CHAPTER C.

Facility Requirements

INTRODUCTION. Determining an airport's future facility requirements involves translating the forecasted aviation activity into specific physical facility improvements. Therefore, the ability of existing facilities to accommodate the projected aviation demand will be assessed. If individual facilities are determined to be deficient, necessary improvements will be identified that safely and efficiently meet the requirements placed on the Airport. This chapter consists of two separate analyses: those requirements associated with airside facilities and those associated with landside facilities.

The forecasts set forth in the preceding chapter are used for establishing future requirements at Arlington Municipal Airport. However, it does not dismiss the possibility that, due to unique circumstances, either accelerated growth or consistently higher or lower levels of activity may occur. Aviation activity levels should be monitored for consistency with the forecasts and, in case of dramatic changes, the development schedule can be adjusted to correspond to actual demand, rather than be set to pre-determined dates. Over-building or under-building can be avoided by constant analysis and prioritization.

As presented in the previous chapter, an airport should be designed in accordance with a specified Airport Reference Code (ARC) based on the "Design Aircraft". FAA criteria indicate that at least 500 annual operations by an aircraft or group of aircraft are required to include the airport in the representative ARC. The primary runway at Arlington Municipal Airport, Runway 16/34, is currently designated as ARC B-II, with the current ALP reflecting a future designation of ARC C-II. Although the forecasts do not support the *substantial use threshold* of 500 annual operations of aircraft in Approach Category C or D (i.e., aircraft with approach speeds greater than 121 knots, but less than 166 knots) will materialize during the planning period, the Airport Sponsor would like to retain the option/capability to implement ARC C-II standards in the future.

Airside Facility Requirements

This section presents the analysis of requirements for airside facilities necessary to meet the anticipated aviation demand at Arlington Municipal Airport. For those components determined to be deficient, the type, size, or needed improvement are identified. Airside facilities examined include runways, taxiways, runway protection zones, and navigational aids.

Runway Orientation

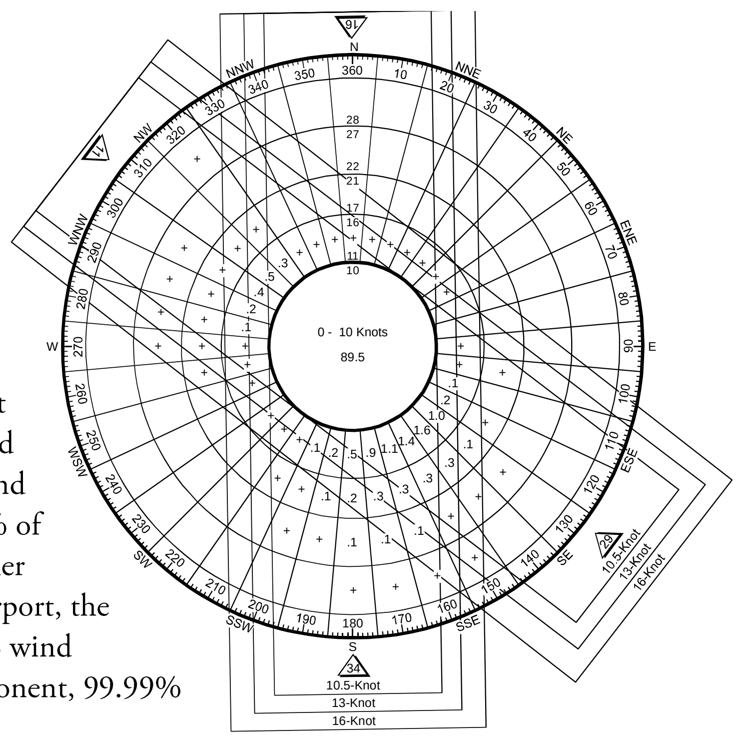
Surface wind conditions have a direct effect on the operation of an airport; runways not oriented to take the fullest advantage of prevailing winds will restrict the capacity of the airport to varying degrees. When landing and taking off, aircraft are able to operate on a runway properly and safely as long as the wind velocity perpendicular to the direction of travel (defined as the crosswind) is not excessive. The wind coverage analysis translates the crosswind velocity and direction into a "crosswind component".

The determination of the appropriate crosswind component is dependent upon the ARC, which for Runway 11/29 is B-I and for Runway 16/34 is B-II with a future designation of C-II. However, the majority of aircraft operating at the Airport are categorized within the smaller ARC categories (i.e., A-I or B-I). According to FAA Advisory Circular (AC) 150/5300-13, *Airport Design*, for ARCs A-I and B-I, a crosswind component of 10.5 knots is considered maximum, 13 knots is considered maximum for ARCs A-II and B-II, and for ARCs C-I and C-II, a crosswind component of 16 knots is considered maximum.

Accurate and timely wind velocity and direction data during all weather conditions were obtained from the National Oceanic and Atmospheric Administration (NOAA) National Climatic Data Center, which compiled the data from the Automated Weather Observing Station (AWOS-3) located at the Airport. Using this data, an all weather wind rose was constructed, which is presented in the following illustration entitled *ALL WEATHER WIND ROSE*.

Figure C1
ALL WEATHER WIND ROSE

Source: National Oceanic and Atmospheric Administration.
National Climatic Data Center.
Station 72794, Arlington, Washington.
Period of Record: 1998-2007.



The desirable wind coverage for an airport is 95%, which means that a runway should be oriented so that the maximum crosswind component is not exceeded more than 5% of the time annually. Based on the all weather wind analysis for Arlington Municipal Airport, the existing runway system provides 100.00% wind coverage for the 16-knot crosswind component, 99.99%

for the 13-knot crosswind component, and 99.95% for the 10.5-knot crosswind component. The following table, entitled *ALL WEATHER WIND ANALYSIS*, quantifies the wind coverage offered by the individual runways and the combined runway ends during all weather conditions at the Airport.

Table C1
ALL WEATHER WIND COVERAGE ANALYSIS

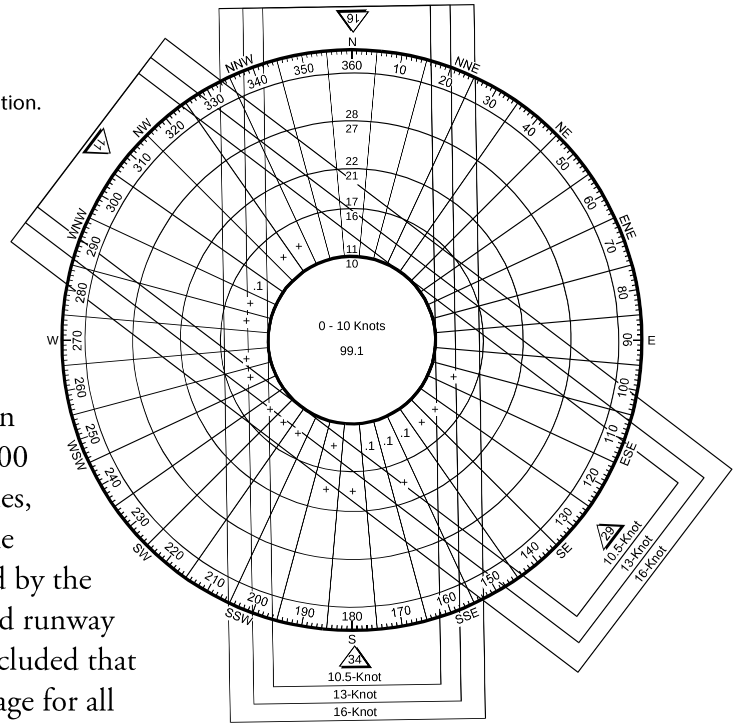
Runway	10.5-Knot	13-Knot	16-Knot
Runway 16/34	97.88%	99.40%	99.91%
Runway 16	89.25%	90.31%	90.66%
Runway 34	78.21%	78.79%	79.07%
Runway 11/29	98.78%	99.13%	99.72%
Runway 11	85.45%	86.37%	86.95%
Runway 29	80.62%	80.72%	80.82%
Combined	99.95%	99.99%	100.00%

Source: BARNARD DUNKELBERG & COMPANY analysis using the FAA Airport Design Software supplied with AC 150/5300-13, *Airport Design*.
Wind data from the National Oceanic and Atmospheric Administration, National Climatic Data Center. Station 72794, Arlington, Washington. Period of Record: 1998-2007.
It is important to note that a five-knot tailwind component was used for the individual runway end analysis.

As stated previously, the Airport currently has two published straight-in instrument approach procedures providing visibility and ceiling minimums as low as ¾-mile and 469 feet (AGL) to Runway 34. In an effort to analyze the effectiveness of these instrument approach procedures, and the need for and placement of improved or additional procedures, an Instrument Flight Rules (IFR) wind rose has been constructed and is presented in the following figure entitled *IFR WIND ROSE*. Again, wind data from the AWOS-3 has been used for the construction of the wind rose and wind coverage analysis.

Figure C2
IFR WIND ROSE

Source: National Oceanic and Atmospheric Administration.
National Climatic Data Center.
Station 72794, Arlington, Washington.
Period of Record: 1998-2007.



The following table illustrates the wind coverage analysis provided during IFR meteorological conditions (i.e., when weather conditions have a ceiling less than 1,000 feet, but equal to or greater than 200 feet and/or visibility is less than three miles, but equal to or greater than ½-mile). The table quantifies the wind coverage offered by the individual runway ends and the combined runway system. From this analysis, it can be concluded that Runway 16 provides the best wind coverage for all crosswind components. However, due to the light winds that are prevalent during these IFR meteorological conditions at Arlington, each of the runway ends would provide very good IFR wind coverage.

