CHAPTER 5. FACILITY REQUIREMENTS

This Chapter identifies the requirements for construction of new and modification of existing airport facilities based on the Air Service Analysis in Chapter 3, the Activity Forecasts in Chapter 4, and analyses of wind, weather, runway extension, and use of Taxiway Alpha as a runway. The major sections of this Chapter are Airfield Facilities, Hangars, Commercial Facilities, and Passenger Facilities.

AIRFIELD FACILITIES

Factors that influence airfield facility requirements include:

- The forecast level of aircraft operations that determines the requirement for additional runways and taxiways.
- The forecast type of aircraft operations that determines pavement strengths and dimensional standards for the runway and taxiway systems.
- The wind analysis that determines the requirement for a crosswind runway.
- The weather analysis which, when combined with the number of aircraft operations, determines the type of approach instrumentation justified on the runways.
- The weather analysis also identifies when the demand for instrument operations is highest and lowest so runway and instrument system repairs can be scheduled to minimize disruption of aircraft operations.
- The Critical Aircraft which determines the Airport Reference Code.
- The efficiency and safety of existing facilities.

Forecasts of aircraft, passenger, and cargo activity are discussed in Chapters 3 and 4. The wind, weather, and runway capacity analyses are presented in the following sub-sections of this Airfield Facilities section. This section also analyzes the cost benefits of a runway extension and the operational and dimensional issues associated with using Taxiway Alpha as a runway during closure of the primary Runway 16-34.

WIND AND WEATHER ANALYSIS

Wind and weather data were collected and analyzed to determine runway wind coverage and to determine the types of instrument landing systems needed to meet current and future requirements. Twenty years of wind data, from January 1983 through December 2002, were analyzed. The wind data included observations every 30 minutes of wind speed and wind direction (in 10-degree increments). Ten years of weather data from January 1993 to December 2002 were analyzed. The weather data included observations every 30 minutes of ceiling height and visibility. The Fort Worth Meacham reporting station recorded the 1983-2002 weather observations. The compiled data were obtained from the National Climatic Data Center, National Oceanic and Atmospheric Administration, Asheville, NC.

Wind Analysis

The wind speed and direction data were input into the FAA Airport Design - Standard Wind Analysis program. Two runway configurations were examined. First, the wind coverage for the three existing runways - 9-27, 16-34, and 17-35 - was determined.[16] The allowable crosswind component for Airport Reference Code IV-C is 20 knots[17]. Conservative crosswind components ranging from 13 to 15 knots

[16] The two north-south runways are parallel but the Primary Runway 16-34 was redesignated from 17L-35R so pilots unfamiliar with the airport would not confuse it with the 100-foot wide parallel Taxiway A.

[17] Paragraph 203.b. AC 150/5300-13

were used for the analysis, however, because a large number of the operations at Meacham are conducted by small, single engine aircraft. Second, wind coverage for only the north-south runways was determined using the same criteria.

Wind velocities and directions can vary considerably from the averages in instrument conditions. Therefore, wind coverage under both visual and instrument conditions were calculated. Visibility and ceiling height information was collected to determine the amount of time that Meacham is under VFR (Visual Flight Rules) and IFR (Instrument Flight Rules) conditions.

Table 5-1 summarizes Meacham wind coverage for the existing runway configuration and for a north-south runway configuration under VFR and Instrument Meteorological Conditions (IMC).

Table 5-1. Percent Wind Coverage

Weather Condition	Existing Three Runway Layout	For Runways 16-34 and 17-35 Only
All weather:		
13 kt crosswind	99.9%	98.7%
15 kt crosswind	99.9%	99.5%
IMC conditions:		
13 kt crosswind	99.8%	98.3%
15 kt crosswind	99.9%	99.4%

FAA guidelines specify that the runway orientation should allow for at least 95% wind coverage during aircraft landings. The results of this study indicate that the two north-south runways provide at least 98.3% wind coverage for all weather and instrument conditions.

Weather Analysis

Meacham operates within the Class D airspace of DFW. Basic VFR weather minimums for Class D airspace[18] were used to calculate the percent time of VFR and IFR coverage. The IFR coverage was further broken down by the visibility minimums for Category (CAT) I, II, and III ILS instrumentation[19]. Meacham is currently equipped with a Cat I ILS on runway ends 16 and 34. Table 5-2 summarizes the VFR and IFR conditions experienced at Meacham. Based on the last ten years of weather observations, the CAT I ILS at Meacham provides coverage for all but 0.8 percent of total observations.

Meacham weather observations for the last ten years were analyzed by month to determine the effect of a temporary runway closure would have on landing operations. Weather observations are categorized in four categories when reported by the National Climatic Data Center lettered A, B, C, and D. Category A is all weather observations. Category B is a Visual Flight Rules (VFR) weather category that includes all weather observations that have a ceiling greater than 1,000 feet and a visibility reported greater than 3 statute miles. Category D is all weather observations that are worse than CAT I ILS landing minimums of less than 200 foot ceiling or less than ½ statute mile visibility. Meacham Airport has ILS landing minimums of 200 feet and ½ mile visibility on Runway 16 and 200 feet and ¾ mile visibility on Runway 34. Category C is the normal Instrument Flight Rules (IFR) weather category that includes all weather better than Category D but less than Category B. Therefore Category C weather observations include

[18] VFR weather minimums for Class D airspace are 3 miles visibility and 500 feet below or 1,000 feet above and 2,000 horizontal feet from clouds while in flight.

[19] The minima for CAT I, II, and III Precision Approach Categories are identified in AC 150/5300-13, Para. 3. The minima are: CAT I – minimum decision height of 200 feet and visibility of ½ mile or Runway Visual Range (RVR) of 2400 feet (down to 1800 feet with touchdown zone and runway centerline lights); CAT II – minimum decision height of 100 feet and visibility of minimum RVR of 1200 feet; and CAT III – provides minima less than CAT II.

observations when the ceiling is less than 1,000 feet but not less than 200 feet, or the visibility is less than 3 statute miles but not less than ½ statute miles.

