated that Rollscreen Corporation intends to base a Beechcraft King Air, or similar aircraft, at the airport as soon as adequate facilities are available. It should also be noted that a decision at Vermeer to utilize the Pella Municipal Airport could have a significant impact on the Pella based aircraft. However, there is no indication that such a move is forthcoming and it is assumed for the purpose of this study that Vermeer will continue to utilize their own facility.

It is anticipated that the number of based aircraft at the Pella Airport will increase at a higher rate than is anticipated in state and regional trends. This is supported by the faster rate of growth of population in

AIRCRAFT OPERATIONS

An aircraft operation is a landing (arrival) or a takeoff (departure) from an airport. A "touch and go," for example, is considered two operations. The total number of operations is an important element in identifying the level of service needed at an airport and in setting priorities in funding airport improvements.

There are two types of operations - local and itinerant. A local operation is an arrival or departure of aircraft which operate in the local traffic pattern and are known to be arriving or departing from flights within a 20-mile radius of the airport. Also, simulated instrument approaches or low passes by any aircraft are considered a local operation. Itinerant operations are all those arrivals or departures other than local operations.

Since there is no daily log of operational activity at the Pella Airport, estimates of operations are made by correlating related elements with actual counts at similar airports. The Iowa Department of Transportation has been counting operations at airports using a sound actuated counter. The DOT methodology involves counting actual operations for several weeks during each season of the year. From this data, total annual operations are extrapolated.

Table I-12 depicts counts taken from the August 1988 DOT report at airports representing communities similar in size to Pella and with comparable airport facilities. As can be seen from Table I-12, the ratio of operations per based aircraft generally range from 300 to 500 with an average of very nearly 400 operations per based aircraft.

AIR PASSENGERS AND AIR FREIGHT

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 I-14
PELLA AIR PASSENGERS (1990-2010)

YEAR	AIR PASSENGERS
1990	5,220
1995	6,264
2000	6,960
2010	8,352

The tonnage of air freight was estimated at eight pounds per enplaned passenger as presented in the following table:

TABLE I-15
PELLA AIR FREIGHT (1990-2010)

YEAR	AIR FREIGHT
1990	20.9 Tons
1995	25.1 Tons
2000	27.8 Tons
2010	33.4 Tons

AIRPLANE DESIGN GROUP

The future Pella Airport facilities should be planned that will safely accommodate anticipated critical aircraft operations. The Iowa Department of Transportation maintains a policy that 500 annual operations of a critical aircraft are necessary to justify planning facilities to accommodate that aircraft.

The type of airport facilities to plan for are based on the design aircraft approach category and airplane design group of a critical aircraft. These can be summarized as follows:

1. Aircraft Approach Categories:

    A. Category A: Approach speed less than 91 knots.
    B. Category B: Approach speed 91 knots or more but less than 121 knots.
    C. Category C: Approach speed 121 knots or more but less than 141 knots.

2. Airplane Design Group:

    A. Airplane Design Group I: Wingspan up to but not including 49 feet.
    B. Airplane Design Group II: Wingspan 49 feet up to but not including 79 feet.
    C. Airplane Design Group III: Wingspan 79 feet up to but not including 118 feet.

As can be anticipated from the forecasts and user contacts, the majority of aircraft operations will be made by single and light twin engine aircraft. A typical larger aircraft in this group would include a Beech King Air. The King Air has a wingspan of 50.3 feet and an approach speed of 100 knots. The gross takeoff weight is 9,650 pounds. On this basis the Pella Airport facilities should be developed to meet Airplane Design Group II, Approach Category B - Utility standards.

FACILITY REQUIREMENTS

INTRODUCTION

This portion of the study describes those facility and equipment requirements needed to accommodate the aviation demand forecasted in the previous portion of the study. It is intended that this information be presented in a form that can be readily used in preparing the Airport Layout Plan for the existing airport site.

The following specific items of development and requirements are addressed:

- Runway and Taxiway - length, width, clearances, visibility, orientation and grades.
- Terminal Area - Apron, hangars, administration building, and auto parking.
- Obstructions - Navigable airspace.
- Drainage.
- Paving - Rigid pavement and flexible pavement.
- Marking, lighting and visual aids.
- Navigational aids.

Information contained herein is drawn primarily from applicable FAA Advisory Circulars. As indicated in the Forecast of Aviation Demand section on this study, development should be planned to utility airport standards for Airplane Design Group II. A typical aircraft in this design group would be a Beech King Air.

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, 4) pavement condition, and 5) altitude of the airport. The following paragraphs describe these factors and their effect on the runway length at the Pella Airport.

- Temperature. The higher the temperature, the longer the runway length requirements. This is due to the fact that higher temperatures reflect lower air densities. Therefore, increased airspeed 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 88 degrees Fahrenheit.

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

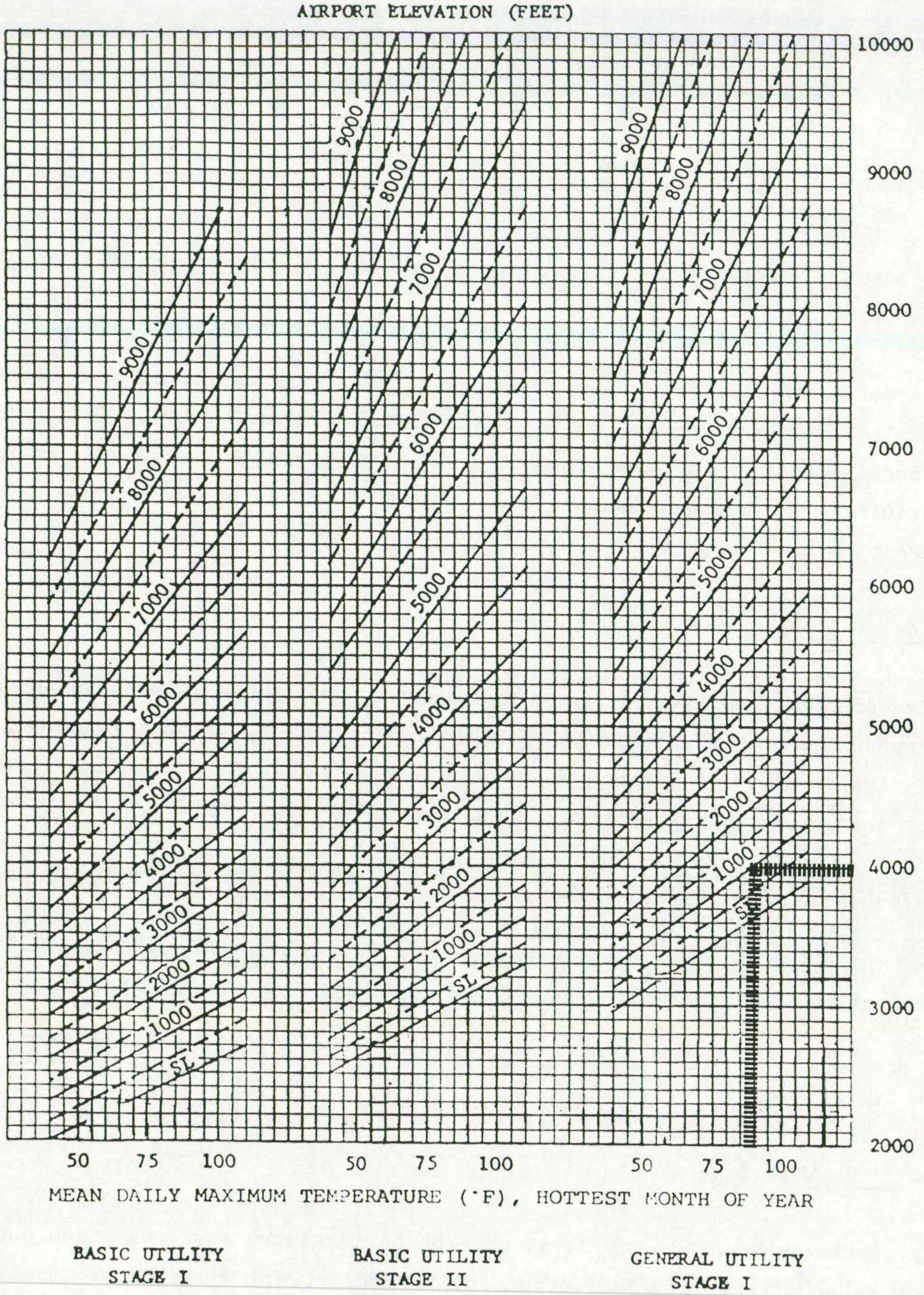
ACTUAL WIND (KNOTS)	% INCREASE OR DECREASE OF LENGTH WITH NO WIND
+ 5	- 3
+ 10	- 5
- 5	+ 7

  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 there is any wind, a landing direction can be selected where there is at least some head wind component.

