SECTION 5

AIRPORT REQUIREMENTS

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Facility requirements are calculated dimensional quantities that serve as guidelines for the preparation of airport plans. Calculated component facility dimensions are not definitive, but instead undergo continual change from time of calculation to the time that facility construction is completed. Toward the latter part of the planning period, unforeseen changes can be expected to cause greater differences between calculated and constructed facility dimensions.

This section describes the physical facilities required to adequately accommodate the forecast aviation demand for an airport serving the Tribe, and the methodologies used to calculate these facility requirements. Methodologies blend the forecast aviation demand presented in Section 4, with planning criteria contained in FAA documents and other references on airport planning. The actual planned size of system components is described in subsequent sections, and delineated on several airport plans accompanying this report.

Detailed facility requirements and methodologies follow the summary of calculated facility requirements. Facility requirements are grouped by airside and landside, and in the latter case, by general aviation and airport support. An additional element entitled "Operational Support" is presented to provide the airport operator with a guide for day-to-day operations, based upon observation of similar airports.

5.1 AIRPORT REQUIREMENTS SUMMARY

Airside system facility requirements calculated in this section identified the need for one runway throughout the long range planning period. The runway should be oriented NE/SW magnetic north. Runway length should

be 2,134 meters (7,000 feet), width 23 meters (75 feet), and pavement bearing strength should be 5,700 kg. (12,500 pounds) single wheel loading. Required air navigation aids include a rotating beacon, Medium Intensity Runway Lighting (MIRL) and a Terminal VHF Omnirange (TVOR). A summary of airfield facility requirements is presented in Exhibit 5-1.

Calculations for landside facilities indicate a maximum need for one 9-unit tee hangar for the short to intermediate-range planning period and a maximum of twelve additional units during the long-range planning period.

If the construction of tee hangars is not possible, it will be necessary to provide a like number of aircraft tiedown positions for each of the based aircraft. Regardless of which type of aircraft storage is selected, additional areas will have to be developed for itinerant aircraft tiedown/parking. For the short to intermediate-range, six itinerant positions are indicated, increasing to eleven positions in the long-range planning period.

During the short to intermediate-range planning period, the amount of activity at the airport will not justify a full time fixed base operator (FBO). However, the airport operator should plan to construct a building of 540 square feet with toilet facilities, a telephone, an office for recording fuel sales, etc., and a small waiting room for itinerant pilots and passengers. A portion of this building might also be used for display and sales of Hopi crafts. At some time prior to the end of the long-range planning period this structure should be enlarged to 1,860 square feet to accommodate increased activity. The building should be planned in such a manner that it may, with minimum modification, become a fixed base operator/general aviation terminal building.

Initial auto parking capacity should be sited adjacent to the general aviation terminal and consist of a paved area capable of accommodating

EXHIBIT 5-1

FACILITY REQUIREMENTS SUMMARY

	AIRSIDE SYSTEM			
	1976	1982	1987	1997
Airfield				
Runway NE/SW				
Length (meters)	1,219	2,134	2,134	2,134
Width (meters)	12	23	23	23
Strength (000 kilograms)	5.7S (EST.)	5.7S	5.7S	5.7S
Length (feet)	4,000	7,000	7,000	7,000
Width (feet)	40	75	75	75
Strength (000 pounds)	12.5S (EST.)	12.5S	12.5S	12.5S
Air Navigation Aids				
Approach Aids	None	TVOR	TVOR VASI-2	TVOR VASI-2
Runway Lights	LIRL	MIRL	MIRL	MIRL
Runway Marking	BASIC	NPI	NPI	NPI
Rotating Beacon	-	1,000 Watt	1,000 Watt	1,000 Watt
Operational Capacity				
Practical Annual Capacity		104,000	149,600	149,600
Practical Hourly - VFR		74	86	86
Practical Hourly - IFR		10	10	10

S - Single wheel loading

EXHIBIT 5-1
(Continued)

FACILITY REQUIREMENTS SUMMARY

	EXISTING	PLANNING PERIOD		
	1976	1982	1987	1997
Terminal Building (SF)	-	540	880	1,860
Auto Parking Spaces	-	15	24	50
Fuel Storage (gallons)	-	8,000	12,000	30,000
Aircraft Storage				
Outdoor Preference:				
Aircraft Tiedowns	5	14	21	32
Maintenance Hangars	-	-	-	1
Maintenance Hangar Spaces	-	-	-	9
Tee Hangars	-	-	-	-
Total Storage	5	14	21	41
Indoor Preference:				
Aircraft Tiedowns	5	5	6	11
Maintenance Hangars	-	-	-	1
Maintenance Hangar Spaces	-	-	-	9
Tee Hangars	-	9	15	21
Total Storage	5	14	21	41

Source: PRC - R. Dixon Speas Associates

15 automobiles. This number will increase incrementally during the latter stages of the planning periods to a requirement for 50 automobile parking positions.