Table C2
IFR[1] WIND COVERAGE ANALYSIS

Runway	10.5-Knot	13-Knot	16-Knot
Runway 16/34	99.79%	99.92%	100.00%
Runway 16	96.57%	96.66%	96.71%
Runway 34	93.01%	93.09%	93.16%
Runway 11/29	99.78%	99.88%	99.99%
Runway 11	95.30%	95.38%	95.46%
Runway 29	95.31%	95.36%	95.42%

Source: BARNARD DUNKELBERG & COMPANY analysis using the FAA Airport Design Software supplied with AC 150/5300-13, *Airport Design*.

Wind data obtained from the National Oceanic and Atmospheric Administration, National Climatic Data Center. Station 72794, Arlington, Washington. Period of Record: 1998-2007.
[1] Ceiling less than 1,000 feet, but equal to or greater than 200 feet and/or visibility less than three miles, but equal to or greater than ½-mile.
It is important to note that a five-knot tailwind component was used for individual runway end analysis.

Conclusion. This analysis indicates that both Runways 16/34 and 11/29 alone can provide more than adequate wind coverage during all weather conditions; so, from a wind coverage standpoint, no additional runways are necessary. The IFR wind coverage analysis indicates that Runway 16/34 provides excellent wind coverage, and the previous planning documents have identified each runway end for new and/or improved instrument approach procedures. A more detailed examination of implementing new instrument approach procedures to Runway 16/34 will be presented in the next chapter.

Ceiling and Visibility. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, describes three categories of ceiling and visibility minimums for use in both capacity and delay calculations. Visual Flight Rules (VFR) conditions occur whenever the cloud ceiling is at least 1,000 feet above ground level and the visibility is at least three statute miles. Instrument Flight Rules (IFR) conditions occur when the reported cloud ceiling is at least 500 feet, but less than 1,000 feet and/or visibility is at least one statute mile, but less than three statute miles. Poor Visibility and Ceiling (PVC) conditions exist whenever the cloud ceiling is less than 500 feet and/or the visibility is less than one statute mile. However, meteorological data obtained for Arlington, from the National Climatic Data Center for use in this study, have been categorized in more specific terms:

- **VFR conditions:** Ceiling equal to or greater than 1,000 feet above ground level and visibility is equal to or greater than three statute miles. These conditions occur at Arlington approximately 90.9% of the time annually.
- **VFR minimums to existing non-precision approach minimums:** Ceiling less than 1,000 feet and/or visibility less than three statute miles, but ceiling equal to or greater than 500 feet and visibility equal to or greater than one statute mile. These conditions occur at Arlington approximately 3.9% of the time annually.
- **VFR minimums to potential non-precision approach minimums:** Ceiling less than 1,000 feet and/or visibility less than three statute miles, but ceiling equal to or greater than 200 feet and visibility equal to or greater than ½-statute mile. These conditions occur at Arlington approximately 5.2% of the time annually.
- **Below minimums (Existing):** These conditions occur at Arlington approximately 5.2% of the time annually.

Therefore, in consideration of the existing weather data also available for analysis from the existing Arlington AWOS-3, it can be noted that the majority of the accessibility benefit (over 84% of the potential IFR access) is provided by the non-precision instrument approach procedure offering 469-foot ceilings and ¾-statute mile visibility minimums. For these existing conditions, the Airport can be expected to experience VFR conditions approximately 90.9% of the time, IFR conditions approximately 3.9% of the time, and below minimums approximately 5.2% of the time. In consideration of the potential lower approach minimums to Runway 34, the annual percentage time for IFR conditions would increase to approximately 5.2%, and thus reduce the time the Airport would be below minimums to 3.9% of the time annually. These findings will be evaluated in consideration of the Instrument Approach Feasibility Determination that will be presented in a later section of this document to identify the appropriate instrument procedure recommendations for the Airport.

Airfield Capacity

The ability of the airside facilities (i.e., runways and taxiways) to accommodate both the existing and forecasted demand at an airport is known as airfield capacity. It is defined in the following terms:

- **Hour Capacity of Runways:** The maximum number of aircraft that can be accommodated under conditions of continuous demand during a one-hour period.
- **Annual Service Volume (ASV):** A reasonable estimate of an airport's annual capacity (i.e., level of annual aircraft operations that will result in an average annual aircraft delay of approximately one to four minutes).

The determination of capacity for long-range planning purposes at Arlington Municipal Airport uses the methodology contained in the FAA AC 150/5060-5, *Airport Capacity and Delay*. Certain site-specific factors influence airfield capacity, and include aircraft mix, runway use, percent arrivals, touch-and-go operations, the location of exit taxiways, and local air traffic control rules and procedures. The following narrative describes these factors in detail.

Aircraft Mix. Aircraft mix is related to the type and size of the aircraft using an airport, and is categorized into four classes: Classes A and B consist of small single engine and twin-engine aircraft (both propeller and jet) weighing 12,500 pounds or less, which are representative of the general aviation fleet. Class C is large jet and propeller aircraft weighing between 12,500 pound and 300,000 pounds. Class D is large jet and propeller aircraft weighing in excess of 300,000 pounds. Classes C and D are typical of those used by the airline industry and the military. Aircraft mix is defined as the relative percentage of operations conducted by each of these classes of aircraft. For Arlington Municipal Airport, the existing aircraft mix has been estimated at 99% Classes A and B, and 1% Class C. The future 2028 aircraft mix is estimated at 98% Classes A and B, and 2% Class C. Examples of the various aircraft within each class are presented as follows:

- **Class A: Cessna 172, Cessna 182, Beech Bonanza 35, Mooney M20, Piper PA-28**
- **Class B: Beech 55, Beech 95, Piper PA-23, Beech King Air B200, Pilatus PC-12, Piper PA-31**
- **Class C: Cessna Citation 500 & 525, Dassault Falcon 20 & 900 EX, Learjet 31 & 35, Cessna Citation 650, Gulfstream V**

Runway Use. The use configuration of the runway system is defined by the number, location, and orientation of the active runway(s) and relates to the distribution and frequency of aircraft operations to those facilities. Both the prevailing winds in the region and the existing runway facility at Arlington Municipal Airport combine to dictate the utilization of the existing runway system. According to Airport personnel, the estimated runway utilization pattern for the Airport is presented as follows:

Runway 16/34 @ 81.3%

- Runway 16 @ 30%
- Runway 34 @ 70%

Runway 16G/34G @ 4.5%

- Runway 16G @ 30%
- Runway 34G @ 70%

Runway 11/29 @ 9.0%

- Runway 11 @ 5%
- Runway 29 @ 95%

Runway 08/26 @ 5.2%

- Runway 08 @ 20%
- Runway 26 @ 80%

Percent Arrivals. The percentage of aircraft arrival operations influences the airfield capacity, because aircraft on approach are travelling at a reduced speed and are typically given priority over departures. Thus, higher percentages of arrivals during peak periods of activity tend to reduce the ability of the airfield system to accommodate the demand. It is estimated that a general balance of arrivals and departures exists at Arlington Municipal Airport.

Touch-and-Go Operations. A touch-and-go operation refers to an aircraft maneuver in which the aircraft performs a normal landing touchdown followed by an immediate takeoff without stopping or taxiing clear of the runway. They are usually associated with training and are counted as local operations. As presented in the previous chapter, local operations comprise approximately 58% of all operations at the Airport, decreasing to approximately 57% by the end of the planning period (2028).

Exit Taxiways. Exit taxiways influence the airfield capacity by providing aircraft the ability to exit the runway as quickly and safely as possible. Therefore, the amount, spacing, and design of the exit taxiways affect runway occupancy times and the capacity of the airfield system. Arlington Municipal Airport has an adequate exit taxiway system in place to minimize runway occupancy times and increase airfield capacity.

Air Traffic Control Rules. The FAA specifies separation criteria and operational procedures for aircraft in the vicinity of an airport contingent upon aircraft size, availability of radar, sequencing of operations, and noise abatement procedures (both advisory and/or regulatory) that may be in effect at an airport. The impact of air traffic control on airfield capacity is most influenced by aircraft separation requirements dictated by the mix of aircraft using an airport. Presently, there are no special air traffic control rules in effect at Arlington Municipal Airport that significantly impact airfield capacity.

As specified in AC 150/5060-5, the determination of ASV and hourly capacity for long-range planning purposes involves several assumptions, which are: arrivals equal departures; the percentage of touch-and-go operations is between 0 and 50% of total operations; a full-length parallel taxiway and adequate exit taxiways are available and no taxiway crossing problems exist; there are no airspace limitations; the Airport has at least one runway equipped with an Instrument Landing System (ILS) and has the necessary air traffic control facilities and services to carry out operations in a radar environment; IFR weather conditions occur roughly 10% of the time; and, approximately 80% of the time the Airport is operated with the runway use configuration that produces the greatest hourly capacity.

Using these assumptions and AC 150/5060-5 guidelines, the existing and future ASV for Arlington Municipal Airport has been calculated at approximately 260,000 operations, with a VFR capacity of 132 operations per hour and an IFR capacity of 59 operations per hour. It is recognized that the Airport does not conform to all of the assumptions stated above, which would result in a loss of capacity from the figures presented here. Among the differences between the Airport and the assumptions are the lack of air traffic control facilities and services, no ILS, and the percent of touch-and-go operations exceeds 50%.