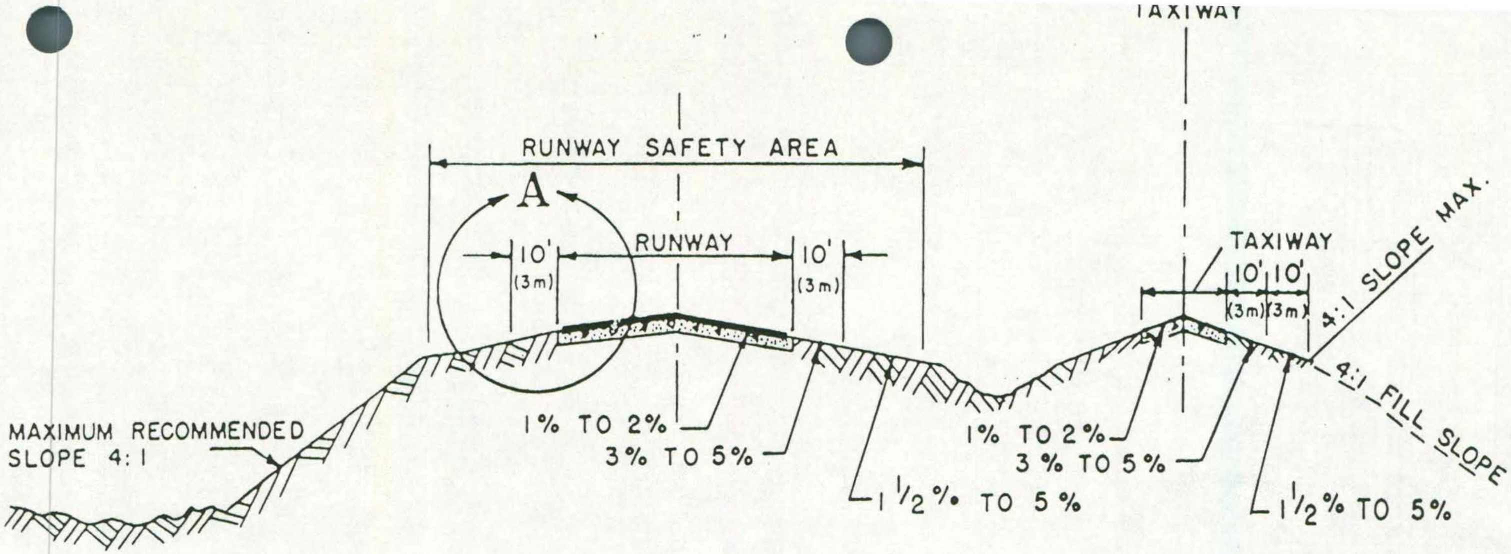
- Runway Gradient. Runway gradient, or slope of the runway, requires additional runway length for takeoff on an uphill gradient as opposed to a level or downhill gradient. However, for general aviation aircraft operating on runways with gradients less than 2%, this effect is considered to be negligible.

- Altitude of the Airport. The higher the altitude of the airport, the longer the runway length requirements. Higher altitudes

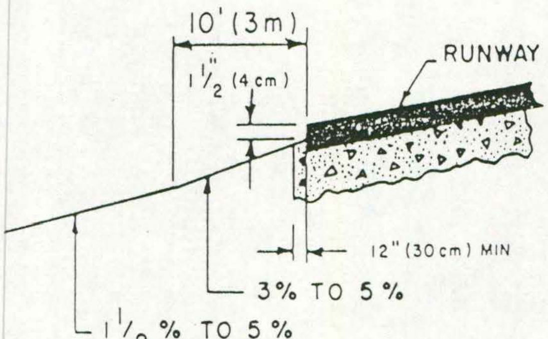


RUNWAY LENGTH CURVES

FIGURE II-1



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 II-2

or hazard is any above ground object, including 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 the Pella Airport is defined as follows:

> Runway OFZ. The runway OFZ is the volume of space above a surface longitudinally centered on the runway. The elevation of any point on 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 for nonprecision instrument and visual runways serving or expected to serve small airplanes with approach speeds of 50 knots or more and no large airplanes.

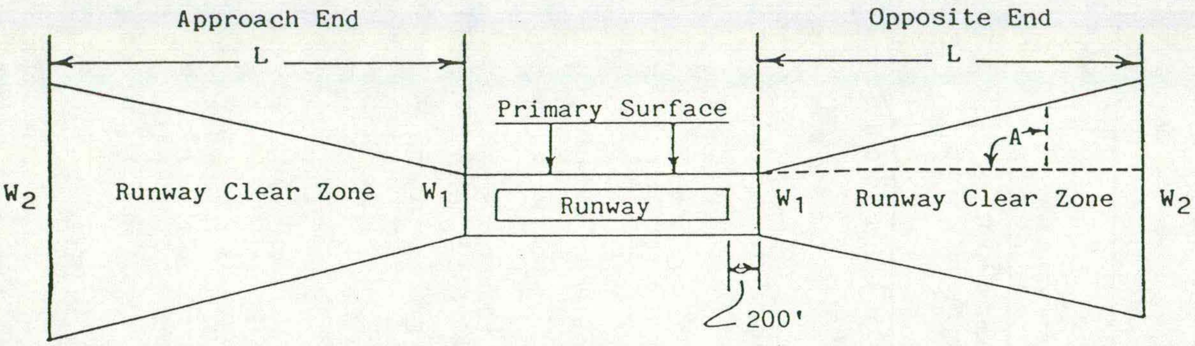
Runway Location and Orientation:

Runway location and orientation are important from a safety, environmental, efficiency and economic point of view. The following paragraphs discuss the considerations to be made in runway location and orientation.

Wind coverage is of paramount importance in orienting a runway. Runway orientation should be such that the airport can be utilized 95% of the time without excessive cross wind components. For "utility" class of airports, FAA standards require that the crosswind component not exceed 10.5 knots (12 miles per hour) 95% of the time.

Airspace beyond the physical extents of the runway should be considered. This includes clear zones, approaches, obstructions and traffic patterns. Clear zones and obstruction standards are discussed elsewhere in this section of the study.

Topography plays an important role in selecting the orientation of the runway. Considerations must be made on the effect of the grading on surface and subsurface drainage, soil types to be encountered along with the total cost of construction.



Facilities Expected To Serve	Set No.	Runway End: Approach End	Runway End: Opposite End	Dimensions: Length L (feet)	Inner Width W_1 (feet)	Outer Width W_2 (feet)	Runway Clear Zones (acres)	Flare Ratio A (rise/run)
Only Small Airplanes	1	V		1,000	250	450	8.035	.1:1
			V	1,000	250	450	8.035	.1:1
	2	V		1,000	500	650	13.200	.075:1
			NP	1,000	500	800	14.922	.15:1
	3	NP		1,000	500	800	14.922	.15:1
			NP	1,000	500	800	14.922	.15:1

V = Visual approach
NP = Nonprecision approach

RUNWAY CLEAR ZONE DIMENSIONS

FIGURE II-4

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 each aircraft represents two operations (a landing and a takeoff).