During the short to intermediate-range planning period, it will be necessary to install aviation fuel storage with a capacity of 8,000 gallons. Assuming that forecast activity is achieved during the long-range planning period, the capacity should be increased to a total of 30,000 gallons. Each of these capacities is calculated to cover a one month period of peak activity. Should the demand for turbine fuel arise, it will be necessary to install a 2,000 gallon capacity facility.

5.2 AIRSIDE SYSTEM

The airside system comprises all facilities supporting the transition of aircraft between the parking apron or hangar and enroute flight. Facilities that normally support this transition are runways and associated taxiways, and air navigation aids. The succeeding analysis includes calculations for runway and air navigation aids, followed by an analysis of the terminal airspace and identification of airfield capacity.

5.2.1 Runway Requirements

Three dimensional criteria are normally specified for planning primary, parallel, and crosswind runways, these are: pavement length, width, and bearing strength. Runway requirements are calculated for general aviation airports according to the airport's projected operational role. The preceding working paper projected that the operational role of the airport for the Hopi Tribe will be "General Utility" during each of the two later planning periods.

Planning guidelines suggest that the need for a basic or general utility crosswind runway be evaluated assuming a 10.5 knot (12 mph) maximum allowable crosswind component. Further, the guidelines recommend that sufficient runways of differing orientations be planned so that the air-

port will achieve a 95 percent all-weather wind coverage. Wind coverage is that percent of the time for which operations are considered safe due to acceptable crosswind components. Information gathered from residents of the Mesa area indicate that wind direction is almost entirely southwest to northeast. The orientation of Runway 4/22 at Polacca Airport and the growth of vegetation supports this observation. Accordingly, it is assumed that this orientation will provide 95 percent or better wind coverage with a maximum crosswind component of 10.5 knots (12 mph), and that a crosswind runway will not be required.

Runway requirements for planning basic and general utility airports are calculated using the FAA publication "Utility Airports Air Access to National Transportation". The publication contains runway length curves for determining the required runway length, based on the airport's operational role, elevation, and normal maximum temperature during the hottest month of the year. Runway lengths calculated with this publication insure that sufficient length will be available for the critical aircraft during the time of year when aircraft performance is poorest. The elements used in determination of runway length for the Mesa area are: elevation - 1,676 meters (5,500 feet) above mean sea level, and mean maximum temperature of the hottest month (July at Winslow) 34.3°C (93.7°F). The calculated requirements are illustrated in Exhibit 5-2.

5.2.2 Air Navigation Aids

Air navigation aids directly affecting airport operations can be classified as either a transition or approach aid. Transition aids provide guidance to pilots during the period of transition from departure to enroute, and enroute to approach phases of flight. Approach aids provide guidance during the approach to landing, and are often used for departure guidance.

Transition aid requirements of pilots operating aircraft into and out of the Mesa area cannot be met by existing facilities in the region. The existing Polacca Airport is situated in a location virtually devoid of distinguishing landmarks and pilots unfamiliar with the region may

EXHIBIT 5-2

RUNWAY REQUIREMENTS

	PLANNING PERIOD			
	1976	1981	1987	1997
RUNWAY 4/22				
International System of Units				
Length (meters)	1,219	2,134	2,134	2,134
Width (meters)	12.2	23	23	23
Strength (000 Kilograms [S])	5.7 (EST.)	5.7	5.7	5.7
U.S. Customary Units				
Length (feet)	4,000	7,000	7,000	7,000
Width (feet)	40	75	75	75
Strength (000 pounds [S])	12.5 (EST.)	12.5	12.5	12.5

[S] - Single wheel loading

Source: PRC - R. Dixon Speas Associates

experience difficulty locating the airport during clear weather. The nearest Very High Frequency (VHF) navigation aid is a BVORTAC* at Tuba City, 40 nautical miles west-northwest. Two other VHF navaids exist; at Winslow 57 n.m. south, and at Flagstaff, 78 n.m. southwest. None of these offer a viable non-precision approach. Due to extreme distance and intervening topography, the electronic signals from each of these facilities is degraded to the point that none is usable.