Table 5-2. Meacham Visibility Percentages

Weather Condition	Total Observations
VFR	90%
Total IFR	10%
ILS Cat I	9.2%
ILS Cat II	0.5%
ILS Cat III	0.3%

The data analyzed includes all reported observations from January 1, 1993 to December 31, 2002. Observations are generally reported every 30 minutes for 24 hours per day. However, not every 30-minute period is covered as data can be lost or not reported for a variety of reasons. Also no attempt was made in the analysis to separate daytime and nighttime observations. The observations in the Category A, all weather, Category C, IFR, and Category D, less than Cat I landing minimums, are reported by month in Table 5-3.

Table 5-3. Meacham Airport Statistics of 10 years of Half-hourly Weather Observations

	Total Observations	Number of CAT I Observations	Average Number of CAT I Hours/Month	Number of CAT II & III Observations	Average Number of CAT II & III Hours/Month
January	14,227	1,596	79.8	269	13.45
February	13,045	1,258	62.9	89	4.45
March	14,309	1,037	51.9	66	3.30
April	13,857	552	27.6	23	1.15
May	14,309	574	28.7	3	0.15
June	13,672	257	12.9	12	0.60
July	14,192	109	5.5	0	0.00
August	13,877	184	9.2	2	0.10
September	13,546	414	20.7	10	0.50
October	14,269	1,029	51.5	60	3.00
November	13,680	1,027	51.4	149	7.45
December	13,956	1,616	80.8	216	10.80

From these weather observations it becomes apparent that there are very few IFR and Category D weather observations in the months of April through September. During the 10 years there were only 27 half hour observations of Category D weather for the months of May, June, July, August and September. There were no observations of Cat D weather for 10 years in the month of July and an average of 5.5 hours per month of Cat C (IFR) weather in the month. Therefore, any construction activity that would cause the airport to reduce it's IFR capacity should be undertaken during the months of April through September to reduce the probable number of hours of impact.

RUNWAY CAPACITY ANALYSIS

Airfield capacity is an important part of the airport planning process. A comparison of the demand identified in the forecasts with the airfield capacity leads to the airfield development needs. Existing capacity and forecasted capacity for ten and twenty years at Meacham were calculated.

Delay increases exponentially as the demand approaches the capacity of the runway and taxiway system (the terms "activity forecast" and "demand" can be used interchangeably). In order to decrease delay, demand must decrease or capacity increase. An airport can increase capacity adding runways and taxiways and through other facility improvements such as adding high-speed exit taxiways or installing navigational aids. Decreasing demand can be accomplished by placing restrictions on certain operations such as local operations and touch and goes (landings that touch down and then take off without stopping).

Capacity, as discussed in this report, is the maximum number of aircraft operations that an airport can accommodate in a given time without causing significant delay. The main considerations in determining capacity for an airport are the runway layout, the types of aircraft that use the airport, and weather conditions.

Runway Layout

Meacham consists of two parallel runways spaced 1500 feet apart and an intersecting crosswind runway (see Figure 2-2). By varying whether a runway is used for takeoff, landing, or both, this runway layout allows for seven use configurations under VFR conditions including simultaneous operations on the two parallel runways. In this analysis a capacity for each configuration is calculated and then the ultimate capacity is taken as the highest of those values. The optimum runway-use configuration occurs with both arrivals and departures occurring on the two parallel runways. Adding Runway 9-27 operations reduces airport capacity because it reduces the more efficient operations on the parallel runways to allow crosswind operations. Based on the Wind Analysis in this Chapter, the requirement for small aircraft to use Runway 9-27 will occur less than one-half percent of the time assuming a 15-knot crosswind limitation.

Weather has a significant impact on airport capacity. During poor weather conditions, spacing between aircraft in the air increases and runway use configuration changes. This causes capacity to decrease. Runway configuration also changes depending on wind direction. Historical climate data show that Meacham is under IFR conditions approximately 10% of the time. During IFR conditions only Runway 16–34 is open. The capacity for this configuration is less than half that of the optimum two parallel runway layout in VFR conditions.

Aircraft Classification

The type of aircraft and the frequency that they operate have a great effect on the capacity of a runway system. Smaller planes operate closer together and thus can conduct more operations than larger aircraft. Runway 17-35 is 4,000 feet long and is primarily used for single engine aircraft under 12,500 pounds and can have a high percentage of touch and go operations when training is being conducted. An operation is classified as either a takeoff or a landing, and a touch and go is counted as two operations as it constitutes both a landing and a takeoff. Table 5-4 identifies the four classes of aircraft used for this capacity and delay analysis.

Generally, the mix of based aircraft is a good indicator of the operations mix. Thus, for capacity calculations, Class C operations are estimated to account for 27 % of the total. Based on the most recent FAA form 5010 information and Forecasts in Chapter 2, Table 5-5 identifies the classes of aircraft at Meacham used in the Capacity Analysis.

Table 5-4. Aircraft Classification Used for the Capacity Analysis.

Aircraft Class	Wake Turbulence Class	Number of Engines	Maximum Take-Off Weight (lbs)
A	Small	Single	12,500 or less
B	Small	Multiple	12,500 or less
C	Large	Multiple	12,500 – 300,000
D	Heavy	Multiple	300,000 or more

Source: FAA Advisory Circular 150/5060-5

Table 5-5. Percentage of Aircraft by Class Used in the Meacham Capacity Analysis.

Class A	54%	Single engine Cessna, Piper, homebuilt, etc.
Class B	19%	Light twin, including Beech King AirB200, Cessna Citation I
Class C	27%	Gulfstream, Falcon, Cessna Citation II, MD-80, BAE 146
Class D	0%	Widebodied aircraft, DC-10

Another factor applied to capacity analysis is the percentage of operations, which are touch and go operations. Discussions with ATC personnel revealed that touch and go operations range from 10% during colder months up to 50% in the spring and summer when training activity is greatest. Averaged through out the year, touch and go operations account for approximately 25% of activity.

Estimated Capacity of the Runway and Taxiway System

Chapter 4 presents 10-year (2012) and 20-year (2022) operations forecasts. For this analysis, a worst-case scenario was developed which included air carrier operations for the 10 and 20-year forecasts. The optimistic air carrier growth forecast from Chapter 4 was used. Based on the Air Service Analysis in Chapter 3, it was assumed that airlines operating out of Meacham would use Regional Jets, which are Class C aircraft. As a result of adding air carrier activity, Class C operations increased from 27% to 38% by 2022. Table 5-6 summarizes the capacity estimates.