Conclusion. As can be seen, the ASV of 260,000 is significantly higher than the 168,194 operations expected at the end of the planning period. However, FAA planning standards indicate that, when 60% of the ASV is reached (in this case, some 156,000 operations), an airport should begin planning ways to increase capacity, and, when 80% of the ASV is reached (approximately 208,000 operations), then construction of facilities to increase capacity should be initiated. Additionally, the Airport's actual ASV and hourly capacities would be reduced from those listed, as the Airport does not conform to all the assumptions. Therefore, the potential exists for the Airport to begin to experience some capacity-related problems during the latter years of the planning period, and various airfield system improvements will be evaluated that could provide additional capacity in the next chapter.

Dimensional Criteria

Standard dimensional criteria for airport facilities are contained in FAA AC 150/5300-13, *Airport Design*. Dimensional standards are regulated with respect to the ARC and the lowest designated or planned instrument approach procedure visibility minimums. Because different aircraft types use the various runways at the Airport, each runway has a specific ARC.

Runway 16/34. Existing dimensions and the corresponding existing/potential design criteria applicable to Runway 16/34 are contained in the following table entitled *RUNWAY 16/34 DIMENSIONAL STANDARDS, IN FEET*. As can be seen, Runway 16/34 meets or exceeds most dimensional standards associated with the ARC B-II criteria with existing visibility minimums. However, there are some deficiencies associated with the ARC C-II dimensional standards, which include the Runway Safety Area (RSA) length at each runway end, the Runway Object Free Area (ROFA) length at each runway end, and the ROFA width.

At a distance of approximately 950 feet south of the Runway 34 threshold, the location of 172nd Street NE limits the ability to implement ARC C-II RSA and ROFA standard lengths of 1,000 feet. An RSA is a defined surface surrounding a runway that is prepared or suitable for reducing the risk of damage to aircraft in the event of an undershoot, overshoot, or excursion from the runway. It should be cleared and graded and have no potentially hazardous surface variations; should be drained by grading or storm sewers to prevent water accumulation; should be capable of supporting snow removal equipment, aircraft rescue and firefighting equipment under dry conditions; and, should be free of objects except for those required by their function (i.e., runway lights with frangible mountings). An ROFA is an area centered on the runway that enhances the safety of aircraft operations by having the area free of above ground objects protruding above the RSA edge elevation, except for those required for air navigation or aircraft ground maneuvering purposes. Taxiing and holding aircraft are permitted within an ROFA, but parked aircraft and agricultural activities are not.

North of the Runway 16 threshold, the ARC C-II RSA standard length would be limited by the presence of the localizer antenna, located approximately 770 feet directly north of the runway threshold, and by the perimeter road, located approximately 825 feet to the north and 250 west of the centerline. Likewise, the ARC C-II ROFA standard length would be limited by the localizer antenna building (located 725 feet north of the Runway 16 threshold and 250 feet east of the centerline) and the perimeter road (located 750 feet north of the Runway 16 threshold and 400 feet west of the centerline). Finally, the ARC C-II ROFA standard width of 800 feet (400 feet on either side of the runway centerline) would encompass the existing glider operations area located approximately 355 feet east of the runway centerline[1]. It should also be noted that the increased ROFA width of 800 feet could be triggered by the potential implementation of lower approach visibility minimums in conjunction with the existing ARC B-II standards.

[1] Previous FAA correspondence, dated January 5, 2001, specified that the expanded Runway 16/34 ROFA width at Arlington would not negatively impact the operation of the glider runway as long as alternating operations are conducted on the two runways (i.e., simultaneous operations would not be permitted).

Table C3
RUNWAY 16/34 DIMENSIONAL STANDARDS, IN FEET

Item	Existing Dimension	ARC B-II with ≥/≤ ¾-Mile Visibility Minimums	ARC C-II with ≥/≤ ¾-Mile Visibility Minimums
Runway:			
Width	100	75/100	100/100
Safety Area Width	150 (1)	150/300	500/500
Safety Area Length (beyond runway end)			
Runway 16	240 (2)	300/600	1,000/1,000(3)
Runway 34	240 (2)	300/600	1,000/1,000(4)
Object Free Area Width	500	500/800)(5)	800/800 (5)
Object Free Area Length (beyond runway end)			
Runway 16	240 (2)	300/600	1,000/1,000 (3)
Runway 34	240 (2)	300/600	1,000/1,000 (4)
Obstacle Free Zone Width	250 (1)	400/400	400/400
Obstacle Free Zone Length (beyond runway end)			
Runway 16	240	200/1,600	200/1,600
Runway 34	1,600	1,600/2,600	1,600/2,600
Runway Centerline to:			
Holdline	250	200/200	250/250
Parallel Runway Centerline	**360**(6)	700/N.A.	700/N.A.
Parallel Taxiway Centerline	400, 500	240/300	300/400
Aircraft Parking Area	572	250/400	400/500
Taxiway:			
Width	35, 50	35	35
Safety Area Width	79	79	79
Object Free Area Width	131	131	131

Source: FAA AC 150/5300-13, *Airport Design*, and actual airport conditions.
(1) Dimension as designated on current ALP. However, ARC C-II standards appear to be met.
(2) Dimension as designated on current ALP. However, ARC B-II standard appears to be met.
(30 Dimension cannot be accommodated from existing threshold location due to location of localizer antenna and perimeter road.
(4) Dimension cannot be accommodated from existing threshold location due to location of 172nd Street NE.
(5) Increased Object Free Area width would encompass existing glider operations area.
(6) The existing non-standard runway centerline separation is not applicable at Arlington because the runways are not operated simultaneously.

Runway 11/29. Existing dimensions and the corresponding design criteria applicable to Runway 11/29 are contained in the following table entitled *RUNWAY 11/29 DIMENSIONAL STANDARDS, IN FEET*. As can be seen, Runway 11/29 complies with, or exceeds, the ARC A-I Small Aircraft Only dimensional standards.

Table C4
RUNWAY 11/29 DIMENSIONAL STANDARDS, IN FEET

Item	Existing Dimension	ARC A-I Small Aircraft Only
Runway:		
Width	75	60
Safety Area Width	120	120
Safety Area Length (beyond runway end)		
Runway 11	240	240
Runway 29	240	240
Object Free Area Width	250	250
Object Free Area Length (beyond runway end)		
Runway 11	240	240
Runway 29	240	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (beyond runway end)		
Runway 11	240	200
Runway 29	240	200
Runway Centerline to:		
Holdline	125	125
Parallel Taxiway Centerline	240	150
Aircraft Parking Area	310	125
Taxiway:		
Width	35, 50	25
Safety Area Width	49	49
Object Free Area Width	131	89

Source: FAA AC 150/5300-13, *Airport Design*, and actual airport conditions.

Runway 16G/34G (Turf Glider Runway). Existing dimensions and the corresponding design criteria applicable to Runway 16G/34G are contained in the following table entitled *RUNWAY 16G/34G DIMENSIONAL STANDARDS, IN FEET*. As can be seen, Runway 16G/34G complies with, or exceeds, the majority of the ARC A-I Small Aircraft Only dimensional standards, with the single exception being the centerline separation between the glider runway and Taxiway "A". As can be noted from the following table, this Small Aircraft Only separation standard could be met with a minor repositioning of the glider runway to the west. However, Taxiway "A" is currently designed to ADG II standards, in association with Runway 16/34, which specifies a 240-foot centerline separation from the adjacent runway.

Table C5
RUNWAY 16G/34G DIMENSIONAL STANDARDS, IN FEET

Item	Existing Dimension	ARC A-I Small Aircraft Only
Runway (Turf):		
Width	75	60
Safety Area Width	120	120
Safety Area Length (beyond runway end)		
Runway 16G	240	240
Runway 34G	240	240
Object Free Area Width	250	250
Object Free Area Length (beyond runway end)		
Runway 16G	240	240
Runway 34G	240	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (beyond runway end)		
Runway 16G	240	200
Runway 34G	240	200
Runway Centerline to:		
Holdline	125	125
Parallel Runway Centerline	**360**[1]	700
Parallel Taxiway Centerline	**138**[2]	150
Aircraft Parking Area	223	125
Taxiway:		
Width	35, 50	25
Safety Area Width	49	49
Object Free Area Width	131	89

Source: FAA AC 150/5300-13, *Airport Design*, and actual airport conditions.
(1) The existing non-standard runway centerline separation is not applicable at Arlington because the runways are not operated simultaneously.
(2) Dimension can be expanded to 150 feet with the repositioning of the glider runway. However, Taxiway "A" is designed to ADG II standards, requiring a 240-foot centerline separation, which cannot be accommodated.

Runway 08/26 (Turf Ultralight Runway). Existing dimensions and the corresponding design criteria applicable to Runway 08/26 are contained in the following table entitled *RUNWAY 08/26 DIMENSIONAL STANDARDS, IN FEET*. As can be seen, Runway 08/26 complies with, or exceeds, the ARC A-I Small Aircraft Only dimensional standards.