Analysis of available weather records for Flagstaff-Pulliam Airport, 78 nautical miles southwest of the Mesa Area, revealed that weather conditions of 300 foot ceiling and 3/4 mile visibility occurred 157 hours annually. Since no data are available regarding Mesa Area weather, it is assumed herein that the foregoing conditions are applicable to the Mesa Area. The Hopi Tribe has historically utilized Polacca Airport during emergencies involving transportation of sick or injured people to the nearest medical facilities. It is reasonable to expect that this practice will continue. Due to the remote location of the Mesa Area with respect to navigational aids, the airport could be considered unusable for 157 hours each year, during which time one or more medical emergencies might be expected to occur.

Although the forecast annual instrument approach count does not meet the minimum required for a Terminal Very High Frequency Omnidirectional Range, or TVOR, (200 annual instrument approaches) it is not possible to utilize other navigational aids in the region for a non-precision approach to a Mesa Area airport. Therefore, it is reasonable to assume, due to the emergency nature of certain aircraft operations and other reasons cited above, that justification exists to support establishment of a TVOR at the Mesa Area airport.

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* BVORTAC

B = Scheduled Broadcast Station (weather)
VOR = Very High Frequency Omnidirectional Radio Range
TAC = Ultra High Frequency Navigational Facility - Distance Information

Prior to the 1987 planning period, the Mesa Area airport will meet requirements for installation of a VASI-2 (two box visual approach slope indicator), which are: (1) a lighted runway (2) 5,000 or more annual landings, and (3) no large turbojet aircraft operations. This unit enhances approach safety during visual approaches.

5.2.3 Airspace Analysis

An airport's airspace is analyzed with respect to two primary concerns: interaction with surrounding airports and obstruction clearance requirements. The former concern, interaction with surrounding airports, occurs when the airspace reserved for aircraft arriving and departing one airport must be shared with airspace reserved for aircraft arriving and departing another airport. Further, this interaction is categorized as occurring during either IFR (Instrument Flight Rules) weather conditions or during VFR (Visual Flight Rules) weather conditions. The airspace interaction can determine a particular airport's capacity by controlling the number of airfield arrivals and/or departures.

Two airports exist (one a private facility) at a distance of 18.5 nautical miles from Polacca Airport; Rocky Ridge (private) to the north-northwest and Low Mountain to the northeast. The only other nearby airports consist of Pinon Airport, 21 n.m. north-northeast, and Toyei Airport, 25 n.m. east-southeast of Polacca. Each of these is a low activity facility, and there is no airspace interaction.

Perhaps the primary deterrent to the free use of airspace in the Mesa Area is a training route utilized by the U.S. Air Force and U.S. Navy. This route is known as the Holbrook "Olive Branch" Route or Holbrook OB-20. An Olive Branch Route is a training route used by USAF and USN jet aircraft in both VFR and IFR weather conditions from the surface to the published altitude. Holbrook OB-20 is a north-south route 8 n.m. wide, the center of which passes 15 n.m. west of Polacca Airport at a maximum altitude of 8,300 feet MSL, or 2,800 feet above Polacca Airport.