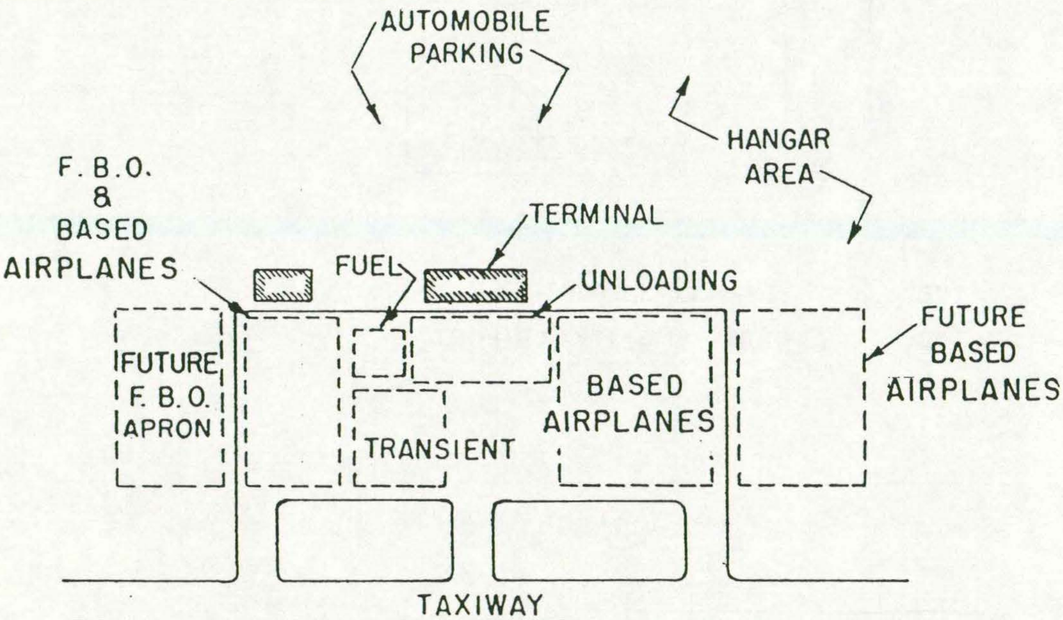
e. Assume that a certain portion of the itinerant airplanes will be on the apron during the busy day. Fifty percent is used here.

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
1990	3,480	3
1995	4,176	4
2000	4,640	4
2010	5,568	5

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



APRON LAYOUT

FIGURE II-6

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.

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

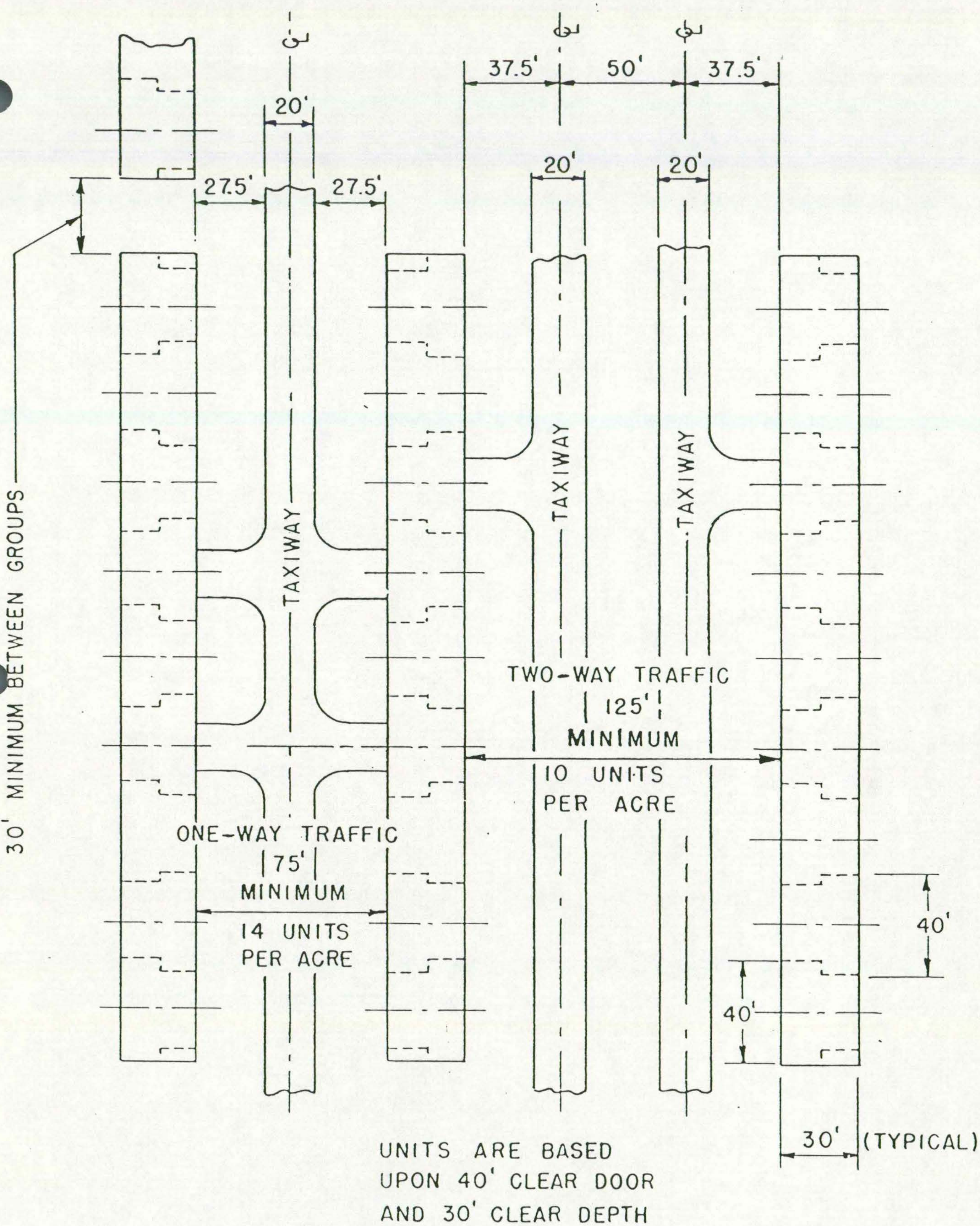
a. T-hangar space should be provided for the number of based aircraft at the airport (use projected numbers for planning purposes). In addition, provide two to three spaces for itinerant aircraft which may need a space and as an attraction to new based aircraft.

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 Pella Airport are determined as follows.

YEAR	T-HANGAR SPACE	CONVENTIONAL HANGAR SPACE
1990	17	1
1995	20	1
2000	22	2
2010	26	2



T-HANGAR LAYOUT

FIGURE II-8

OBSTRUCTIONS

This section sets forth the standards for determining obstructions in the navigable air space around the airport. This information 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 Pella Airport.

Obstruction Standards:

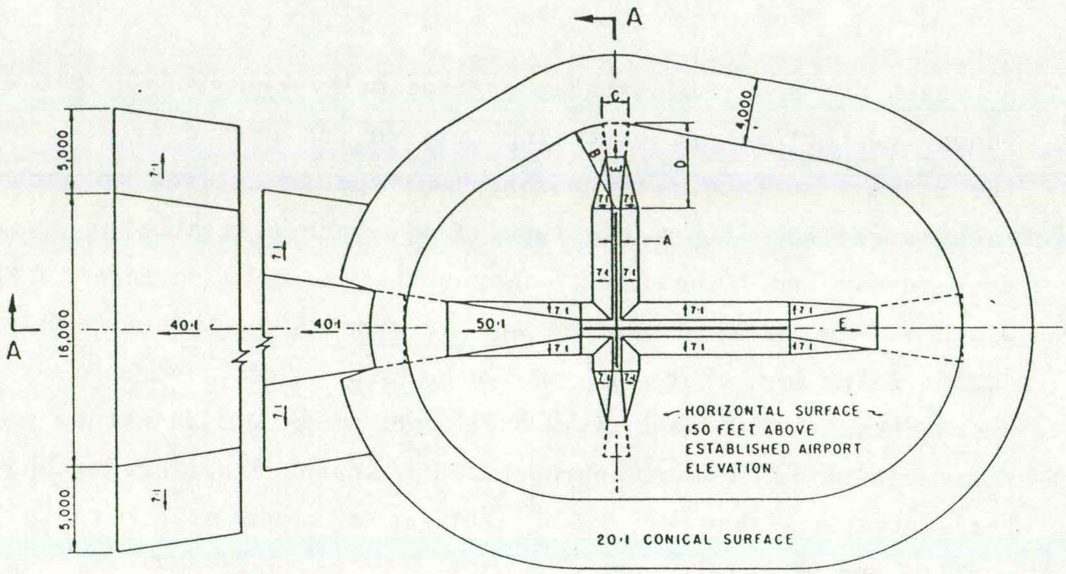
An obstruction is considered to be any object of natural growth, terrain, or structures of permanent or temporary construction if it is higher than any of the following heights or surfaces:

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.