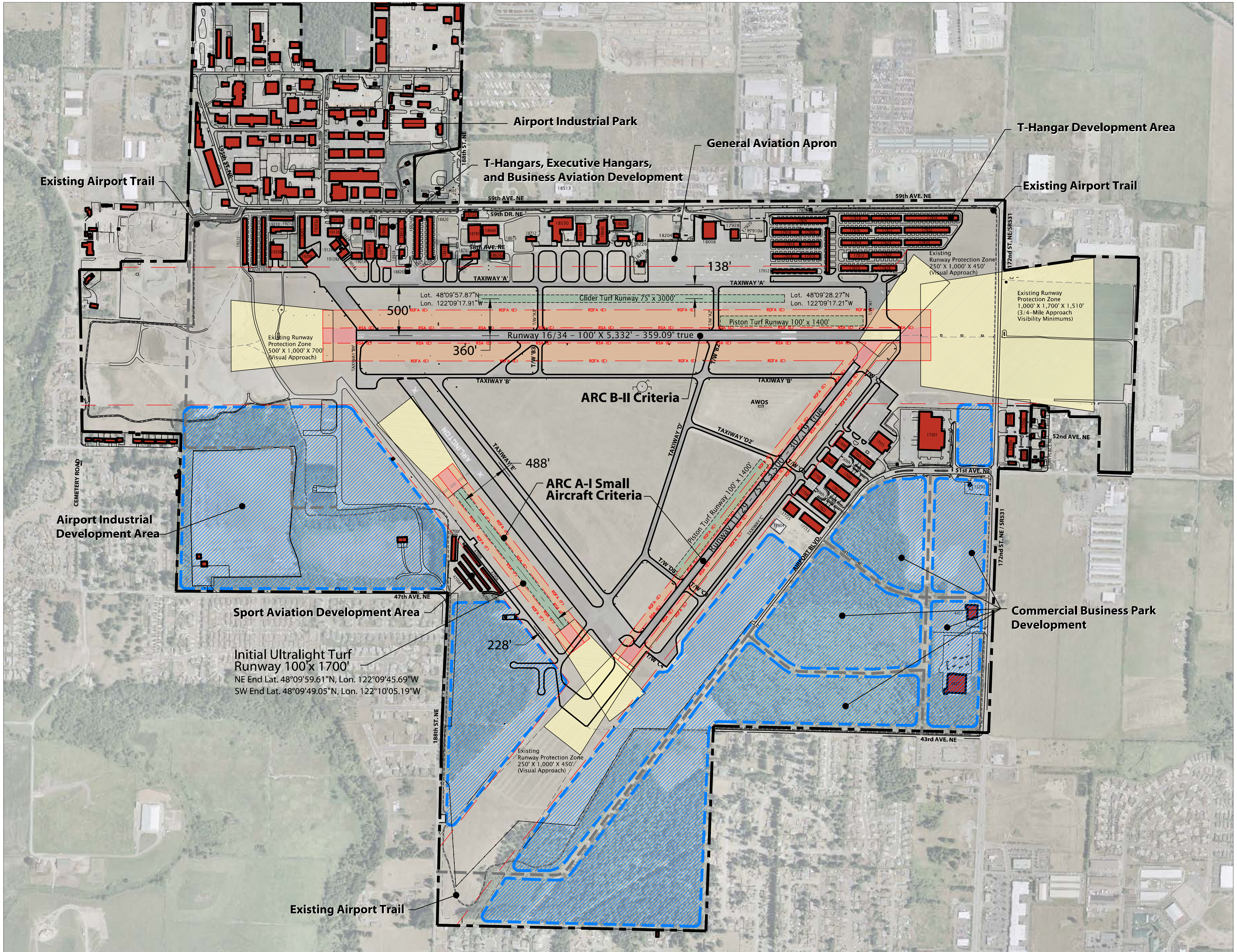
Table C6
RUNWAY 08/26 DIMENSIONAL STANDARDS, IN FEET

Item	Existing Dimension	ARC A-I Small Aircraft Only
Runway (Turf):		
Width	100	60
Safety Area Width	120	120
Safety Area Length (beyond runway end)		
Runway 08	240	240
Runway 26	240	240
Object Free Area Width	250	250
Object Free Area Length (beyond runway end)		
Runway 08	240	240
Runway 26	240	240
Obstacle Free Zone Width	250	250
Obstacle Free Zone Length (beyond runway end)		
Runway 08	240	200
Runway 26	240	200
Runway Centerline to:		
Holdline	N.D.	125
Parallel Taxiway Centerline	228, 488	150
Aircraft Parking Area	N.D.	125
Taxiway:		
Width	35, 50	25
Safety Area Width	49	49
Object Free Area Width	131	89

Source: FAA AC 150/5300-13, *Airport Design*, and actual airport conditions.

The following figures, entitled *EXISTING AIRPORT DIMENSIONAL STANDARDS* and *POTENTIAL AIRPORT DIMENSIONAL STANDARDS*, provide a comparison of the various ARC A-I Small Aircraft Only, ARC B-II, and ARC C-II design standards associated with each runway facility.

Conclusion. The examination of dimensional standards leads to the conclusion that, in consideration of the existing and forecast aircraft operational fleet, Runway 16/34 should be planned and developed to accommodate future ARC C-II standards, while Runways 11/29, 16G/34G, and 08/26 should be maintained to meet ARC A-I Small Aircraft Only standards. An examination of alternatives that would correct the potential future non-standard ARC C-II dimensional standards will be analyzed in the next chapter.



BUILDING LEGEND

NO.	DESCRIPTION	ELEVATION	NO.	DESCRIPTION	ELEVATION
1	ROTATING BEACON W/OBS. LIGHT (OL)	186.0'@O.L.	17916	T-HANGAR	152.2'
2	BUILDING	161.9'	17918	T-HANGAR	152.4'
4407	WESTON	143.6'			
4417	ATHLETIC CLUB	152.5'	17928	NAVY HANGAR	171.8'
4700a	ULTRALIGHT T-HANGAR	149.5'	18008	NAVY HANGAR	168.6'
4700b	ULTRALIGHT T-HANGAR	151.5'	18204	AIRPORT OFFICE/WSDOT AVIATION	143.2'
4700c	ULTRALIGHT T-HANGAR	149.5'	18218	RESTAURANT	154.0'
4700d	ULTRALIGHT T-HANGAR	148.7'	18228	WILD BLUE AVIATION	181.1'
4700e	ULTRALIGHT T-HANGAR	150.5'	18306	OUT OF THE BLUE AVIATION	156.6'
4700f	BUILDING	155.4'			162.0'
5200a	CAR WASH	139.0'			169.2'
5200b	GAS STATION	151.0'	18530	GLASAIR	164.1'
5200d	RESTAURANT	150.0'	18615	.	.
5200e	MOTEL	152.0'	18620	UNIVERSAL AEROSPACE BUILDING	161.0'
5200f	BUILDING	145.0'	18620a	CASCADE AVIATION	158.2'
17200	HENKENS RV	139.5'	18640	UNIVERSAL AEROSPACE BUILDING	161.0'
17301	BOWMAN	157.6'	18650	HANGAR	161.3'
17415	CONDO HANGAR	157.4'	18660	STODDARD HAMILTON	160.4'
17600	HANGAR	155.0'	18701	HANGAR	159.8'
17601	HANGAR	155.0'	18712	AVIATION COVER, INC.	158.8'
17605	HANGAR	155.0'	18722	THE POINT CHURCH OFFICES	165.0'
17609	HANGAR	155.0'	18781	STODDARD HAMILTON	159.3'
17617	HANGAR	155.0'	18810	HANGAR	169.4'
17620	HANGAR	155.0'	18820	AERONAUTICAL TESTING SERVICES	162.0'
17622	HANGAR	155.0'	18820a	WRANGELL ELECTRONICS	162.0'
			18824	GPS SURVEYING	162.0'
17705	HANGAR	155.0'	18824a	.	162.0'
17708	HANGAR	155.0'	18826	CASTLE AND COOKE/BIG SKY AVIATION	145.5'
17713	HANGAR		18914	GOLD AERO	
17725	HANGAR		18928	AVIATION INSPECTION & REPAIR	170.1'
17804	T-HANGAR		19002	METAL MOTION	160.0'
17808	PUMP HOUSE		19003	METAL MOTION	163.8'
17810	T-HANGAR	151.8'	19007	VACANT	161.2'
17812	T-HANGAR	158.1'	19010	HANGAR	165.7'
17814	T-HANGAR	151.6'	19018	PRIVATE HANGAR	160.3'
17816	T-HANGAR	151.9'	19018a	PARA-PHERNALIA	160.3'
17818	T-HANGAR	151.7'	19026	ARLINGTON GLASS	161.5'
17820	T-HANGAR	150.5'	19124	GLOBAL MACHINE WORKS	161.7'
17822	T-HANGAR	150.5'	19128	PRIVATE HANGAR	167.0'
17824	T-HANGAR	150.6'	19128a	PRIVATE HANGAR	167.5'
17826	T-HANGAR	150.6'	19130	GLOBAL MACHINE WORKS	162.5'
17828	T-HANGAR	148.4'	19132	HANGAR	163.8'
17830	T-HANGAR	146.0'	19200	PRIVATE HANGAR	172.5'
17832	T-HANGAR	146.0'	19203a	CASCADE ENGINE SERVICE	158.2'
17834	T-HANGAR	146.0'	19203	CONDO HANGARS	162.3'
17904	T-HANGAR	151.6'	19208	PRIVATE HANGAR	180.8'
17906	T-HANGAR	154.3'	19210	CONDO HANGARS	
17908	T-HANGAR	155.1'	19212	CONDO HANGARS	
17910	T-HANGAR	154.9'	19218	T-HANGAR	
17910a	(REMOVED)		19220	T-HANGAR	159.8'
17912	T-HANGAR	147.1'	19222	T-HANGAR	160.0'(E)
17914	T-HANGAR	152.0'			

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT PROPERTY LINE		
AIRPORT SECURITY FENCE	X	X
BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
RPZ EASEMENT		
BUILDING RESTRICTION LINE	BRL	BRL
RUNWAY SAFETY AREA	RSA (E)	RSA (F)
RUNWAY OBJECT FREE AREA	ROFA (E)	ROFA (F)
RUNWAY OBJECT FREE ZONE	OFZ	OFZ
POTENTIAL DEVELOPMENT AREAS		