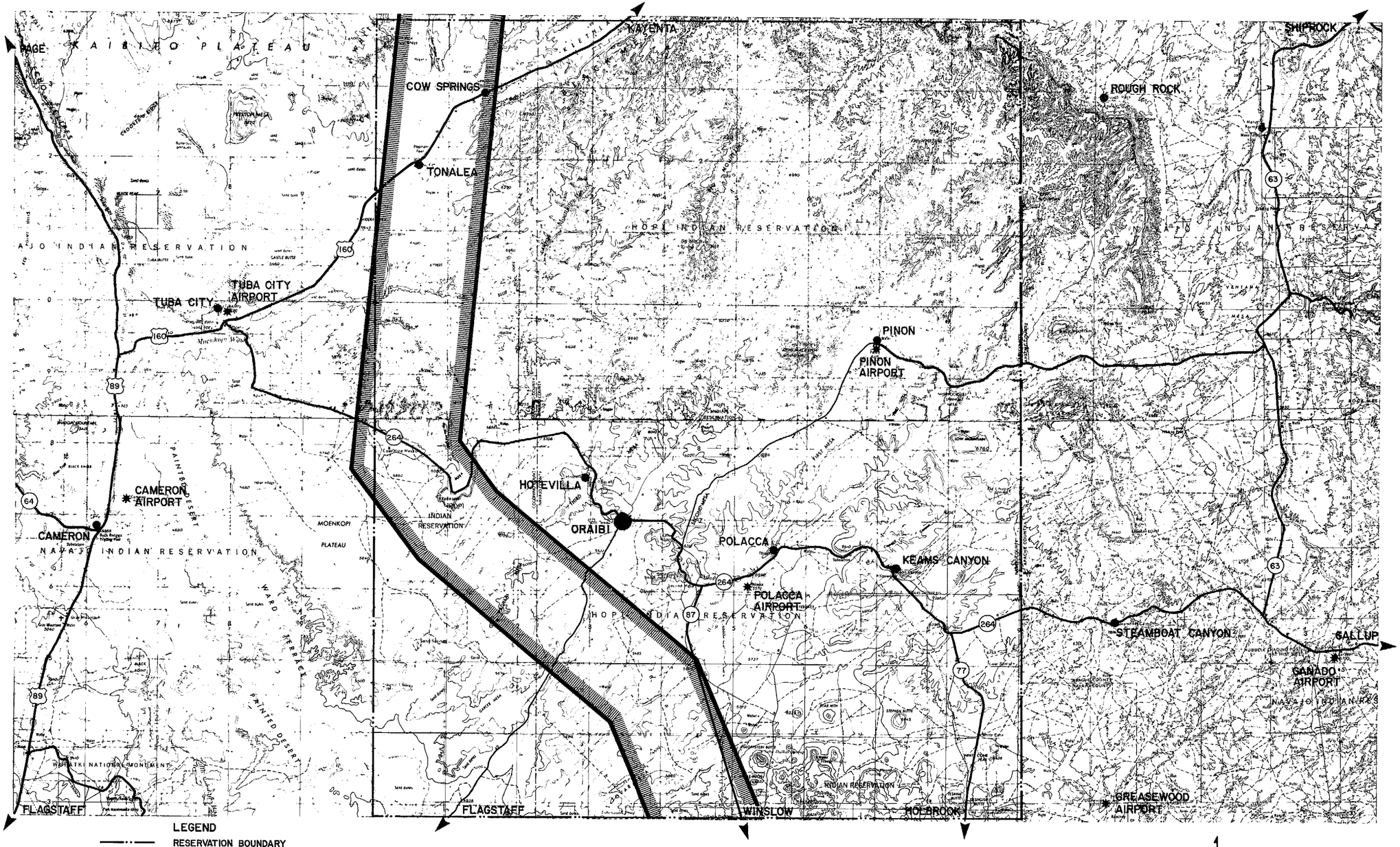
Hours of operation for Primary Penetration are 24 hours daily, 7 days per week. Alternate Penetration occurs from 0200Z through 1600Z and from 1900Z through 2300Z daily, 7 days per week. Exhibit 5-3 indicates the extent of Holbrook OB-20 in the Mesa Area.

5.2.4 Airfield Capacity

Capacity of an airfield is measured by the number of aircraft movements (takeoffs and landings) that can be accommodated, assuming an average tolerable level of delay. The assumption used in this study is: airfield capacity is reached when delays to aircraft departures average two minutes during the two adjacent peak hours of the week. The requirement for additional airfield capacity is identified by comparing the estimated long-range capacity of the initial airfield, to the forecast of aircraft movements. Both hourly and annual demand/capacity comparisons are made to determine any required taxiway and runway improvements. Capacities are calculated using the Airport Capacity Handbook.[1/]

The airport's long-range airfield capacity is estimated based on an analysis of the runways, taxiways, and instrument approaches. Factors having a major effect on the calculation of airfield capacity include average weather conditions, airspace constraints, and the forecast type of aircraft activity. The assumptions for the calculation of the Mesa Area initial airfield long-range capacity are presented in Exhibit 5-4.