Table 5-6. Airfield Capacity Estimates

Year	Hourly Capacity	Annual Service Volume
2002	145	430,000
2012	140	400,000
2022	135	390,000

Sources: Airport Capacity and Delay, AC 150/5060-5, Figures 2-1, 3-2, 3-9

With a greater percentage of large aircraft operations, as would be the case with passenger service, capacity would decrease. The analysis was performed to determine if sufficient runway capacity exists to accommodate forecast activity. Therefore, the analysis is more conservative if the runway system capacity is estimated on the low side using larger aircraft, and less touch and go activity. The conclusion reached indicates that the hourly capacity and the estimated annual service volume of the runway system are less than the forecast requirements. Therefore, no additional runways are required to meet the long-term forecast.

RUNWAY 16-34 REPAIR, SHOULDER, AND SAFETY AREA REQUIREMENTS

Strengthening Runway 16-34

The *Review of Preliminary Engineering Report*[20] concluded that results of nondestructive testing (NDT) indicate a generally stiff pavement system. Visual observation reveals little discernible change from conditions observed in 1991. The generally good surface condition of the runway pavement is attributable to the following factors:

- A very strong cement treated base (CTB) layer;
- A relatively high strength, unreinforced Portland Cement concrete (PCC) surface layer;
- Actual flexural stresses that likely have been well below the original working stress design, except for a brief period of time during Page Avjet MRO operations; and
- High level of effective maintenance by Airport Operations (City of Fort Worth).

As a result, the City of Fort Worth has a fully depreciated and still highly useful asset in Runway 16L-34R. However, because the unimproved, 27-year pavement is relatively old by performance comparisons and current design standards, future performance is a justifiable concern.

The RDD testing did identify high deflections in the southern 2,000 feet of the Runway and in the northern 1,000 feet. These findings are also reflected in TxDOT's 2002 Pavement Condition Index observations which identify some pavement sections with PCI's ranging from 55 to 77 at the southern and northern ends of the runway (see Appendix A). Even with these lower observations, the TxDOT observations in 2002 produced an overall average PCI of 89 – a relatively good rating.

Two sets of transverse profiles were taken during the RDD testing. The transverse profile at Taxiway A-1 (in front of the Spirit hangar) showed good load transfer between pavement lanes while the profile at Taxiway A-5 (the angled taxiway west of the T-hangars in the "Hole") showed poor load transfer between lanes. The RDD readings for paving Lane A (west side of the Runway) and Lane C (the center-west lane) were also interpreted as representing poor load transfer among lanes. Based on these findings, the Report concludes that:

- – The lime treated subgrade and cement treated base are in good condition and to the extent possible should not be disturbed in the rehabilitation process.
- – Should keel section replacement be warranted based upon projected traffic and lifecycle costs, the keel section should be replaced in the south end for the first 2000 feet and on the north end for the first 1000 feet.

Runway Safety Area

The present Runway Safety Areas (RSA's) off both ends of Runway 16-34 do not provide the 1,000 feet of cleared and graded area capable of supporting the "…occasional passage of aircraft" identified for Design Group IV aircraft in Section 305 of FAA Advisory Circular 150/5300-13. Funding for the needed Safety Area improvements has already been reserved by FAA and TxDOT. Because FAA requires the RSA to meet their dimensional standards, the RSA improvements are identified in the short-term program of the Capital Improvement Program presented in Chapter 6.

South Security Road

The *Review of Preliminary Engineering Report* states: "With the grading modifications to the safety area for Runway 34R, the addition of a security road which is outside of the runway safety area was considered. …The security road would allow vehicular traffic to traverse from the east side of the airport property to

[20] DMJM Aviation, *Review of Preliminary Engineering Report for Runway 16L-34R*, October 3, 2001.

the west side without crossing the runway and without interfering with runway operations." This security road is included in the Capital Improvement Program in Chapter 6.

EXTENSION OF RUNWAY 16-34

Currently, Spirit Airlines is overhauling MD-80, Airbus 320, and some B-727 aircraft in it's Meacham facility. Spirit has recently taken on contract maintenance for other airlines so could see other aircraft types in the future. Spirit recently discussed extension of the runway with the airport staff. The practicality of extending the Runway is addressed in this section.

In "Review of Preliminary Engineering Report"[21], DMJM Aviation indicated that it was feasible to extend the runway an additional 500 feet to the south. However, the analysis of aircraft performance in Table 6.1 of that report did not indicate that the extension would be justified. Revisiting this analysis has indicated that the density altitude during summer time operations routinely exceeds 2,000 feet and can exceed 3,000 feet during very hot days. The maximum density altitude that Meacham Airport would expect to see would be about 3,500 feet. Evaluating the last 10 years of weather data for Meacham, the highest calculated density altitude during that time was 3,462 feet, occurring on July 12, 1998.

It was considered during the Runway Safety Area development phase that 500 feet of stopway could be built with less than full strength pavement and would result in increased takeoff capability for hot days with little cost. However, the current FAA declared distances standard would only increase the Accelerate Stop Distance (ASD) for the stopway if the runway still provides additional 1000 feet of runway safety area beyond the stopway. Therefore, the additional 500 feet of takeoff distance can only be realized if the grading for the runway safety area continues for 1500 feet south beyond the existing end of Runway 16-34.

The MD-80, Boeing Business Jet, and B-737

Aircraft performance was investigated for the MD-80 family of aircraft and the Boeing Business Jet aircraft. The effect of increased density altitude compared to a standard day is very significant. Calculations for one model of the BBJ shows that the FAR Takeoff Runway Length Requirement for a fully loaded aircraft on a dry runway increases from 7,800 feet to 9,500 feet for a density altitude of 3,500 feet.