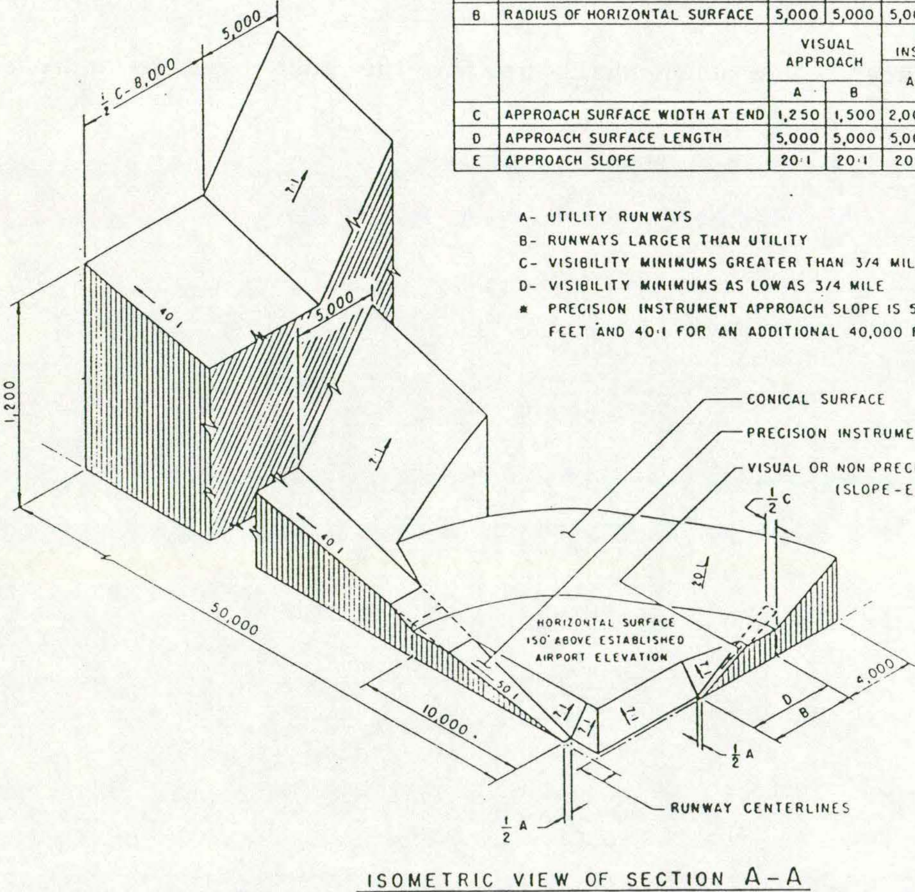
c. The surface of a takeoff and landing area of an airport or any imaginary surface established under paragraphs 77.25, 77.28, or 77.29 (FAR Part 77). However, no part of the takeoff or landing area itself will be considered an obstruction.

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



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 II-9

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 II-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 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 or where there are capillary susceptible soils. 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, it is recommended that pavement subdrains be provided at the Pella Airport.

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. For the utility category of airport this would include aircraft with a maximum gross weight of 12,500 pounds and a single wheel gear.

Various pavement courses are shown graphically in Figure II-10 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, lime rock, 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.

The existing pavement section at the Pella Airport consists of a 6" portland cement concrete surface with a 4" granular subbase. Although current design standards would allow a 5" P.C.C. surface with the 4" granular subbase, it is recommended that any new pavement be equivalent in strength to the existing pavement for consistency reasons. This would also permit potential future usage of the airport by larger than utility aircraft.

There are many combinations of flexible surface, base and subbase that could be required for the Pella 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.

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 Pella Airport. Refer to Figures II-11 and II-12 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.

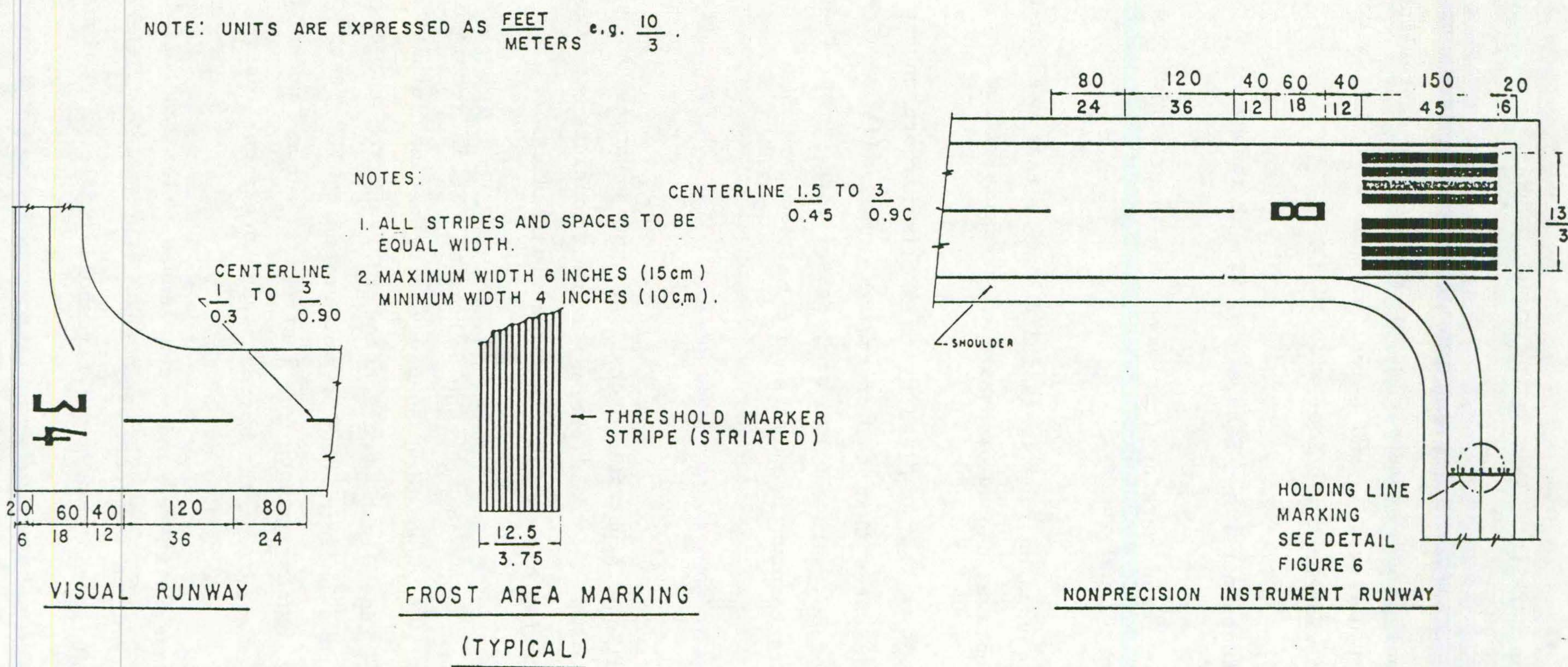
b. Designation marking - The designation marking indicates the magnetic bearing of the runway centerline to the nearest 10 degree increment. For example, a magnetic bearing of 127 degrees would be represented by "13". The numbers are normally 60 feet high with a width dependent on the runway width.

c. Fixed distance marking - Required when there is 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.