Given the assumptions presented in Exhibit 5-4, the VFR Practical Hourly Capacity (PHOCAP) was calculated to be 86 aircraft movements, and the IFR PHOCAP was calculated to be 10 aircraft movements. Assuming that peaking will occur according to public desire, the long-range Practical Annual Capacity (PANCAP) was calculated to be 149,600 aircraft movements, and the Planning PANCAP to be 119,700 aircraft movements. The Planning PANCAP (80% of PANCAP) is the point at which the FAA recommends that additional airfield capacity becomes available for use.



No.	Revision	By	Appr.	Date

Approved
By _____
Date _____

R. DIXON SPEAS ASSOCIATES

Designed TMS
Checked MFR
Drawn TMS
Date

HOPI TRIBE
ORAIBI, ARIZONA

HOLBROOK OB-20
OLIVE BRANCH ROUTE

EXHIBIT
5-3

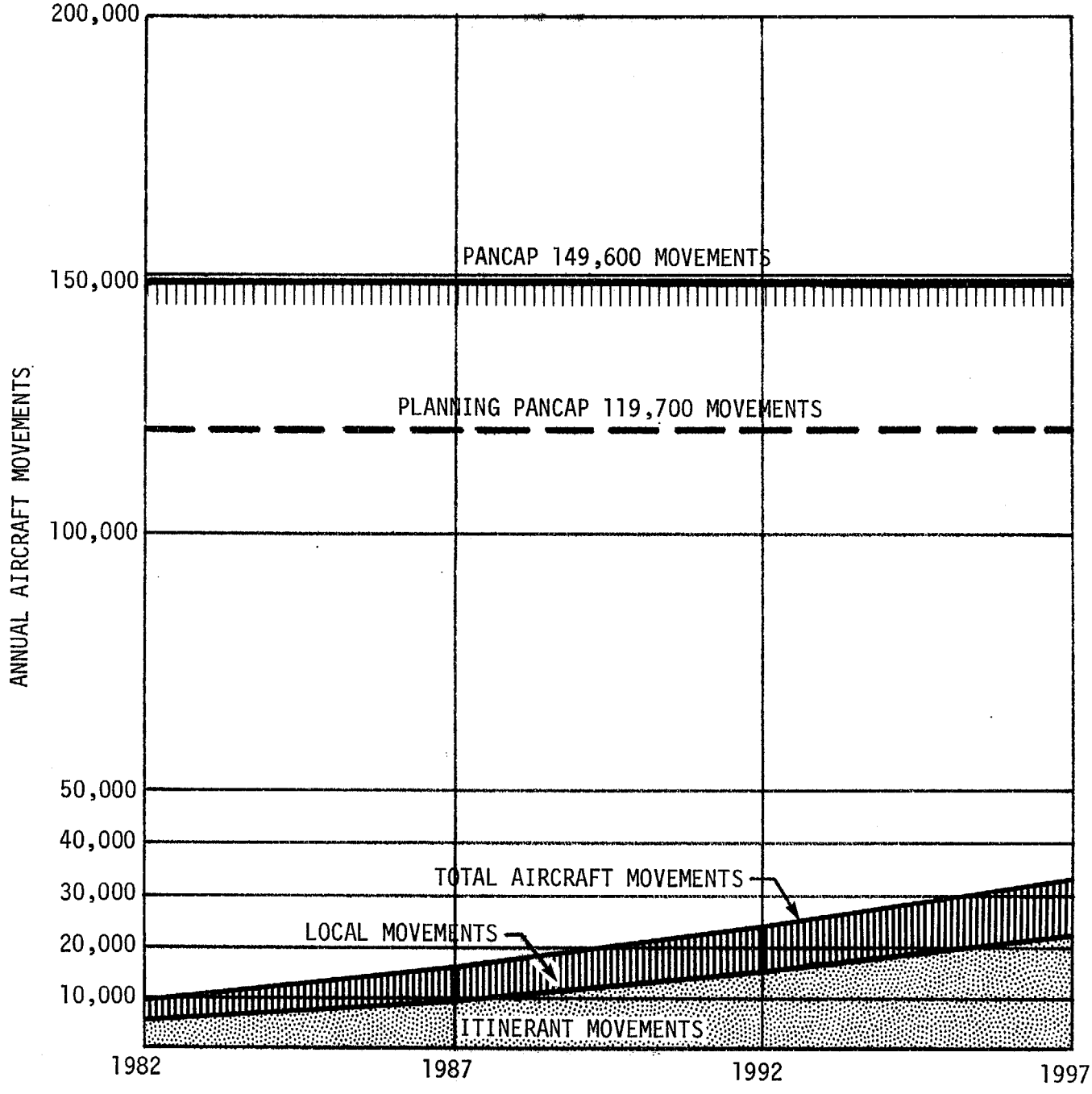
EXHIBIT 5-4

ASSUMPTIONS FOR THE
CALCULATION OF AIRFIELD CAPACITY

AIRCRAFT CLASS	1997 AIRCRAFT MOVEMENTS	1997 AIRCRAFT MIX (%)
C	2,425	7.9
D/E	30,575	92.1
TOTAL	33,000	100.0%

- TOUCH & GO ACTIVITY 9,900 30.0%
- NON-PRECISION INSTRUMENT APPROACH (TVOR)
- NON-RADAR ENVIRONMENT

Source: PRC - R. Dixon Speas Associates



Source: PRC - R. Dixon Speas Associates

R. DIXON SPEAS ASSOCIATES *Aviation Consultants*	**HOPI TRIBE** **ORAIBI, ARIZONA** AIRFIELD DEMAND/CAPACITY COMPARISON	EXHIBIT 5-5

A comparison of the forecast annual demand and the airport's long-range airfield capacity is graphically depicted in Exhibit 5-5. The illustration shows that a single runway will provide sufficient capacity to accommodate the long-range forecast demand for the Mesa Area airport, and a significant time thereafter.

5.3 LANDSIDE SYSTEM

The airport landside system is comprised of all facilities supporting the movement of passengers and goods between the community's ground transportation system and the airport's airside system, and also any facilities used in the maintenance or protection of those facilities.