Since a 9,500-foot runway is not likely or justified at Meacham at this time, operators of such aircraft will chose other airports or reduce the gross weight of takeoff, or wait until the temperature gets cooler in the day. The same model of BBJ on a 7,500-foot runway at Meacham can reduce its maximum gross takeoff weight from 171,000 pounds to 167,000 lbs on a standard day at 710 feet of altitude. If the worst condition of 3,500 feet density altitude were to occur, the gross takeoff weight must be reduced to 157,000 pounds. The reduction of Max TO weight is 4,000 lbs or 2.3 % on a standard day or 14,000 lbs or 8.2 % for the worst condition. The weight reduction must either be taken off in the form of fuel that reduces range, or payload that reduces passengers or cargo. The 4,000 lb payload or fuel reduction equates to approximately 11% payload or 11% useable fuel reduction and the 14,000 lb reduction equates to a 39% payload or 39% useable fuel reduction.

Increasing the FAR takeoff distance to 8,000 feet will recover some of this reduction but not nearly all of it. The 500-foot increase benefits the BBJ and many aircraft not just during the few hottest days of the year, but possibly for as much as 8 months of the year. The amount of gross take off weight gained by increasing the runway takeoff length to 8,000 feet varies for each model of aircraft and with various flap settings, temperature, dew point, and density altitude combinations. Estimating its effect on the BBJ aircraft equated to a 6,000 to 8,000 pounds gain and about 3,000 to 4,000 pounds gain for the MD-80 family of aircraft.

[21] DMJM Aviation, "Review of Preliminary Engineering Report", October 3, 2001

Figure 5-2. Direct Travel Range from Fort Worth to USA Destinations

Tables giving Density Altitude versus Maximum Takeoff Weight for the BBJ family, the MD-80 family, and for the B-737 family are shown in Appendix C. Note in those tables that the BBJ has such good long-range performance that the difference between a hot day at 7,500 and 8,000 feet runway length at 3,000 feet density altitude is only a range reduction from 2,700 nm to 2, 200 nm at maximum payload. As shown in Figure 5-2 above, based upon flight distances to New York, Miami, Seattle, and Los Angeles, the range of the BBJ to continental US destinations would not be affected. Shorter range aircraft such as the B737-300, 400, and 500 series would be more adversely impacted. At 3,000 feet density altitude the range of the B737-300 would be extended from 1,000 nm to 1,200 nm if the runway were extended from 7500 feet to 8,000 feet.

Cost of Extension

There is the possibility that Runway 16 could be extended 500 feet to the south either as full strength pavement or stopway to provide additional accelerate stop distance (ASD) to accommodate the request for additional takeoff length during hot weather (southerly wind) operations. A project is proposed to grade the south end of the runway to meet new requirements for 1000 feet of RSA graded at a maximum of –5% slope. The amount of fill required for the 1000 foot RSA would be approximately 377,395 cubic yards. The amount of fill required if the stopway or full strength pavement is extended 500 feet and 1000 feet of RSA is graded beyond the extension is roughly 480,943 cubic yards. The difference in cost would be approximately 104,000 cubic yards of additional fill at between 5 and 10 dollars per yard. The cost of the extension, not including the pavement surface, would be in the neighborhood of ½ to 1 million dollars for earthwork.

Conclusions

Most aircraft will not benefit significantly from increasing the runway takeoff length from 7,500 feet to 8,000 feet. The aircraft most likely to benefit significantly from the 500 foot increase would be older version, twin jets such as B737-300, MD-80 family, and older version midrange business jets such as Falcon 20 and the Lear 25. The short range business jets will not need the additional runway, and the very long-range business jets such as the BBJ and Gulfstream V will be able to reach the entire continental U.S. on the available runway even on very hot days. Mid sized cargo jets may be significantly impacted, but they are not encouraged to operate from Meacham Airport.

Regional jet aircraft in the 37-50 passengers size should have no problems operating from Meacham even in hot weather conditions. However, new aircraft such as 70-100 passengers regional jet aircraft may gain some advantage by having the runway extended 500 feet.

In the absence of potential scheduled airline service using full sized jets, or 100 seat passenger jets, there appears to be no significant advantage for the general aviation population to extend the runway an additional 500 feet based upon flight destinations to the continental United States.

TAXIWAYS

The activity forecasts in Chapter 4 do not justify significant modification of Meacham's runway/taxiway system to increase capacity in the planning period. Taxiway modifications and improvements are needed to:

- Provide orderly, efficient access to the hangar areas on the east and west side.
- Minimize opportunities for runway incursions and conflicts between taxiing aircraft.
- Clear up the disorderly taxiway system between the east building areas and Taxiway Alpha.
- Meet clearance standards around navaids.
- Provide clearance for Design Group III aircraft into the FBO aprons and for Design Group IV aircraft into the industrial/commercial areas.

Second East Side Parallel Taxiway

A way to address the requirements for orderly, efficient access to the east building areas; clear up the disorderly taxiway system east of Taxiway Alpha; and reduce opportunities for conflicts between taxiing aircraft would be to preserve the space to build a second parallel taxiway or taxilane east of Taxiway Alpha. The dual parallel taxiway/taxilane would be used when aircraft need to taxi in opposite directions when accessing or departing from the east hangar and terminal area. Such a taxiway/taxilane could serve the additional functions of defining the western edge of the east side aircraft parking aprons; restricting buildings from encroaching on Taxiway Alpha clearances when Alpha is used as the alternate primary runway; and serving as a parallel taxiway to Alpha when it is used as a runway.

West Side Parallel Taxiway

As more hangars are built west of Runway 16-34, it would be desirable to have a parallel taxiway on that side of the Runway. Initially it should be a part parallel taxiway to the south runway end and could be extended to the north end when additional building areas are opened on the west side or when activity increases to warrant the additional taxiway capacity. The two stub taxiways from hangars west of the runway and any connecting taxiways from new west side hangars would then connect to the parallel taxiway thus minimizing opportunities for runway incursions.

Bypass Taxiways

There is currently a proposed project to provide bypass taxiways at each end of Taxiway Alpha and eliminate the taxiway bulbs that extend beyond the runway ends. Figure 5-3is a sketch of the proposed bypass taxiway at the north, Runway 16 end, which is approximately 160 feet by 600 feet. This proposed project was developed when FAA began discussing elimination of all aircraft holding and taxiing in the Object Free Area for a Precision Approach. FAA may not adopt this requirement so other, less costly alternatives, including the current configuration, should be investigated to provide queuing aircraft the ability to pass each other at the taxiway ends.