VISUAL AND NONPRECISION MARKING

FIGURE II-12

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.

Blue taxiway lights are similar to runway lights as far as intensity and location are concerned. 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 Pella 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.) or Precision Approach Path Indicators (P.A.P.I.) provide visual guidance for landing approaches. The light units are normally located on the left side of the runway as viewed on approach and emit red and white beams of light which enables a pilot to

NAVIGATIONAL AIDS

A Nondirectional Beacon (NDB) is recommended for the Pella 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.

AIRPORT LAYOUT PLAN

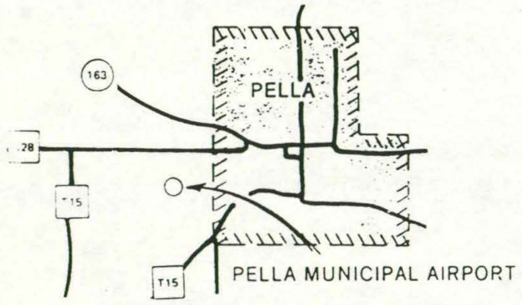
AIRPORT LAYOUT PLAN
PELLA MUNICIPAL AIRPORT
PELLA, IOWA
~1989~

LEGEND

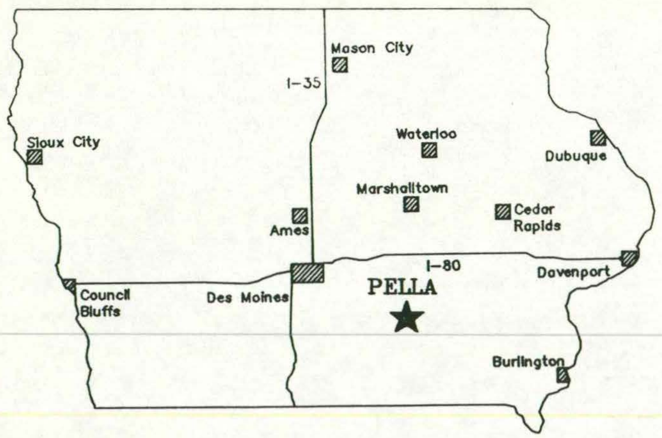
- Property or Right-of-Way Lines
- Railroad Tracks
- Building
- Power Pole w/Guy
- Telephone Pole
- Intakes
- Fences
- Manhole
- Hydrant
- Trees
- Bushes
- Stump
- Curb Stop
- Valve
- Street Light
- Street Signs
- Culvert
- Water Line
- Sanitary Sewer Line
- Storm Sewer Line
- Gas line
- Electric Cable
- Telephone Cable

REVISIONS	
DATE	SHEETS

SHEET INDEX



LOCATION MAP



CGA
CONSULTING ENGINEERS
MARSHALLTOWN AMES

APPROVED:

SIGNED, DATE

CHAIRMAN: ____ ____

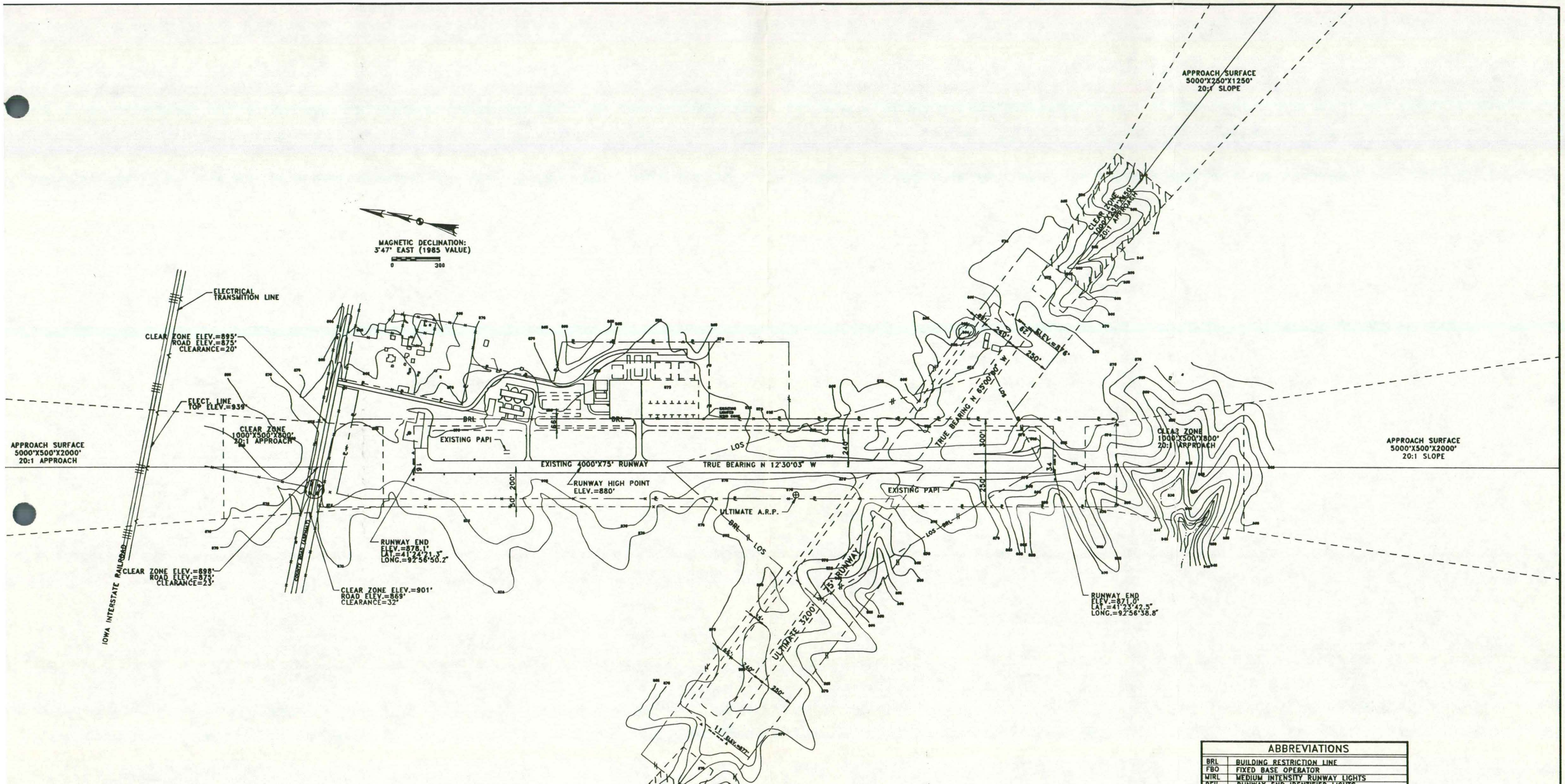
I HEREBY CERTIFY THAT THESE PLANS WERE PREPARED BY ME OR UNDER MY DIRECT PERSONAL SUPERVISION AND THAT I AM A DULY REGISTERED PROFESSIONAL ENGINEER UNDER THE LAWS OF THE STATE OF IOWA.