The general aviation landside system is normally comprised of competing privately owned Fixed Base Operators (FBO's). The FBO's usually provide one or more of the basic general aviation services, which include: aircraft storage, fueling, maintenance, aircraft charter and rental, or flight instruction. Facilities needed to support these services include automobile parking, pilot and passenger lounges, office space, classrooms, maintenance hangars, aircraft parking aprons, and indoor aircraft storage.

In the case of the Mesa Area airport, however, justification to initiate a business venture such as a fixed base operator facility, will not exist for an indeterminate period due to the low level of forecast activity. Accordingly, one FBO has been identified in the 1988-1997 planning period as a possibility, should higher demand level be realized.

Terminal building space (pilot and passenger lounges, offices and toilets, etc.) requirements are based on relationship of area of floor space to the number of busy hour pilots and passengers. A unit figure of 49 square feet per busy hour pilot and passenger was applied. Automobile parking requirements were calculated by assuming that 1.3 spaces are needed for each busy hour pilot and passenger. The calculated terminal facility requirements are presented in Exhibit 5-6.

EXHIBIT 5-6

FACILITY REQUIREMENTS - LANDSIDE SYSTEM

	EXISTING	PLANNING PERIOD		
	1976	1982	1987	1997
Facilities Design Demand				
Total Based Aircraft	4	9	15	30
Busy Hour Transient Aircraft	1	5	6	11
Total Storage Positions Required	5	14	21	41
Busy Hour Enplanements	4	11	18	38
Terminal Building (SF)	-	540	880	1,860
Auto Parking Spaces	-	15	24	50
Fuel Storage (gallons)	-	8,000	12,000	30,000
Aircraft Storage				
Outdoor Preference:				
Aircraft Tiedowns	5	14	21	32
Maintenance Hangars	-	-	-	1
Maintenance Hangar Spaces	-	-	-	9
Tee Hangars	-	-	-	-
Total Storage	5	14	21	41
Indoor Preference:				
Aircraft Tiedowns	5	5	6	11
Maintenance Hangars	-	-	-	1
Maintenance Hangar Spaces	-	-	-	9
Tee Hangars	-	9	15	21
Total Storage	5	14	21	41