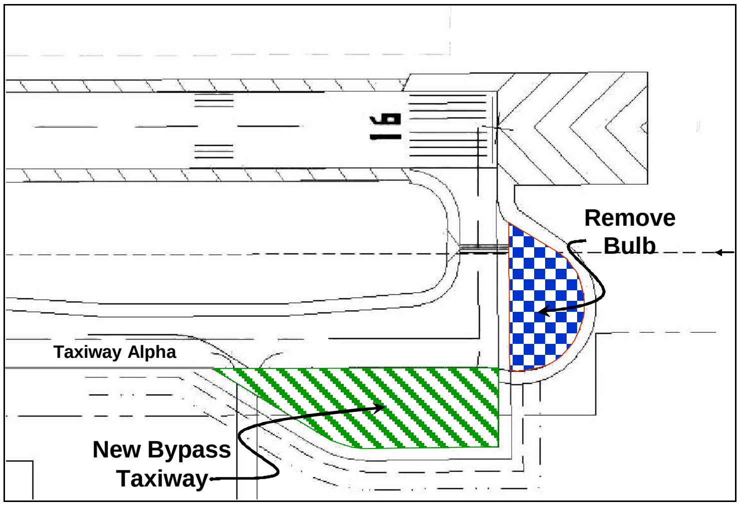

Figure 5-3. Proposed Bypass Taxiway at the Runway 16 End.

Taxiway Separation Standards

The IEC complex discussed in the Commercial/Industrial Facilities section of this Chapter will require access taxiways for specific Design Group IV aircraft. It will not be practical to provide Aircraft Design Group IV clearances for taxiways and taxilanes in all building areas. It would be desirable, then, for other commercial/industrial facilities servicing Design Group IV aircraft to be located adjacent to these taxiways. It would also be desirable to preserve Design Group III clearances on the taxiways and taxilanes providing access to the Sandpiper, Trajen, and Texas Jet transient aprons and to a new FBO apron on the west side if ever developed. Currently there is only one Design Group III aircraft permanently based at Meacham. It is likely that there will be more Group III aircraft (with wingspans between 79 and 118 feet) based at Meacham. This Plan needs to identify the best area(s) on the airport to locate taxiways and storage hangars for these larger business aircraft.

TEMPORARY RUNWAY OPERATIONS ON TAXIWAY ALPHA

In the 1992 Master Plan Update conducted by TC&B Aviation (now DMJM Aviation), Taxiway Alpha was proposed at 75 feet wide as the major airfield improvement to reduce taxiing congestion and accommodate proposed B-747 aircraft for Page Avjet. However, Page Avjet never did maintenance work on B-747 (Group V) aircraft, but did do maintenance work on DC-8 (Group IV) aircraft.

The normal taxiway width for Aircraft Design Group IV or V is 75 feet. However, Taxiway Alpha was not constructed at a 100-foot width to meet aircraft design Group VI specifications. The increased width was justified on the basis that the taxiway could be used as a temporary runway if Runway 16-34 were closed for reconstruction. The decision to build at a 100-foot width was made during the engineering design of the Taxiway Alphas as described in the 1995 report published by Poe Engineers, Inc.

In 2002, Taxiway Alpha was completed 400 feet to the east and parallel for the entire 7,500-foot length of Runway 16-34. Soon after Taxiway Alpha was opened for operations, it became a magnet for unintended landings because the appearance and size of the taxiway is often mistaken for a runway. Over a dozen unintended landings took place on Taxiway Alpha during the first year of operation. Fortunately, no incidents or accidents resulted from these occurrences.

Because Taxiway Alpha has been developed as a temporary runway, the dimensional requirements for it to serve that purpose will be addressed in Chapter 6.

NAVIGATION AIDS

Chapter 2 provides a complete description of the existing navigation aids at Meacham Airport. Table 5-1 lists the precision and non-precision approach minima existing at Meacham. Notice in the table that there are two differences in landing minima between Runway 16 and Runway 34. Runway 34 would be the predominately used runway during winter months when winds are out of the north and the weather is more often IFR than summer conditions. However, Runway 34 has a ¾ mile minimum visibility requirement for the ILS DME approach while Runway 16, which has a MALSR approach lighting system, has a ½ mile minimum visibility requirement. Also notice that for aircraft with approach category C (landing approach speeds from 121 to 141 knots) that on the non-precision GPS approach, Runway 34 has a 1 ¼ mile minimum visibility while Runway 16 has a 1 mile minimum visibility requirement.

The visibility minimums for the precision approach to Runway 34 could be reduced to ½ mile by installing 2400 feet of Runway Alignment Indicator Lights (RAIL) on the existing Medium Intensity Approach Lighting System (MALS). The airport property south of the Runway 34 threshold extends to approximately 1800 feet. Beyond that distance is public street right of way and residential buildings. The RAIL would extend the approach light lane 2400 feet south of the threshold. The Runway Protection Zone would also increase to 2,500 feet in length if the landing minimums are reduced to less than ¾ miles visibility. Therefore, this alternative is feasible only if the new Part 150 Study (see page 7-4).

Table 5-7. Landing Minima of Instrument Approaches Available at Meacham

Runway	Precision or Nonprecision	Type Approach	Visibility Minimums
Runway 16	Non Precision	NDB or GPS RWY 16	A & B: ¾ mile C: 1 mile D: 1.5 miles
Runway 34	Non Precision	GPS RWY 34	A & B ¾ mile C: 1 ¼ mile D: 1.5 mile
Runway 16	Precision	ILS DME with MALSR	½ mile
Runway 34	Precision	ILS DME with MALS	¾ mile

A full Benefit-Cost Analysis is not required to justify the installation of MALSR to reduce landing minimums. Fortunately because of the relatively good weather in Fort Worth, the decision to install ILS equipment is often based on safety and operating improvements. Meacham Airport is attracting the number and type of corporate business aircraft that wish to use the airport in all weather conditions. Therefore, the percentage of weather observations that the installation of the MALSR would allow and aircraft to land at Meacham was analyzed in detail.