SIGNED, DATE

William R. Grabe 3-26, 1990

WILLIAM R. GRABE, P.E.
IOWA REG. NO. 9221

P.N. 4080



LEGEND

...ING	ULTIMATE	ITEM
...OWN	BRL	BUILDING RESTRICTION LINE
	NOT SHOWN	GROUND CONTOURS
		AIRPORT PROPERTY LINE
	000 000	THRESHOLD LIGHTS
		FACILITIES
	▲	RUNWAY IDENTIFIER LIGHTS
	O	RUNWAY LIGHTS
		BUILDING CONSTRUCTION
	TL	TILE LINE & INTAKE
	NOT SHOWN	POWER LINE
		EASEMENTS
...OWN	LOS	LINE OF SIGHT
		AIRPORT PROPERTY LINE
		CLEAR ZONE
		AIRPORT FENCING
	NOT SHOWN	TELEPHONE LINE
	△	RUNWAY END IDENIFICATION LIGHTS
		PRECISION APPROACH PATH INDICATOR

AIRPORT DATA

ITEM		EXISTING	ULTIMATE
AIRPORT ELEVATION		880' MSL	880' MSL
NORMAL MAX. TEMP.		88.3° F	SAME
TAXIWAY MARKING		BASIC	SAME
NAVIGATIONAL AIDS		NDB	NDB
AIRPORT COORDINATES	LAT.	41°24'02"	41°23'58"
	LONG.	92°56'45"	92°56'46"
AIRPLANE DESIGN GROUP		II	II
COMBINED WIND COVERAGE		86.0	95.1

RUNWAY DATA

ITEM	RUNWAY 16 - 34		RUNWAY 11 - 29	
	EXISTING	ULTIMATE	EXISTING	ULTIMATE
EFFECTIVE GRADIENT, %	0.22	0.22		0.14
% WIND COVERAGE	86.0	86.0		81.4
SAFETY AREA	4,400'X150'	4,400'X150'		3,600'X150'
PAVEMENT STRENGTH	30,000	30,000		12,500
APPROACH SLOPES	20:1	20:1		20:1
LIGHTING	MIRL/MITL/REIL	MIRL/MITL/REIL		MIRL/MITL/REIL
MARKING	NONPRECISION	NONPRECISION		BASIC
APPROACH AIDS	PAPI	PAPI		PAPI
LENGTH	4000'	4000'		3200'
WIDTH	75'	75'		75'

ABBREVIATIONS

BRL	BUILDING RESTRICTION LINE
FBO	FIXED BASE OPERATOR
MIRL	MEDIUM INTENSITY RUNWAY LIGHTS
REIL	RUNWAY END IDENTIFIER LIGHTS
VASI	VISUAL APPROACH SLOPE INDICATOR
NDB	NON-DIRECTIONAL RADIO BEACON
ARP	AIRPORT REFERENCE POINT
LOS	LINE OF SIGHT
ILS	INSTRUMENT LANDING SYSTEM
VOR	VERY HIGH FREQUENCY OMNIRANGE
TVOR	TERMINAL VOR

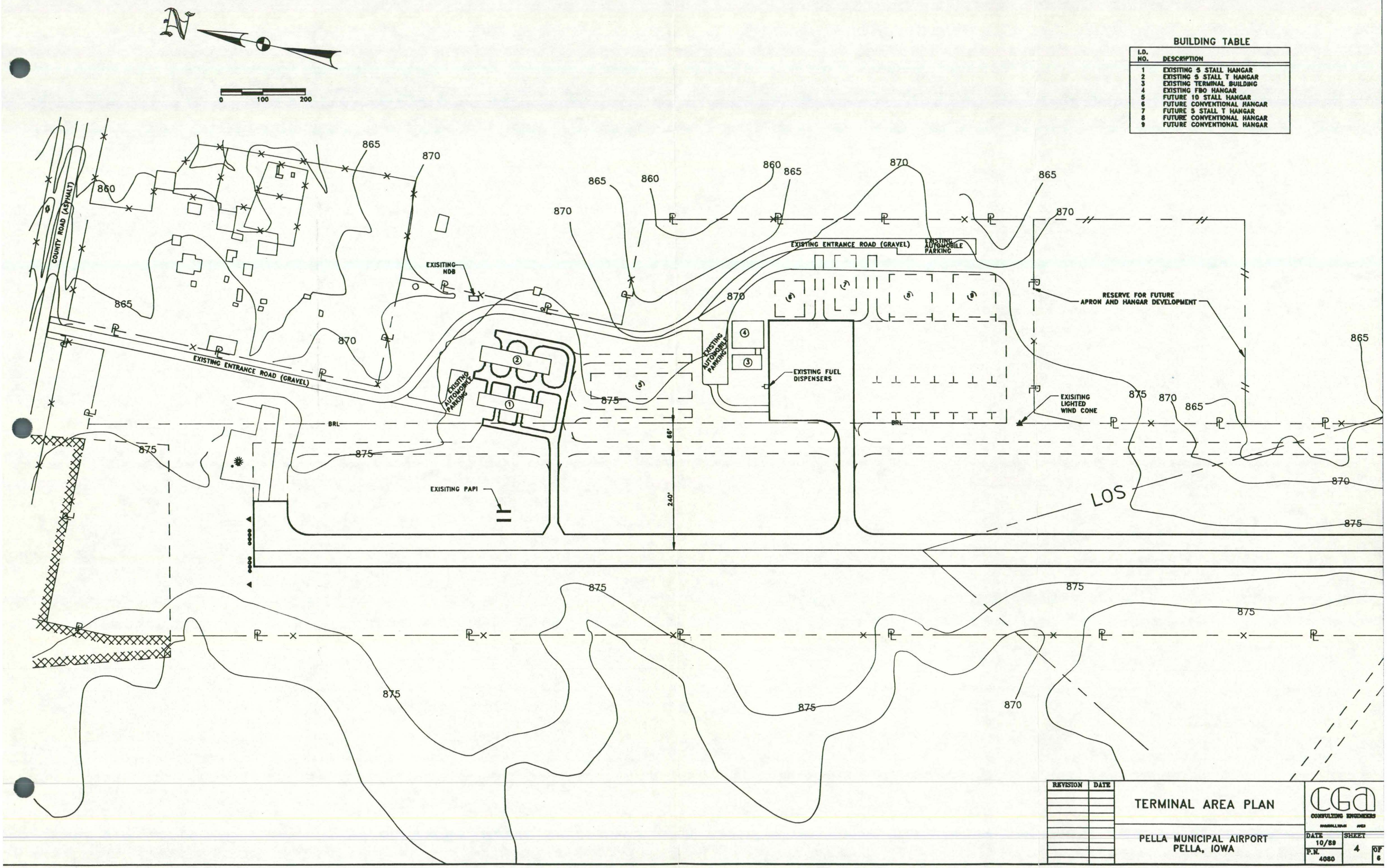
REVISION	DATE

AIRPORT LAYOUT PLAN

PELLA MUNICIPAL AIRPORT
PELLA, IOWA

CGA CONSULTING ENGINEERS

DATE 10/89
P.N. 4080
SHEET 2 OF 6



BUILDING TABLE

I.D. NO.	DESCRIPTION
1	EXISITING 5 STALL HANGAR
2	EXISTING 5 STALL T HANGAR
3	EXISTING TERMINAL BUILDING
4	EXISTING FBO HANGAR
5	FUTURE 10 STALL HANGAR
6	FUTURE CONVENTIONAL HANGAR
7	FUTURE 5 STALL T HANGAR
8	FUTURE CONVENTIONAL HANGAR
9	FUTURE CONVENTIONAL HANGAR