DESIGN AIRCRAFT

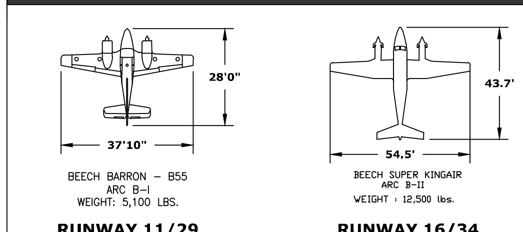


FIGURE C3

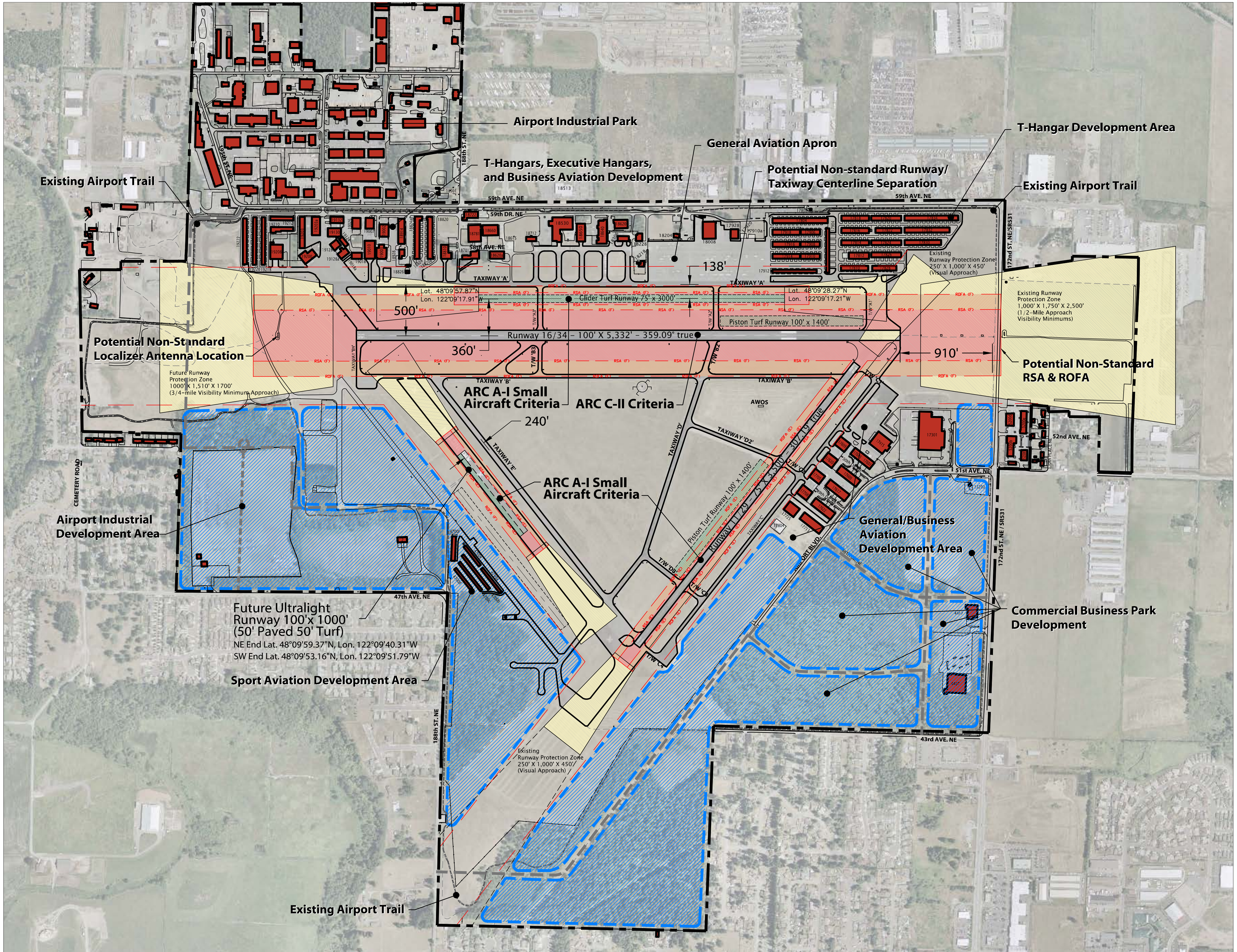
Existing Airport Dimensional Standards

N

0 250' 500' 1000' 1500'

GRAPHIC SCALE IN FEET

Source: Aerial photography by Aero-Metric, Inc. September 2008, Airport Layout Plan by Barnard Dunkelberg & Company, December 2003.



BUILDING LEGEND

NO.	DESCRIPTION	ELEVATION	NO.	DESCRIPTION	ELEVATION
1	ROTATING BEACON W/OBS. LIGHT (OL)	186.0'@O.L.	17916	T-HANGAR	152.2'
2	BUILDING	161.9'	17918	T-HANGAR	152.4'
4407	WESTON	143.6'			
4417	ATHLETIC CLUB	152.5'	17928	NAVY HANGAR	171.8'
4700a	ULTRALIGHT T-HANGAR	149.5'	18008	NAVY HANGAR	168.6'
4700b	ULTRALIGHT T-HANGAR	151.5'	18204	AIRPORT OFFICE/WSDOT AVIATION	143.2'
4700c	ULTRALIGHT T-HANGAR	149.5'	18218	RESTAURANT	154.0'
4700d	ULTRALIGHT T-HANGAR	148.7'	18228	WILD BLUE AVIATION	181.1'
4700e	ULTRALIGHT T-HANGAR	150.5'	18306	OUT OF THE BLUE AVIATION	156.6'
4700f	BUILDING	155.4'			162.0'
5200a	CAR WASH	139.0'			169.2'
5200b	GAS STATION	151.0'	18530	GLASAIR	164.1'
5200d	RESTAURANT	150.0'	18615	.	.
5200e	MOTEL	152.0'	18620	UNIVERSAL AEROSPACE BUILDING	161.0'
5200f	BUILDING	145.0'	18620a	CASCADE AVIATION	158.2'
17200	HENKENS RV	139.5'	18640	UNIVERSAL AEROSPACE BUILDING	161.0'
17301	BOWMAN	157.6'	18650	HANGAR	161.3'
17415	CONDO HANGAR	157.4'	18660	STODDARD HAMILTON	160.4'
17600	HANGAR	155.0'	18701	HANGAR	159.8'
17601	HANGAR	155.0'	18712	AVIATION COVER, INC.	158.8'
17605	HANGAR	155.0'	18722	THE POINT CHURCH OFFICES	165.0'
17609	HANGAR	155.0'	18781	STODDARD HAMILTON	159.3'
17617	HANGAR	155.0'	18810	HANGAR	169.4'
17620	HANGAR	155.0'	18820	AERONAUTICAL TESTING SERVICES	162.0'
17622	HANGAR	155.0'	18820a	WRANGELL ELECTRONICS	162.0'
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17908	T-HANGAR	155.1'	19212	CONDO HANGARS	
17910	T-HANGAR	154.9'	19218	T-HANGAR	
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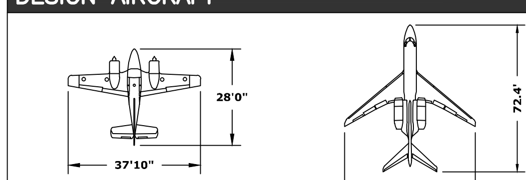
17914	T-HANGAR	152.0'			

DRAWING LEGEND

	EXISTING	FUTURE
AIRPORT PROPERTY LINE		
AIRPORT SECURITY FENCE	X	X
BUILDINGS		
AIRFIELD PAVEMENT		
PAVED ROADS		
RUNWAY PROTECTION ZONE		
RPZ EASEMENT		
BUILDING RESTRICTION LINE	BRL	BRL
RUNWAY SAFETY AREA	RSA (E)	RSA (F)
RUNWAY OBJECT FREE AREA	ROFA (E)	ROFA (F)
RUNWAY OBJECT FREE ZONE	OFZ	OFZ
POTENTIAL DEVELOPMENT AREAS		

DESIGN AIRCRAFT



BEECH BARRON - B55
ARC B-I
WEIGHT: 5,100 LBS.
RUNWAY 11/29

CESSNA 750 CITATION X
ARC C-II
WEIGHT: 36,100 lbs.
RUNWAY 16/34

FIGURE C4

Potential Airport Dimensional Standards

N
0 250' 500' 1000' 1500'
GRAPHIC SCALE IN FEET

Source: Aerial photography by Aero-Metric, Inc. September 2008, Airport Layout Plan by Barnard Dunkelberg & Company, December 2003.

Runway Length

The determination of runway length requirements for Arlington Municipal Airport is based on several factors, which include:

- **Airport elevation**
- **Mean maximum daily temperature of the hottest month**
- **Runway gradient**
- **Critical aircraft type expected to use the Airport**
- **Stage length of the longest non-stop trip destination**

Generally, for design purposes, runway length requirements at general aviation airports are premised upon a combination of the most demanding aircraft within the general aviation fleet that are operating, or are projected to operate, at the airport. For Arlington Municipal Airport, this fleet is dominated by small aircraft having a Maximum Takeoff Weight (MTOW) of 12,500 pounds or less, and includes the operation of some turbo-jet powered aircraft weighing less than 60,000 lbs.

Runway length requirements are derived from the Airport Design Software supplied in conjunction with FAA AC 150/5300-13, *Airport Design*. Using this software, three values are entered into the computer, including the airport elevation of 137 feet Above Mean Sea Level (AMSL), the Mean Normal Maximum Temperature (NMT) of 75 degrees Fahrenheit, a length of haul of 500 Nautical Miles (NM), and the maximum difference in runway elevation at the centerline of 13.4 feet (Runway 16/34). This data generates the general recommendations for runway length requirements presented in the following table entitled *RUNWAY TAKEOFF LENGTH REQUIREMENTS*.