Table 5-8 lists the weather observations by month in several categories. Column 1 represents those observations below ½ mile when aircraft cannot land at Meacham. Column 2 represents those times when the visibility is between ½ and ¾ miles – those observations when an aircraft could land with the MALSR. Column 3 represents minimums between ¾ and 1 mile when aircraft can land using the current ILS instrumentation on Runway 34.

Table 5-8. FTW Weather Observations by Month 1993-2002

	Visibility in statute miles						
MONTH	0 to ½	½ to ¾	¾ to 1	0 to 1.0	All IFR	All VFR	Total Obs
JAN	119	81	96	296	1663	6722	8385

	Visibility in statute miles						
MONTH	**0 to ½**	**½ to ¾**	**¾ to 1**	**0 to 1.0**	**All IFR**	**All VFR**	**Total Obs**
FEB	22	26	60	108	1008	6537	7545
MAR	26	49	72	147	1330	7243	8573
APR	6	21	21	48	574	7418	7992
MAY	2	21	27	50	607	7808	8415
JUN	3	17	12	32	321	7642	7963
JUL	7	10	9	26	135	7530	7665
AUG	0	6	6	12	187	7229	7416
SEP	3	3	9	15	343	7268	7611
OCT	29	42	57	128	1086	7484	8570
NOV	70	44	72	186	1189	6918	8107
DEC	85	55	96	236	1352	6899	8251
TOTALS	372	375	537	1284	9795	86698	96493

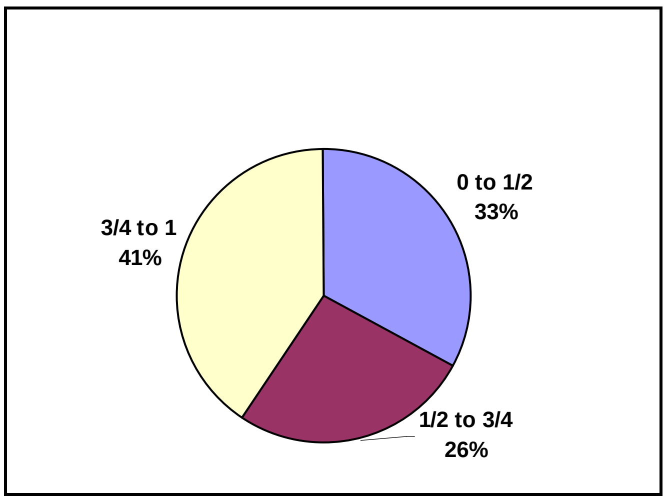

Figure 5-4. Distribution of FTW November-March Weather Observations With 1 Mile or Less Visibility.

Based upon this distribution, 41% of observations of 1 mile or less visibility can land on Runway 34 using the ILS with the current ¾ mile minimum visibility. The MALSR installation would reduce the minimum visibility to ½ mile and allow an additional 26% of the observations to land. Aircraft would not be able to land during the remaining 33 % of observations. Previously, Runway 34 did not have an ILS installed. If FAA considered the installation of the ILS justified for the 41% of observations of less than 1-mile visibility from November to March, then it could also consider the justification of the additional 26% of observations. The additional cost of the MALSR installation provides a benefit of reducing the number of weather observations in November to March that aircraft can't land by 44%. Assuming all weather observations in the category are recorded hourly, the airport would be open for landings an additional 255 hours in the 10 year period. Pilots and FBO operators at the airport are supportive of this improvement. Based upon the forecast growth of business travel, the expense seems to be justified for the benefit gained. Because the existing MALS would be removed during the grading of the Runway Safety Area, it would be justified to be replaced with a MALSR.

HANGARS

In 2002 there were 219 aircraft based at Meacham. The forecasts in Chapter 4 suggest the number of based aircraft will grow to 251 in 2012 and 291 in 2022. Most of that growth will be in turbo-jet aircraft (business jets). Table 5-9 is a repeat of the based aircraft forecasts from Chapter 4. These “preferred” forecasts are actually the mid-range of three forecasts (see pages 4-5 through 4-8). The low-range forecast produced 264 aircraft (9% fewer) in 2022 and the high-range, 303 aircraft (4% more). It would be more realistic to talk in terms of this range, rather than a specific number, when planning for facilities in the year 2022.

The turbo-jet aircraft (business jets) that will comprise a majority of the growth in based aircraft, along with the larger turbo-prop aircraft, are usually stored in shop type hangars rather than the nested tee-hangers frequently used for the single engine and multi-engine piston aircraft. Given the limited developable land at Meacham, it will be a challenge to find space to build shop hangars for approximately 60 new business jets and turbo props by 2022.

Most of the single and twin-engine piston aircraft at Meacham are stored in the T-hangars in the Hole south of Runway 9-27. There is sufficient area in the Hole to accommodate the 12 single engine piston aircraft forecast to become part of the Meacham fleet in the future. Based on conversations with the Meacham FBO’s during the past few months, it is not likely that additional T-hangars will be built at Meacham. This Master Plan will assume that those new permanently based single and light twin-engine piston aircraft coming to Meacham through the long-term will be accommodated in the existing T-hangars, or on the tie-down areas in the Hole. There is, of course, the probability that another flight training company will locate on Meacham using single and light twin-engine aircraft. If so, the aircraft associated with that operation will likely be tied down on one of the remaining aprons north of Runway 9-27 or in a new area on the west side of the airport.

Table 5-9. Mid-range Forecast of Based General Aviation Aircraft at Meacham.

	Existing	Forecast		
Item	**2002**	**2007**	**2012**	**2022**
Single Engine Piston	119	120	123	131
Multi-engine Piston	13	13	13	13
Turbo-prop	27	28	29	31
Turbo-jet	58	74	84	114
Helicopter	2	2	2	2
Total Based Aircraft	219	237	251	291
Average Annual Growth Rate		1.5%	1.1%	1.4%

Table 5-10. Average, Total, and New Hangar Areas for Turboprops and Business Jets at Meacham.