REVISION	DATE

TERMINAL AREA PLAN

PELLA MUNICIPAL AIRPORT
PELLA, IOWA

CGA CONSULTING ENGINEERS

DATE 10/89
SHEET 4 OF 6
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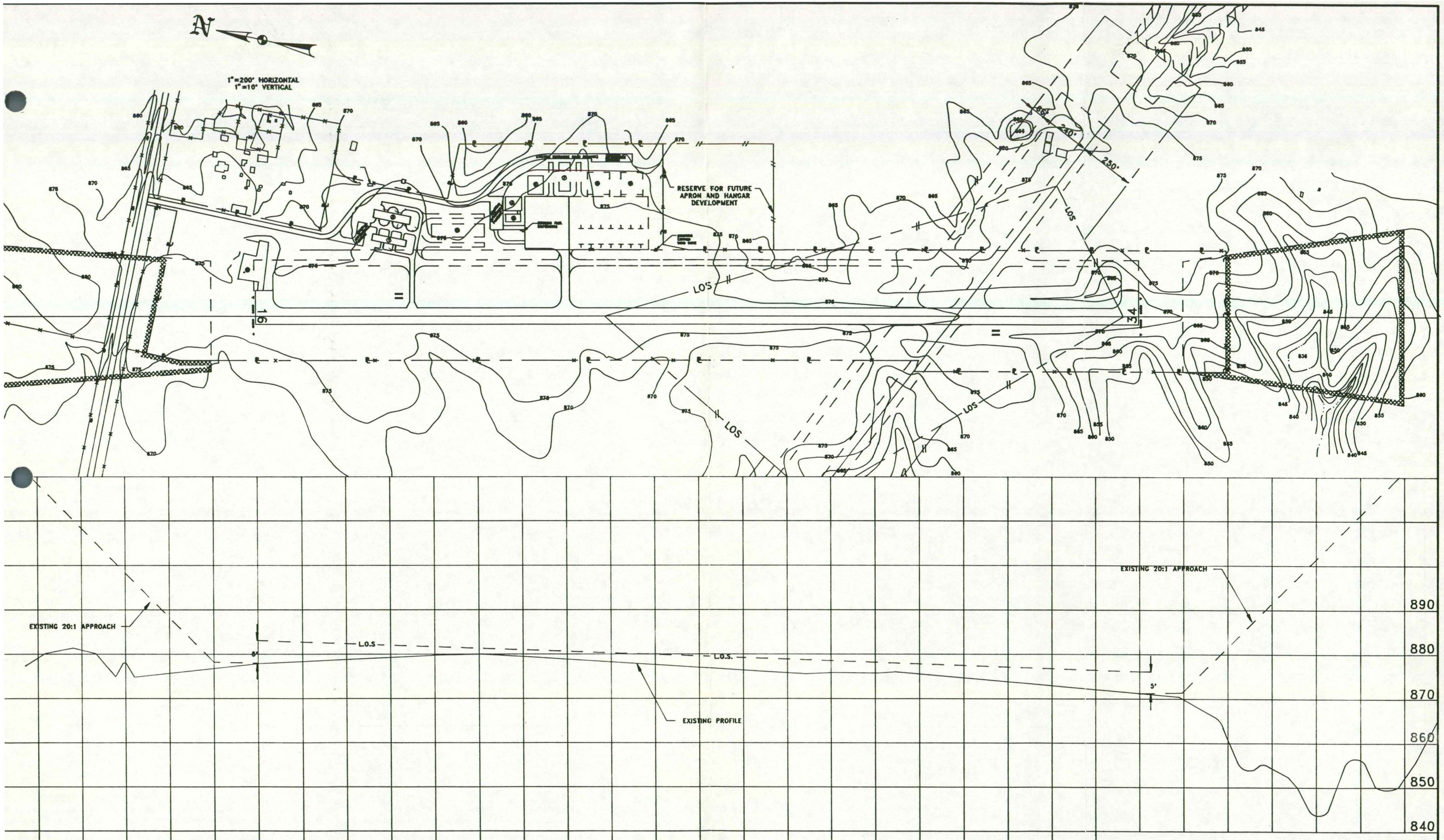


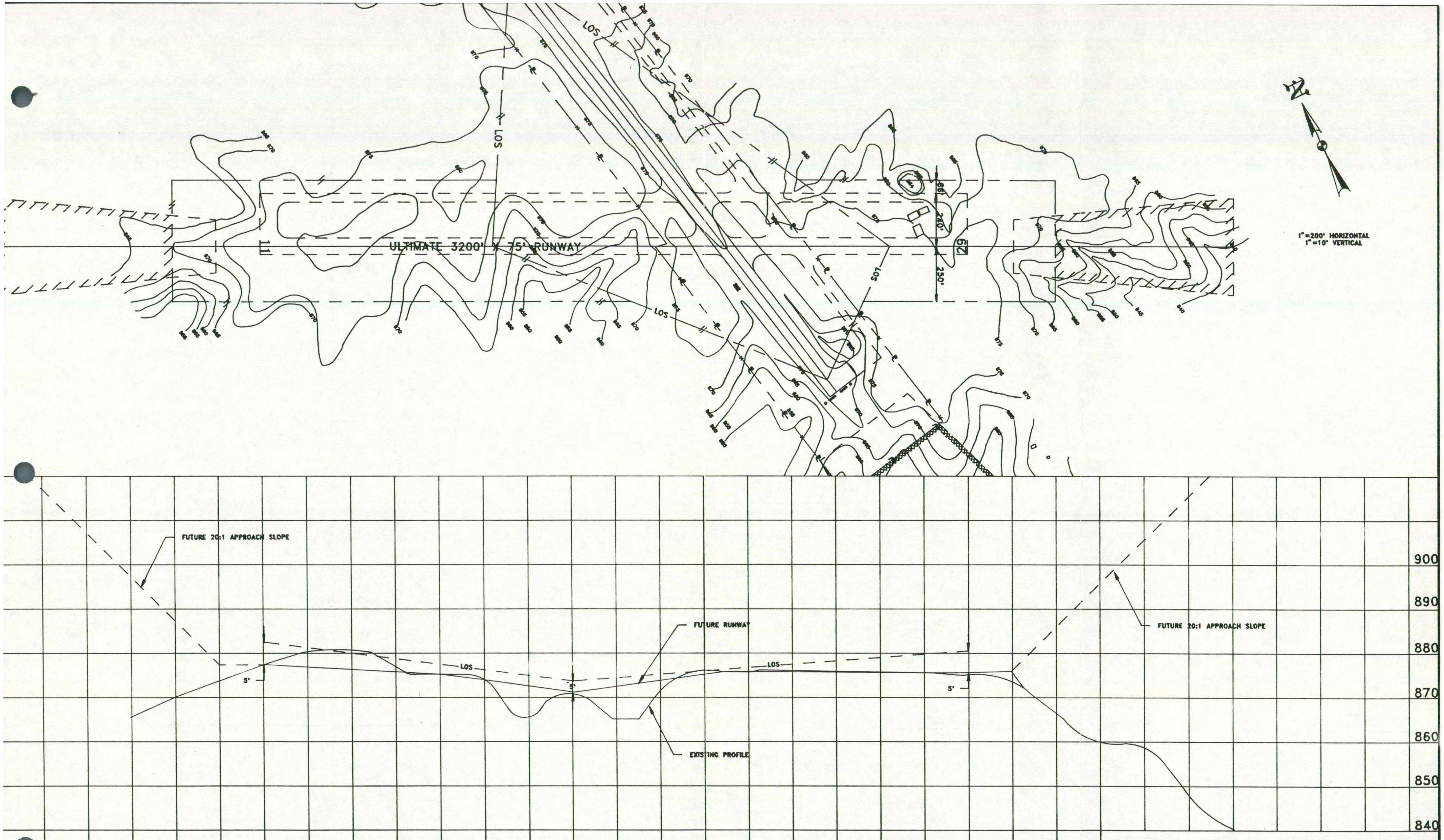
REVISION	DATE

PLAN AND PROFILE
RUNWAY 16/34

PELLA MUNICIPAL AIRPORT
PELLA, IOWA

CGA CONSULTING ENGINEERS

DATE 10/88 | SHEET 5 OF 6 | P.N. 4080



REVISION	DATE

PLAN AND PROFILE
RUNWAY 11/29

PELLA MUNICIPAL AIRPORT
PELLA, IOWA

CGA CONSULTING ENGINEERS

DATE 10/88 | SHEET 6 OF 8 | P.N. 4080

DEVELOPMENT SCHEDULE AND 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): The projects planned for Stage One accomplishment provide for improvements in the terminal area. At the time of this report, Rollscreen Company was planning development of private hangar space at the airport. Phase I ramp expansion will provide the minimum additional pavement (estimated at 75'x285') necessary to provide access to their hangar.