Source: PRC - R. Dixon Speas Associates

Weather conditions, investment decisions, and the attitude of local aircraft owners determine the proportion of based aircraft requiring indoor storage. As the airport develops, the latter two criteria change, usually resulting in a changing proportion of based aircraft preferring indoor storage, as opposed to outdoor. Since there is a question as to which preference aircraft owners will choose, plans are drawn such that the option exists to build a higher percentage of either indoor or outdoor storage positions. Therefore, to guide facilities planning, facility requirements are calculated assuming that a maximum of 100 percent of the based aircraft will prefer indoor storage, and that a maximum of 100 percent will prefer outdoor storage. The calculated facility requirements are presented in Exhibit 5-6. Notice that the total storage positions required under either preference are equal. Advantages of enclosed aircraft storage in the Mesa Area are obvious: due to extremes of climate, protection from the elements is a paramount consideration. A secondary, but perhaps equally important consideration, involves security against theft and vandalism, particularly during those hours when the airport is unattended. Approximately 25 percent of all aircraft storage positions should be designed to accommodate light multi-engine aircraft, the remainder for single-engine aircraft. The dimensional standards for the hangar and tiedowns are presented in Exhibit 5-7.

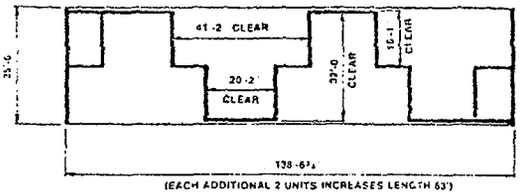
5.4 OPERATIONAL SUPPORT

Airport management and maintenance needs of the airport will not be of a magnitude requiring a full time staff. However, in order to provide required services for both local and itinerant activity, it will be necessary to establish definite hours during which a trained attendant will be available to park itinerant aircraft, clean windshields, fuel aircraft and record sales, etc. Suggested hours of operation for these services are 0700 to 1900 seven days a week. It is not anticipated that any repairs, other than very minor items requiring little skill, be offered until such time as a qualified fixed base operator establishes a facility.

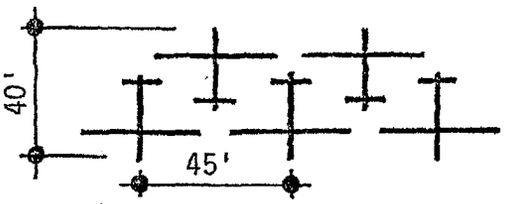
EXHIBIT 5-7

TEE HANGAR AND TIEDOWN
DIMENSIONING REQUIREMENTS

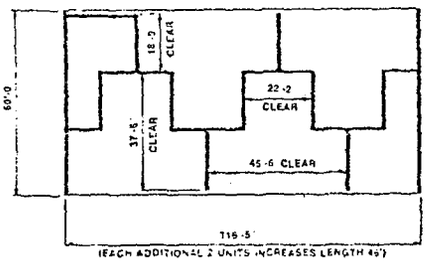
TEE HANGARS

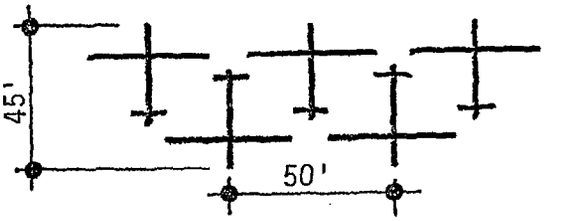


TIEDOWN LAYOUT



SINGLE-ENGINE





LIGHT
MULTI-ENGINE

In the initial state of the short to intermediate-range planning period, the proposed terminal/office/waiting room should be equipped with a public telephone and perhaps a direct line to local motels to aid arriving pilots and passengers in acquiring transportation to such facilities. The TVOR should be equipped to handle voice communications with the Flight Service Station at Prescott for weather briefing and filing flight plans.

Another suggestion in the interest of maximizing air safety is that the airport rotating beacon (Exhibit 5-1) be automatically operational from dusk to dawn and that it be manually activated during daylight hours when visibility is marginal. Runway lights should also be equipped so that they may be turned on by an approaching pilot by setting his radio to a specified frequency and depressing his microphone button. The lights may also be wired to a timer which automatically shuts off the lights, perhaps 10 minutes or so following activation, thus allowing a pilot time to land and taxi to a parking position before the lights are extinguished.