	Actual	Forecast		
Year ð	**2002**	**2007**	**2012**	**2022**
Turboprops	27	28	29	31
Business Jets	58	74	84	114
Total Turbine Aircraft	85	102	113	145
Average Square Footage per Aircraft	3,488	3,800	4,200	5,000
Total Square Footage	296,471	387,600	474,600	725,000
Square Footage Above 2002	--	91,129	178,129	428,529

Source: Inventory of all buildings and DMJM Aviation Calculations.

A majority of the business jets at Meacham today and anticipated in the future are in Airplane Design Groups I and II with wingspans less than 79 feet[22]. Meacham's FBO's typically store two of the smaller of these aircraft (with 45 to 60-foot wingspans) in a single 100-foot by 100-foot shop hangar. There are now several new long-haul business jets in Airplane Design Groups III and IV with wingspans between 79 and 125 feet[23]. While there is only one Group III business jet based at Meacham today (a BAe 146 used for business purposes), there have been transient business jets in these Groups and there will likely be more based business jets in this size range in the future. Aircraft in this class would require a single hangar in the 10,000 to 15,000 square-foot range. Table 5-10 identifies the approximate square footage of hangars for storage of business jet and turboprops on Meacham today and the amount of additional square footage of business jet hangars needed to accommodate the based aircraft forecasts in 0. These estimates assume the vast majority of jets in the future remain in Aircraft Design Groups I and II but increase in size over the period of the forecast.

By 2022, it is estimated that a minimum of approximately 430,000 square feet of storage space for business jets and turboprops will need to be added to the approximately 300,000 square feet that exist today. Currently, several of the hangars built for aircraft storage in the FBO areas are being used for aircraft maintenance and storage of parts. The areas of these hangars are not included in the figures in Table 5-10. Space to accommodate these types of activities will be addressed in the next section.

Traditionally, hangars at Meacham have been built by individuals, fixed base operators, and other companies on land leased from the City. Those leases state that the improvements on the land (hangars, shops, etc.) revert to the City after a period specified in the lease that is sufficient to amortize the improvements. The City owns only a few hangars it has obtained through the expiration of leases and does not anticipate getting into the business of building new hangars. The initiative for development of the additional hangar space needed to accommodate all new aircraft based at Meacham will likely remain with the individual aircraft owners and the fixed base operators.

Most of the existing hangar access taxiways outside of the Hole will accommodate Design Group II aircraft. As the size of based and transient aircraft grows, it will be necessary to expand or build new hangar access taxiways to a minimum standard of Design Group III. In the future, the FBO aprons and a limited number of taxiways to a hangar/commercial area that is convenient to the fixed base operators will need to accommodate Design Group IV aircraft.

COMMERCIAL FACILITIES

Of concern in this section are those businesses working on and providing services to aircraft and requiring access to the runway/taxiway system. These include:

- Businesses performing maintenance, repair, refurbishment, and other services for aircraft. These businesses are housed in hangars frequently with offices located in or adjacent to the hangars. At Meacham, one of these businesses is an airline performing routine maintenance on its aircraft.
- Fixed Base Operators (FBO's) providing services to general aviation passengers and pilots and selling fuel and lubricants to aircraft operators. FBO's may offer limited maintenance and repair service and can refer aircraft owners to the full time maintenance/repair businesses on the airport. FBO's require large apron areas for staging of based aircraft and storage of transient aircraft.

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[22] Some typical business jet wingspans in Groups I and II include: Lear 54-55-56 Series – 43.7 feet; Rockwell Sabre 75A – 44.5 feet; Cessna Citation III – 53.5 feet; Dessault Falcon 900 – 63.4 feet; Lockheed Jetstar – 54.4 feet; Gulfstream IV – 77.8 feet.

[23] The new generation of long-range business jets in Groups III and IV and their wingspans include: Gulfstream V SP – 93.5 feet; Bombardier Global Express – 94 feet; and the Boeing Business Jet (BBJ) – 117.4 feet.

There are other aviation related businesses based at Meacham such as the FAA Flight Service Station, retail outlets for aviation supplies, and rent car operations which do not require access to the runways so they will not be discussed in this section.

COMMERCIAL/INDUSTRIAL FACILITIES

Currently, there are approximately 400,000 square feet of commercial/industrial facilities on Meacham. Most of these facilities are in the area between the passenger terminal and Runway 9-27 and east of the Runway 16 end. A number of these businesses are also located in hangars adjacent to FBO operations that could be used for jet/turbine aircraft storage. At this writing, IEC International, a company already located on the airport, is planning a new 117,000 square foot development which will replace the approximately 26,000 square feet in Buildings 6N, 7N, 8N, 9N and 10N. When complete in early 2004, the six hangars in this complex will bring the total square footage of commercial/industrial facilities to almost 486,000 square feet. IEC will operate out of three of these hangars and lease out three to another aircraft service company.

The commercial/industrial businesses are frequently large employers and occasionally have multi-shift operations. These businesses need access for large trucks delivering aircraft parts and sufficient auto parking facilities for their employees. Auto and truck access to some of these facilities today is across the aircraft aprons and taxiways. It is likely that such access will be restricted or prohibited when the Transportation Security Administration promulgates rules for general aviation airports.

Many of the commercial/industrial operators based on Meacham provide services for aircraft based at other airports. The opportunistic nature of these businesses makes it very difficult to predict the demand for commercial/industrial facilities in the future. Because they are large employers and also provide services that attract both based and transient aircraft, it would be desirable for the City to provide as many opportunities for new or expanded aviation businesses at Meacham in the future as possible. When the IEC complex is completed in 2004, about 190,000 square feet of commercial/industrial space will have been added at Meacham since 1999. Almost all of the commercial/industrial operations are located on the east side of the airport, which has better roadway access. It would be reasonable, then, to anticipate demand for an additional 400,000 square feet of commercial facilities, also on the east side, by the year 2022. While this is not a number that can be forecast, it probably represents about as much square footage that can be developed on the east side without removing needed aircraft storage hangars.