As indicated in the table, there are nine different runway length requirements listed. The first three lengths pertain to general aviation aircraft with a MTOW of 12,500 pounds or less, and having less than ten seats. The fourth length presented also pertains to general aviation aircraft with a MTOW of 12,500 pounds or less, but applies to aircraft having more than ten seats. The next four rows present the runway length requirements of the general aviation aircraft fleet, generally jet-powered, having a MTOW between 12,500 pounds and 60,000 pounds. The last row illustrates the runway length requirement for aircraft with MTOW greater than 60,000 pounds.

The runway length requirements given in the table for the large aircraft fleet with less than 60,000 pounds MTOW are dependent upon meeting the operational requirements of a certain percentage of the fleet at a certain percentage of the useful load (i.e., 75% of the fleet at 60% useful load). The useful load of an aircraft is defined as the difference between the maximum allowable structural gross weight and the operating weight empty. In other words, it is the load that can be carried by the aircraft composed of passengers, fuel, and cargo. Generally, the following aircraft comprise 75% of the general aviation aircraft fleet having a MTOW less than 60,000 pounds: Learjets, Sabreliners, Citations, Falcons, Hawkers, and Westwinds.

Table C7
RUNWAY TAKEOFF LENGTH REQUIREMENTS

Aircraft Category	Takeoff Length (In Feet) Wet	Takeoff Length (In Feet) Dry
Existing Conditions		
Runway 16/34	5,332	5,332
Runway 11/29	3,498	3,498
Runway 16G/34G (Turf Glider Runway)	3,000 [1]	3,000[1]
Runway 08/26 (Turf Ultralight Runway)	1,000	1,000
Small Aircraft[2] with less than 10 seats		
75% of the fleet	2,390	2,390
95% of the fleet	2,940	2,940
100% of fleet	3,480	3,480
Small Aircraft[2] with more than 10 seats	4,030	4,030
Aircraft Greater Than 12,500 Pounds, but Less Than 60,000 Pounds MTOW		
75% of fleet at 60% useful load	5,260	4,720
100% of fleet at 60% useful load	5,500	5,100
75% of fleet at 90% useful load	6,650	5,920
100% of fleet at 90% useful load	7,300	7,300
Aircraft Greater Than 60,000 Pounds MTOW	5,060	5,060

Source: FAA AC 150/5300-13, *Airport Design*. Lengths based on 137 feet AMSL, 75° F NMT, length of haul of 500 miles, and a maximum difference in runway centerline elevation of 14 feet for Runway 16/34.
[1] The glider runway is divided into three sections, with the area between connector Taxiways "A3" and "A4" being used for staging and takeoffs, while the area located north of Taxiway "A3" and south of Taxiway "A4" being designated for landings and recovery.
[2] Under 12,500 pounds MTOW.

It should be noted that, when analyzing the runway lengths presented in the table, the actual runway length necessary for each individual aircraft to operate safely is a function of elevation, temperature, and aircraft weight (usually dependent upon the stage length of the longest non-stop trip destination). As temperatures change on a daily or hourly basis, the runway length requirements change accordingly (i.e., as temperatures increase, runway length increases). Therefore, if a runway is designed to accommodate a certain aircraft under all conditions, it can also accommodate a larger aircraft, or one that requires a longer runway, when temperatures are cooler or when a shorter stage length is required.

Runway 16/34. The data presented in the table indicate that Runway 16/34, with an existing length of 5,332 feet, can accommodate between 75% and 100% of the large general aviation aircraft fleet with MTOW less than 60,000 pounds, operating at 60% useful load during wet or slippery conditions. In accordance with AC 150/5325-4B, entitled *RUNWAY LENGTH REQUIREMENTS FOR AIRPORT DESIGN*, the required length for Runway 16/34 is driven by the operational requirements of the turbo-jet powered aircraft weighing less than 60,000 pounds maximum certified takeoff weight (MTOW). Based upon existing turbo-jet aircraft activity at Arlington, which was documented in the previous chapter, a runway length ranging between 5,260 and 5,500 feet is recommended. However, these lengths could increase in response to additional stage length requirements by specific aircraft. With this in mind, the current ALP reflects a potential maximum runway length of 6,000 feet, which can be accommodated within the existing development footprint of the Airport.

Runway 11/29. With an existing length of 3,498 feet, this runway can accommodate 100% of the small aircraft fleet with less than ten seats.

Runways 16G/34G and 08/26. With existing lengths of 3,000[2] feet and 1,000 feet, respectively, these runways can accommodate the existing operators of the glider and ultralight aircraft fleet.

Conclusion. In consideration of the category of aircraft that regularly operate, or are expected to regularly operate, at the Airport, it is recommended that the future extension of Runway 16/34 on the north end of the runway to an ultimate length of 6,000 feet be retained for long-term planning purposes. In addition, Runways 11/29 and 16G/34G should be maintained at their existing lengths, while Runway 08/26 will continue to be illustrated at a future length of 1,000 feet, as identified on the current Airport Layout Plan (ALP).

Runway Pavement Strength

As identified in the *Inventory of Existing Conditions* chapter, Runway 16/34 has an existing gross weight bearing capacity of 114,000 pounds single wheel, 150,000 pounds dual wheel, and 270,000 pounds dual tandem wheel main landing gear configuration. Runway 11/29 has an existing gross weight bearing capacity of 32,000 pounds single wheel, 34,000 pounds dual wheel, and 59,000 pounds dual tandem wheel main landing gear configuration. According to the projected operational aircraft fleet mix, the existing Runway 16/34 and Runway 11/29 pavement strength exceeds the requirements expected to be placed on it.

Conclusion. It is recommended that the existing pavement strength for each runway be retained through a regular pavement maintenance program. In consideration of the existing/future design aircraft for each runway facility at the Airport, both the Runway 16/34 and the Runway 11/29

[2] The glider runway is divided into three sections, with the area between connector Taxiways "A3" and "A4" being used for staging and takeoffs, while the area located north of Taxiway "A3" and south of Taxiway "A4" being designated for landings and recovery.

pavement strengths will likely need to be re-evaluated to consider a reduced design strength at the next pavement reconstruction interval.

Runway Line of Sight

Line of sight standards provide pilots the ability to see runway and taxiway surfaces to assure that they are clear of aircraft, vehicles, wildlife, and other hazardous objects. According to the runway line of sight standards contained in AC 150/5300-13, *Airport Design*, any two points located five feet above the runway centerline must be mutually visible for the entire length of the runway. However, if the runway is served by a full-length parallel taxiway, the requirement is reduced to a distance of one-half the runway length. Because both Runways 16/34 and 11/29 are served by parallel taxiways, the distance requirements for both runways is one-half the distance. Using the runway profile elevation data from the existing Arlington Municipal Airport Obstruction Chart (OC #795), the line of sight criteria is met for both runways.

Conclusion. Since the line of sight criteria is met for both runways at Arlington Municipal Airport, no additional analysis is necessary. With any proposed improvements to the runway system, these standards will need to be revisited.

Runway Surface Gradients

Runway surface gradients should allow design flexibility without adversely affecting operational safety. Longitudinal runway gradients (i.e., along the length of the runway) should be as flat as practicable to increase aircraft operational efficiency and safety. Transverse surface gradients (i.e., across the runway and RSA), as a general rule, should be kept to a minimum consistent with drainage requirements. Surface gradient standards are contained in AC 150/5300-13, *Airport Design*, and are presented in the following table entitled *RUNWAY SURFACE GRADIENT STANDARDS*.

Runway 16/34. The maximum longitudinal gradient of Runway 16/34 is 0.5%, and has 0.2% and 0.5% within the north and south quarters of the runway, respectively. These gradients are well within the standards for runways serving aircraft in approach categories C and D. According to available topographic data, the maximum transverse surface gradient associated with this runway is 1.3%, also within the allowable limits.

Runway 11/29. This runway has a maximum longitudinal gradient of 0.2%, which is within the standard for runways serving aircraft in approach categories A and B that are outlined in the following table.

Table C8
RUNWAY SURFACE GRADIENT STANDARDS

Surface Standard	Gradient
Longitudinal Gradient	
Aircraft Approach Category A and B	0% - 2%
Aircraft Approach Category C and D	0% - 1.5%
Within First and Last Quarter of Runway Length	0% - 0.8%
200 Feet Beyond the Ends of the Runway	0% - 3%
Transverse Gradient	
Aircraft Approach Category A and B	
Runway Centerline to Edge of Pavement	1% - 2%
First Ten Feet of the RSA Beyond Pavement Edge	3% - 5% (Recommended 5%)
Remainder of the RSA	1.5% - 5%
Aircraft Approach Category C and D	
Runway Centerline to Edge of Pavement	1% - 1.5%
Runway Shoulder	1.5% - 5% (Recommended 5%)
Remainder of RSA	1.5% - 3%

Source: FAA AC 150/5300-13, *Airport Design*.

Conclusion. Because the surface gradient standards are met, additional analysis is not required. Any proposed runway improvements or extensions will include further analysis to ensure that specified FAA engineering standards are maintained.

Runway Protection Zones

The function of a Runway Protection Zone (RPZ) is to enhance the protection of people and property on the ground beyond the end of the runway. This is achieved through airport control of the RPZ areas. The RPZ is trapezoidal in shape, centered about the extended runway centerline, and begins 200 feet beyond the end of the area usable for takeoff or landing. RPZ dimensions are a function of the ARC, the size of the aircraft a runway is designed to accommodate, and the lowest visibility minimums associated with a runway end.