At the present time, the apron area has no permanent tie-down spaces and areas for maneuvering, fueling and short term parking of aircraft are minimal. Therefore, it is anticipated that during Stage One, the remainder of the apron will be developed providing this needed space. This project has been designated as Phase II ramp expansion.

Lastly, it is anticipated that additional hangar space will be needed to accommodate the growing number of based aircraft. A five stall nested T-hangar south of the terminal building is planned for this purpose.

Stage Two (6 to 10 Years): The major development items anticipated during Stage Two include additional hangar development, taxiway improvements and the beginning phases for development of the crosswind runway.

The hangar improvements include the development of a conventional hangar immediately south of the terminal building. It is anticipated that this hangar will be needed to accommodate a growing F.B.O. operation. It is also planned to develop the 10 stall T-hangar to house the growing number of based aircraft. It is expected that the T-hangar will be needed towards the end of Stage Two.

A partial parallel taxiway is planned for Stage Two to provide a connection with runway end 16. This taxiway will enhance the safe movement of aircraft by eliminating the need to back-taxi to get into position for takeoff to the south. For the same reason it will also increase the capacity of the runway and reduce delay times by allowing aircraft to enter and exit the runway sooner.

Also included in Stage Two are the initial elements for development of the crosswind runway. These development items would include acquisition of the land in fee and easement and the grading required for the ultimate 3,200 foot safety area. After the grass is established, this could then function as a turf runway.

STAGE DEVELOPMENT COSTS

Based on the above described improvements, costs have been estimated for the stage development of the airport. The unit costs used represent an average for 1989 pricing. Actual project costs may vary depending on several parameters such as construction conditions, specification requirements and time of construction.

Following are the estimated costs for the stage development.

ITEM NO.	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
	STAGE ONE DEVELOPMENT (1 TO 5 YEARS)				
	RAMP EXPANSION (PHASE I)				
1.	Subgrade Preparation	2,520	S.Y.	$ .50	$ 1,260
2.	4" Granular Base	520	Ton	10.00	5,200
3.	6" P.C.C. Paving	2,400	S.Y.	15.00	36,000
4.	Contingencies		10%		4,246
5.	Engineering, Legal & Administrative		18%		9,294
					$56,000
	RAMP EXPANSION (PHASE II)				
1.	Subgrade Preparation	7,300	S.Y.	$ 0.50	$ 3,650
2.	4" Granular Base	1,550	Ton	10.00	15,500
3.	6" P.C.C. Paving	7,200	S.Y.	15.00	108,000
4.	Seeding & Fertilizing	1	Acre	650.00	650
5.	Tie-Down Anchors	42	Each	75.00	3,150
6.	Contingencies		10%		13,095
7.	Engineering, Legal & Administrative		18%		$ 25,955
					$170,000
	5 STALL T-HANGAR				
1.	Site Preparation		L.S.	$	$ 3,000
2.	5 Stall Nested T-Hangar	5	Stall	12,000.00	60,000
3.	Taxiway Paving	750	S.Y.	20.00	15,000
4.	Contingencies		10%		7,800
5.	Engineering, Legal & Administrative		18%		16,200
					$102,000

ITEM NO.	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE

STAGE THREE DEVELOPMENT (11 TO 20 YEARS)

PARTIAL PARALLEL TAXIWAY TO RUNWAY END 34

ITEM NO.	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
1.	Excavation & Shouldering	40,000	C.Y.	$ 2.00	$ 80,000
2.	Subgrade Preparation	12,300	S.Y.	.50	6,150
3.	Crushed Stone Base	2,600	Ton	10.00	26,000
4.	6" P.C.C. Paving	11,000	S.Y.	13.00	143,000
5.	Drainage Improvements		L.S.		7,500
6.	Taxiway Lights		L.S.		30,000
7.	Seeding & Fertilizing	4	Acre	650.00	2,600
8.	Contingencies		10%		29,525
9.	Engineering, Legal & Administrative		18%		$ 59,225
					$384,000

PAVING AND LIGHTING OF CROSSWIND RUNWAY

ITEM NO.	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
1.	Fine Grading & Shouldering	2,000	C.Y.	$ 2.50	$ 5,000
2.	Subgrade Preparation	30,000	S.Y.	.30	9,000
3.	Crushed Stone Base	6,300	Ton	10.00	63,000
4.	6" P.C.C. Paving	28,200	S.Y.	13.00	366,600
5.	Subdrains	6,600	L.F.	5.00	33,000
6.	Lighting System		L.S.		140,000
7.	Seeding & Fertilizing	6	Acre	650.00	3,900
8.	Contingencies		10%		62,050
9.	Engineering, Legal & Administrative		18%		123,450
					$806,000

GRADING, PAVING AND LIGHTING OF CROSSWIND PARALLEL TAXIWAY

ITEM NO.	DESCRIPTION	QUANTITY	UNITS	UNIT PRICE	TOTAL PRICE
1.	Excavation & Grading	40,000	C.Y.	$ 2.00	$ 80,000
2.	Subgrade Preparation	16,900	S.Y.	.30	5,070
3.	Crushed Stone Base	3,600	Ton	10.00	36,000
4.	6" P.C.C. Paving	15,200	S.Y.	13.00	197,600
5.	Subdrains	6,600	L.F.	5.00	33,000
6.	Drainage Structures		L.S.		8,000
7.	Lighting System		L.S.		50,000
8.	Seeding & Fertilizing	6	Acre	650.00	3,900
9.	Contingencies		10%		41,357
10.	Engineering, Legal & Administrative		18%		$ 82,073
					$537,000

FINANCING

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

Government Grants: The Iowa Department of Transportation currently participates in eligible airport improvement projects through grants of 70% of the project cost with the remaining 30% to come from local sources. The D.O.T. in the past has had $1.5 to $2.5 million available per year for improvement projects. In general, eligible projects include any improvements serving public aviation. Projects not eligible for participating include hangars, aprons within 20 feet of a hangar, parking lots and driveways. Since demand for D.O.T. money exceeds the available funds, projects are funded in the following order or priority: safety projects, preservation of existing facilities, and construction of new facilities. The D.O.T. also maintains a reserve for airport facilities and equipment on a 50-50 matching basis. The facilities and equipment program has approximately $50,000 to $100,000 available annually.

The Federal Aviation Administration participates in similar general aviation airport improvement projects as the D.O.T. The current legislation provides for participation in projects at the rate of 90% of allowable project costs. The amount of money available for general aviation improvements is variable from year to year depending on the appropriation bill and the amount of discretionary funds. Current funding levels for general aviation airports is approximately $2.5 million per year.

Other grants are sometimes available through other state and federal agencies. Such grants for airport improvements 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.

Private financing may also be available through donations. Some communities have had successful industrial fund drives soliciting private funds to help defray the local share of government participation grants.

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. The disadvantage is that the financing cost of revenue bonds is usually greater than general obligation bonds and it is very difficult to obtain sufficient rent on a hangar to retire revenue bonds.

PROJECT	TOTAL COST	FEDERAL SHARE @ 90%	DOT SHARE @ 70%	LOCAL SHARE
AGE I IMPROVEMENTS				
mp Expansion (Phase I)	$ 56,000	$		$ 56,000
mp Expansion (Phase II)	170,000		119,000	51,000
Stall T-Hangar	$ 102,000			102,000
	$ 328,000		$119,000	$209,000
AGE II IMPROVEMENTS				
nventional Hangar	$ 160,000	$		$160,000
Stall T-Hangar	240,000			240,000
nd Acquisition for Crosswind	180,000	162,000		18,000
rtial Parallel Taxiway to Runway End 16	211,000		147,700	63,300
ading of Crosswind Runway	192,000		134,400	57,600
	$ 983,000	$ 162,000	$282,100	$538,900
AGE III IMPROVEMENTS				
rtial Parallel Taxiway to Runway End 34	$ 384,000		$268,800	$115,200
ving & Lighting of Crosswind Runway	806,000	725,400		80,600
ading, Paving & Lighting of Crosswind Parallel Taxiway	537,000	483,300		53,700
	$1,727,000	$1,208,700	$268,800	$249,500