FIXED BASE OPERATOR (FBO) FACILITIES AND APRONS

Presently there are four FBO's serving transients and based aircraft at Meacham:

- Texas Jet located in Building 23N south of the industrial hangars on the northeast side of the airport. Texas Jet is the largest of the FBO's in terms of fuel sales and manages a number of hangars located throughout the airport.
- Sandpiper with offices in Building 1S, the Sandpiper Hotel. Sandpiper is the longest operating FBO on Meacham, serves many of the single and twin-engine piston aircraft on the airport, and manages a number of hangars south of Runway 9-27.
- Trajen located in Building 11N immediately north of the passenger terminal (the old American Airways hangar and offices). Trajen recently purchased the leases of Gate One and is the newest FBO on Meacham.
- Richardson located in Building 45S on the west side of Runway 16-34. Richardson sells fuel to transient and based aircraft.

Currently these FBO's provide excellent services to transients and to aircraft operators based at Meacham. With appropriate growth, four FBO's can provide the services needed by the transient operations and based aircraft forecast in Chapter 4. It may, however, be desirable for another FBO facility to operate on the west side of the airport as more hangars are built there. It is important to preserve the opportunity for these operators to grow as demand dictates. Essential to that growth will be preservation of space for new or enlarged office and passenger lounge facilities adjacent to a large apron for transient aircraft parking. The current FBO facilities have adequate space to meet today's demands but may need more transient parking space as business aircraft get larger and as more transients come to Fort Worth. Although it may be impossible to provide all the transient parking space an FBO would like to have, a reasonable goal would be development or preservation of sufficient space to park up to a dozen business jets and an equal number of light twins and turbo props. The area required for this many aircraft depends on the shape and organization of the apron, apron access taxiways, and the proportion of transients that remain long enough for their aircraft to be parked away from the FBO terminal and nested. Such an area might range from 60,000 to 90,000 square feet (6,700 to 9,300 square yards)[24]. Taxiway access to any new FBO apron should be able to accommodate Design Group III aircraft (wingspans up to 118 feet). It is also important to maintain a transient apron somewhere on the airport to accommodate the occasional Design Group IV or V aircraft that visit Meacham.

PASSENGER FACILITIES

The final sections of the Air Service Analysis in Chapter 3 suggest that the only feasible short-term market for Fort Worth is Regional Jet (RJ) service to Houston. That analysis does not offer an optimistic outlook for air service to Fort Worth and states it is not likely that any airline will seriously consider introducing new service until the current airline financial situation improves. The City of Fort Worth, then, needs to decide whether to preserve the current terminal facilities until such time as an airline is available to introduce new service at Meacham or to convert the terminal and support areas (parking, access roads, etc.) to other uses in the short term.

If the City chooses to retain the terminal area for future air service, Figure 5-5 shows that the current site is capable of accommodating an expansion of the passenger terminal to as many as nine RJ gates. Under the optimistic scenario for air service development identified in Chapter 4, them maximum number of arrivals identified in Table 4-9 is 36. The nine RJ gates in Figure 5-5 will accommodate this number of daily arrivals. The specific configuration of the new perpendicular concourse would depend on the preferred development flanking the existing terminal apron. If the taxiway serving the proposed IEC hangars is to accommodate Design Group IV aircraft, the terminal concourse must be at least 300 feet from those hangars. If it is desirable to build aircraft storage hangars north of the terminal, there must be sufficient room for the aircraft taxiing to and parking on the north side of the concourse. The present auto parking lots were considered too small for the service provided by Mesa in 1998-99. Any expansion of these lots would encroach on areas for new hangar development to the north and south. Alternatives for development of the terminal area will be discussed in Chapter 6.

[24] See AC 150/5300-13, Appendix 5 for apron sizing guidelines. The range of areas bracket the AC's general guidelines.

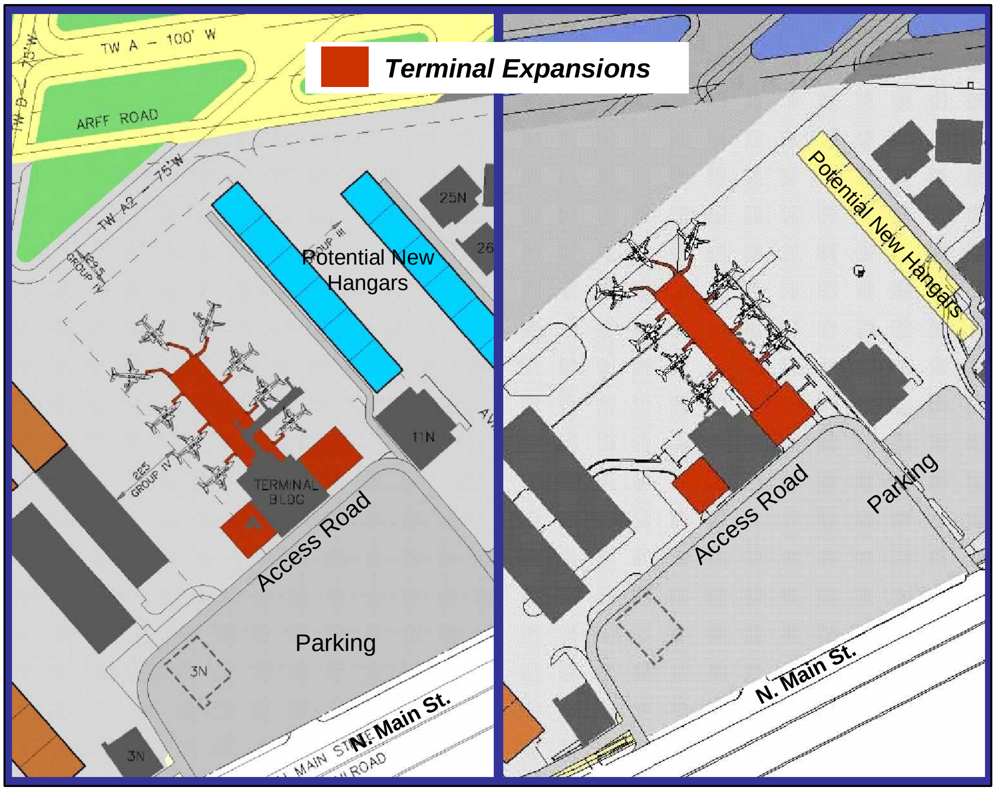

Figure 5-5. Alternate Layouts for Expansion of the Meacham Passenger Terminal to 9 Regional Jet Gates.