As noted earlier, Runway 16/34 has two published straight-in instrumentation approach procedures with visibility minimums as low as ¾-mile. Runway 11/29 does not have any published instrument approach procedures. The following table, entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists the RPZ dimensions as illustrated on the existing ALP. The remainder of the table presents the dimensional standards for various approach minimums and aircraft types, and indicates if the Airport owns or controls the entire area contained within the RPZ.

Table C9
RUNWAY PROTECTION ZONE DIMENSIONS

Item	Width at Inner Edge	Length	Width at Outer Edge	Airport Controls Entire RPZ
Existing RPZ Dimensions:				
Runway 16	500	1,000	700	Yes
Runway 34	1,000	1,700	1,510	Yes
Runway 11/29	250	1,000	450	Yes
Runway 08/26	250	1,000	450	Yes
Required RPZ Dimensions:				
Visual and Not Lower Than One Mile, Small Aircraft Exclusively	250	1,000	450	
Visual and Not Lower Than One Mile, Approach Categories A and B	500	1,000	700	
Visual and Not Lower Than One Mile, Approach Categories C and D	500	1,700	1,010	
Not Lower Than ¾-Mile, All Aircraft	1,000	1,700	1,510	
Lower Than ¾-Mile, All Aircraft	1,000	2,500	1,750	

Source: FAA AC 150/5300-13, *Airport Design*.

Conclusion. The existing RPZs, as illustrated on the ALP, appear adequate in size based on the existing instrument approach visibility minimums. Alternatives that analyze the future requirements through changes or improvements to the airfield or instrument approach capabilities are provided in the next chapter.

Threshold Siting Requirements

Guidelines contained in FAA AC 150/5300-13 provide criteria for the proper siting of runway thresholds to meet approach and departure obstacle clearance requirements. Like the RPZ criteria, the threshold siting criteria are based on the type of aircraft and approach visibility minimums associated with each runway end. The existing criteria for Arlington Municipal Airport is contained in the following table entitled *THRESHOLD SITING CRITERIA*.

Based on the existing threshold siting standards and the elevation data provided on the Arlington Municipal Airport Obstruction Chart (OC), all thresholds are currently sited to achieve adequate clearance over adjacent roadways, terrain, and other objects listed on the OC.

Table C10
RUNWAY THRESHOLD SITING CRITERIA

Item	Distance from Threshold	Width at Inner End	Width at Outer End	Length of First Segment	Length of Second Segment	Slope
Small aircraft only with approach speeds < 50 knots, visual approach	0	120	300	500	2,500	15:1
Small aircraft only with approach speeds > 50 knots, visual approach	0	250	700	2,250	2,750	20:1
Large aircraft, visual approach, or instrument minimums ≥ one mile, day only	0	400	1,000	1,500	8,500	20:1
Instrument night circling	200	400	3,400	10,000	0	20:1
Aircraft approach category A and B only, instrument straight in night operations	200	400	3,800	10,000	0	20:1
Aircraft approach category greater than B, instrument straight in night operations	200	800	3,800	10,000	0	20:1
Instrument approach with visibility minimums < one mile but ≥¾-mile, day or night	200	800	3,800	10,000	0	20:1
Instrument approach with visibility minimums < ¾-mile or precision approach, day or night	200	800	3,800	10,000	0	34:1

Source: FAA Advisory Circular 150/5300-13, *Airport Design*.

Conclusion. Based on this analysis, the existing thresholds at each runway end provide adequate obstruction clearance. The examination of future requirements in conjunction with any improvements or changes to the runway threshold locations or instrument approach capabilities will be examined in the next chapter.

Instrumentation, Lighting, and Marking

Electronic Landing Aids (Instrumentation). Currently, Runway 34 is equipped with LOC and NDB or GPS published straight-in instrument approaches providing visibility minimums ranging from ¾-mile to 2¼-miles, depending upon the category of aircraft.

Satellite-based Global Positioning System (GPS) technology is the FAA's standard approach technology and has the potential for providing new or improved instrument approach procedures to nearly every runway end in the United States. The continued development of Wide Area Augmentation System (WAAS) further improves upon this technology by improving the GPS signal accuracy and allows for Localizer Performance with Vertical Guidance (LPV) approaches. Since WAAS does not require any ground-based navigational equipment at an airport, costs are reduced and approach capability is not affected by signal reflection from waiting or landing aircraft, hangars, or other structures.

It is expected that Arlington Municipal Airport will continue to experience increased use by more sophisticated general aviation aircraft in the future. Therefore, the ability to implement improved instrument approach procedures should be preserved. Currently, Runway 34 is programmed for an LPV approach procedure that offers visibility minimums of ½-mile. The wind analysis conducted earlier in this chapter supports this decision by confirming that Runway 34 provides more than adequate wind coverage during IFR weather conditions. The current ALP recommends that the instrument approach to Runway 34 be upgraded to provide visibility minimums of ½-mile, and that an instrument approach procedure with visibility minimums of ¾-mile be implemented to Runway 16. The current ALP does not illustrate any improvements to the Runway 11/29 visual approaches and none are recommended as a project from this MP Update.

Visual Landing Aids (Lighting). Presently, Runway 16/34 is equipped with MIRL and two-light PAPIs. Runway 34 is equipped with a 1,400-foot MALS and Runway 16 has REILs. Runway 11/29 has REILs and PAPIs at each runway end. According to Appendix 16 of AC 150/5300-13, an Approach Procedure with Vertical Guidance (APV) with visibility minimums less than one mile requires, at a minimum, an MALS, ODALS, or SSALS approach lighting system and MIRL. For runways with a precision instrument approach with visibility minimums less than ¾-mile, an MALSR, SSALR, or ALSF approach lighting system and MIRL (at a minimum) are required. Each of these lighting considerations will be evaluated with the alternatives development prepared in the next chapter, as will the current ALP recommendation that the existing Runway 34 MALS be upgraded with RAILs in conjunction with the future implementation of the LPV approach procedure.

Marking. As detailed in the *Inventory of Existing Conditions* chapter, Runway 16/34 currently has non-precision instrument runway markings and Runway 11/29 has basic runway markings. Appendix 16 of AC 150/5300-13 requires precision runway and holding position markings for runways served by instrument approach procedures with visibility minimums as low as ½-mile, and non-precision markings for runways with instrument approach procedures with visibility minimums as low as ¾-mile.

Conclusion. Based on the expected continued development and use of GPS navigation systems in general aviation aircraft and increasing the functional use of the airfield during adverse weather conditions, the instrument approach procedure improvements indicated on the current ALP are recommended for retention and will be re-examined in the next chapter. Marking and lighting requirements will be made based on the desired instrument approach visibility minimums proposed in the Conceptual Development Plan.

Taxiways

Taxiways provide defined movement corridors for aircraft between the runway system and the various functional areas on an airport. Some taxiways are necessary simply to provide access between aircraft parking aprons and the runways, whereas, others become necessary to provide more efficient and safer use of the airfield.

In general, the taxiway system configuration at Arlington Municipal Airport is considered adequate. However, there are aspects of the airfield geometry that could create potential runway incursion conditions that could result in unsafe situations. According to FAA Engineering Brief No. 75: *Incorporation of Runway Incursion Prevention into Taxiway and Apron Design*, right-angled taxiways are the recommended standard for all runway/taxiway intersections, except where there is a need for high-speed exit taxiways. Using this guideline, there are several runway/taxiway intersections at the Airport with less than 90° angles, including:

- **Taxiway "A4" intersects the Runway 16 end at an approximate 51° angle**
- **Taxiway "E" intersects the Runway 11 end at an approximate 80° angle**
- **Taxiway "B2" intersects Runway 16/34 at an approximate 72° angle**
- **Taxiway "D2" intersects Runway 11/29 at an approximate 74° angle**
- **Taxiway "B" intersects Runway 11/29 at an approximate 52° angle**

FAA Engineering Brief No. 75 also recommends avoiding taxiway layouts that provide straight direct access onto a runway from a parking apron area. An example of this situation occurs at the General Aviation Apron Area, located southwest of Runway 11/29, with direct taxiway access provided from the apron to the Runway 29 end by Taxiway "C1".

Conclusion. Correction of the identified taxiway intersections causing potential runway incursion conditions will be evaluated through the development alternatives presented in the next chapter. Other taxiway recommendations include the extensions of Taxiways "A" and "B" as needed in conjunction with any runway extensions of Runway 16/34 to the north. This retains the taxiway system integrity and safety by providing adequate access to the future Runway 16 end. Finally, in the interest of safety and efficiency, lighting and signage should be installed on all taxiways not currently equipped at the Airport.

Landside Facility Requirements

Landside facilities are those facilities that support the airside facilities, but are not actually a part of the aircraft operating surfaces. They consist of such facilities as terminal buildings, hangars, aprons, access roads, and support facilities. Following a detailed analysis of these facilities, current deficiencies can be noted in terms of accommodating both existing and future aviation needs at the Airport.

Aircraft Storage Requirements

Aircraft based at Arlington Municipal Airport are stored in one of four areas: T-hangars, executive hangars, large FBO storage hangars, or apron tiedowns. Currently, there are 582 aircraft based at the Airport. Over the course of the 20-year planning period, the number of based aircraft is expected to increase to 713, indicating that an increase in storage facilities to accommodate approximately 131 new aircraft will be required. It is assumed that future storage facilities will reflect many of the same characteristics of current storage patterns.

Based Aircraft Apron. Aircraft tiedowns are provided for those aircraft owners and operators that do not require or desire to pay the costs for hangar storage. Space calculations for these areas are based on 360 square yards of apron for each aircraft tiedown. This amount of space allows for aircraft parking and circulation between the rows of parked aircraft. Trends indicate that, as more aircraft are based at an airport, hangar storage capacity is surpassed before additional hangar space is supplied.

Itinerant Aircraft Apron. In addition to the needs of the based aircraft tiedown areas, transient aircraft also require apron parking areas at Arlington Municipal Airport. This storage requirement is provided in the form of transient or itinerant aircraft tiedown space. In calculating the area requirements for these tiedown spaces, an area of 500 square yards per aircraft has been used. There are a couple of reasons this area is larger than the area required for based aircraft. First, the users of the transient tiedown spaces will not be as familiar with the layout and circulation patterns as based aircraft operators, and additional maneuvering room is essential. Secondly, whereas typically smaller, single engine based aircraft use tiedowns for storage, various sizes of transient aircraft use tiedowns making it necessary to provide additional space for the larger aircraft.

Hangar Storage. Based on the high investment cost of owning an aircraft, hangars are, generally speaking, the most desired option for aircraft storage. The Transportation Security Administration (TSA) has identified hangar storage as one of the most effective ways to secure general aviation aircraft from use by terrorist organizations. As stated previously, it is assumed that future storage patterns will reflect existing characteristics. Therefore, the development plan for future hangars will focus on identifying potential parcels, in consideration of the ability to provide roadway and taxiway access in an efficient and secure manner.

Conclusion. The accompanying table, entitled *GENERAL AVIATION STORAGE REQUIREMENTS, 2008-2028*, depicts the type of facilities and the number of units or acres needed for that facility in order to meet the forecast demand for each development phase. It is expected that most of the owners and operators of newly based aircraft at the Airport will desire some type of indoor hangar storage facility. The actual type of the hangar storage facility to accommodate based aircraft has been identified as T-hangars, executive hangars, and larger corporate and/or FBO type hangars, although the actual number, size, and location of the larger hangar types will depend on user needs and financial feasibility. Additionally, access and perimeter roadway locations and auto parking requirements are not included in the tabulations, because the amount of land necessary for these facilities will be a function of the location of other facilities, as well as the most effective routing of roadways.

Table C11
GENERAL AVIATION FACILITY REQUIREMENTS, 2008-2028

Facility	2008[1]	2013	2018	2023	2028
Apron Storage					
Itinerant GA Apron (acres)		6.5	6.9	7.2	7.6
Based GA Apron (acres)		5.7	5.9	6.1	6.1
Total Apron (acres)	12.9	12.2	12.8	13.3	13.7
Hangar Storage					
T-hangar Spaces	375	406	422	438	446
Acres	34.4	37.3	38.8	40.2	41.0
Condominium Spaces	31	38	42	48	54
Acres	4.4	7.6	8.4	9.6	10.8
Glider Trailers	40	45	47	50	51
Acres	0.5	0.6	0.6	0.7	0.7
Ultralight Spaces	64	65	68	71	73
Acres	3.9	4.2	4.5	4.7	4.8
Total Spaces/Acres	510/43.2	554/49.7	579/52.3	607/55.2	624/57.3

Source: BARNARD DUNKELBERG & COMPANY projections based on FAA AC 150/5300-13, *Airport Design*.
[1] Actual.

Support Facilities Requirements

In addition to the aviation and airport access facilities described above, there are several airport support facilities that have quantifiable requirements, and which are vital to the efficient and safe operation of the Airport. The support facilities at Arlington Municipal Airport requiring further evaluation include fuel storage facilities, Aircraft Rescue and Fire Fighting (ARFF) facilities, and roadway access.

Fuel Storage Facility. According to fuel sales records provided by airport personnel, there has been an average of 171,942 gallons of AVGAS and auto gas, and 83,228 gallons of Jet A fuel sold per year over the past five years. Based on 2007 operational counts, this equates to approximately 1.7 gallons of AVGAS/auto gas per operation of piston-powered engine aircraft, and approximately 6.4 gallons of Jet A fuel per turbine-powered engine aircraft operation. Typically, as operations increase, fuel storage requirements can be expected to increase proportionately. By increasing the ratio of gallons sold per operation, an estimate of future fuel storage needs can be calculated as a two-week supply during the peak month of operations.

The following table, entitled *FUEL STORAGE REQUIREMENTS, 2008-2028*, provides an estimate of the future fuel storage requirements at Arlington Municipal Airport. As can be seen, it appears that the Airport's existing fuel storage capacity is more than adequate to accommodate the expected demand during the planning period.

Table C12
FUEL STORAGE REQUIREMENTS, 2008-2028

Operations by Type	2008(1)	2013	2018	2023	2028
AVGAS					
Average Day of Peak Month Operations	398	436	460	479	496
Two Weeks of Operations	5,578	6,102	6,443	6,702	6,946
Gallons Per Operation	1.7	1.9	2.1	2.3	2.5
Fuel Storage (gallons)	20,000 (2)	11,596	13,531	15,414	17,364
Jet A					
Average Day of Peak Month Operations	47	52	56	60	65
Two Weeks of Operations	652	721	781	846	903
Gallons Per Operation	6.4	6.7	7.5	8.5	9.0
Fuel Storage (gallons)	29,500 (3)	4,834	5,858	7,193	8,131

Source: BARNARD DUNKELBERG & COMPANY.
(1) Base year estimates.
(2) Existing AVGAS fuel storage.
(3) Existing Jet A fuel storage.

Aircraft Rescue and Fire Fighting (ARFF) Facility. The Airport does not presently have an Aircraft Rescue and Fire Fighting (ARFF) facility on airport property that conforms to Federal Aviation Regulations (FAR) Part 139 guidelines. Fire protection services are provided for the Airport by the City of Arlington Fire Department Fire Station No. 47, which is located near the intersection of 188th and 63rd within the northeast quadrant of airport property. A future fire station (Fire Station No. 48) is in the planning stages for a location in the southwest quadrant of airport property at the corner of SR531/172nd Street NE and 43rd Avenue.

Roadway Access. The capacity of a roadway access system is a function of the maximum number of vehicles accommodated by a particular facility. At Arlington Municipal Airport, this relates primarily to the roadway system capacity, which is the number of vehicles that can use a certain roadway section in a given time period.

The capacity analysis for the roadways providing access to the Airport, as well as the airport roadway system, is based on the *Highway Capacity Manual*, published by the Transportation Research Board, Special Report 209. According to this manual, it is normally preferred that roadways operate below capacity to provide reasonable flow and minimize delay to the vehicles using it. The manual defines different operating conditions, known as levels-of-service. The levels-of-service are functions of the volume and composition of the traffic and the speeds attained. Six levels-of-service have been established, designated by the letters A-F, providing for best to worst service in terms of driver satisfaction. Level-of-service A roadways are completely unimpeded in their ability to maneuver within the traffic system. A level-of-service C (stable traffic flow and minimal delays) is generally the preferred level-of-service for an urban road system[3]. Average hourly volumes of airport service roadways of typical facilities at level-of-service C and D are summarized in the following table entitled *GROUND ACCESS FACILITY VOLUME*. The various ranges given in the table make their use in defining roadway capacity analysis useful primarily for initial problem testing.

Table C13
GROUND ACCESS FACILITY VOLUME

Facility Type	Average Hourly Volume(1) (Vehicle/Hour/Lane)(2)
Main-access and feeder freeways (controlled access, no signalization)	1,000-1,600
Ramp to and from main-access freeways, single lane	900-1,200
Principal arterial (some cross streets, two-way traffic)	900-1,600
Main-access road (signalized intersections)	700-1,000
Service road	600-1,200

Source: Highway Capacity Manual, Transportation Research Board, Special Report 209, 1994.
(1) Highway Level-of-Service C and D.
(2) Passenger-Car Equivalents.

At a general aviation airport, the focus of the access roadway capacity assessment is typically on the service provided between the various aviation use areas on the airport and the regional highway system. In the case of Arlington, the WSDOT is currently designing a roadway widening project for SR531/172nd Street NE (between 43rd Avenue NE and 67th Avenue NE), which will include two through-lanes in each direction and a two-lane left-turn lane with curb and gutters, bike lanes, and sidewalks. It should also be noted that the proximity of this roadway with the Airport will dictate that the ultimate alignment/positioning of this roadway be coordinated with the FAA design criteria to ensure proper clearances are achieved over the roadway.

[3] For comparison, Snohomish County Code specifies an LOS F standard for urban arterial roadways.

In addition to the widening of SR531/172nd Street NE, Airport Boulevard is programmed for extension to the northwest in two phases to ultimately connect with 188th Street NE, and Phase One of the project is scheduled to begin in 2009. This roadway extension will permit the continued aviation development of the Runway 11/29 flightline, as well as an alternative access route to the ultralight aviation development area. The following chapter of this document will also investigate options for providing a new controlled access roadway around the north end of Runway 16/34 to improve access for emergency response vehicles, Airport Staff, and tenants.

The information presented in the previous table would indicate that, at a level-of-service in the C to D range, the existing airport access roads have a capacity between 600 to 1,200 vehicles per hour. All indications are that this capacity is adequate to serve on-airport demand. Therefore, future on-airport roadway improvements will focus on providing good access to future facility development areas and on security issues related to separation of areas accessible to automobiles from the aircraft operational areas.

Summary

Although most of the existing airport facilities are sufficient to accommodate the aviation demand throughout the planning period, others require improvement or replacement to provide a safe and efficient airport facility. The facility requirements detailed in this chapter will be used to help formulate the overall future Development Plan of the Airport. The necessary projects will only be implemented when actual demand is demonstrated for the facility, it is financially feasible, and any potential environmental impacts can be avoided or mitigated.