

PORT OF ASTORIA

Astoria Regional Airport

Master Plan Update



C. Capacity Analysis & Facility Requirements

C Capacity Analysis and Facility Requirements

INTRODUCTION. The determination of an airport’s ability to accommodate its existing and forecasted aviation activity is the critical analysis of any master plan. A thorough review of all key airport facilities in relation to the projected aviation demand described in the previous chapter must be conducted to ascertain not only how that airport is currently performing, but also if it can meet those demands throughout the planning period. This analysis focuses on the major aircraft operating surfaces, the operational capacity of the Airport, and also considers weather conditions, the surrounding airspace, the availability and type of navigational facilities, the type and arrangement of aircraft storage facilities, the supporting facilities, and the type and amount of landside access.

The capacity of an airfield is primarily a function of the major aircraft operating surfaces that compose the facility and the configuration of those surfaces (runways and taxiways). However, it is also related to and considered in conjunction with wind coverage, airspace utilization, and the availability and type of navigational aids. Capacity refers to the number of aircraft operations that a facility can accommodate on either an hourly or yearly basis. It does not refer to the size or weight of aircraft. Facility requirements are used to determine the facilities needed to meet the forecasted demand related to the existing and forecast aircraft fleet. Evaluation procedures will analyze runway length, dimensional criteria, aprons, hangars, and vehicular access.

Airport Reference Code (ARC)/Critical Aircraft Analysis

Knowledge of the types of aircraft currently using, and those aircraft expected to use, Astoria Regional Airport provides information concerning the Airport Reference Code (ARC). FAA Advisory Circular 150/5300-13, *Airport Design*, provides guidelines for this determination. The ARC is based on the “Design Aircraft” that is judged the most critical aircraft using, or projected to use, the Airport. Typically, the Design Aircraft is an aircraft or an aircraft type with the most demanding operational and physical characteristics that currently or is projected to perform a minimum of 500 annual operations at the Airport. That aircraft’s resultant ARC relates those aircraft operational and physical characteristics to design criteria that are applied to various

airport components. Under this methodology, safety margins are provided in the physical design of airport facilities.

The types of aircraft presently utilizing an airport and those projected to utilize the facility in the future are important considerations for planning airport facilities, since an airport should be designed in accordance with the ARC standards that are described in the aforementioned advisory circular. The ARC has two components that relate to the Airport's "Design Aircraft." The first component, depicted by a letter (i.e., A, B, C, D, or E), is the aircraft approach category and relates to aircraft approach speed (operational characteristic). The second component, depicted by a Roman numeral (i.e., I, II, III, IV, or V), is the aircraft design group and relates to aircraft wingspan (physical characteristic). Aircraft approach speed applies to runways and runway-related facilities, while aircraft wingspan is primarily related to separation criteria associated with taxiways and taxilanes.

Runway 8/26 and Runway 13/31. Both of the runways at the Airport accommodate "small aircraft" (classified as aircraft weighing 12,500 pounds or less) and "large aircraft" (classified as aircraft weighing over 12,500 pounds). The largest aircraft currently using the Airport on a regular basis are business jets such as the Cessna Citation II, Cessna Citation V and Dassault Falcon 20 (including the HU-25 flown by the Coast Guard). These aircraft (and many others in the business jet fleet) have "B" approach speeds (greater than 91 knots but less than 121 knots) and wing spans contained on airplane design group "II" (greater than 49 feet but less than 79 feet). This indicates that both of the runways should be designed using ARC B-II criteria. Note that this is consistent with the ARC that has been used in previous planning documents for the Airport. While the Airport is utilized to a lesser degree by some business jet aircraft with "C" approach speeds (greater than 121 knots but less than 141 knots), these aircraft do not use the Airport on a frequent enough basis to warrant "design aircraft" considerations.

Astoria Regional Airport will maintain its existing ARC classification of B-II.

Airfield Capacity Methodology

The evaluation method used to determine the capability of the current airside facilities to accommodate the existing and projected operational demands is described in the following narrative. Note that evaluation of this capability is expressed in terms of potential excesses and deficiencies in capacity. The methodology used for the measurement of airfield capacity in this study is described in the Federal Aviation Administration (FAA) Advisory Circular 150/5060-5,

Airport Capacity and Delay. From this methodology, airfield capacity is defined in the following terms:

- *Hourly 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:* **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 capacity of an airport’s airside facilities is a function of several factors. These factors include the layout of the airfield, local environmental conditions, specific characteristics of local aviation demand, and air traffic control requirements. The relationship of these factors and their cumulative impact on airfield capacity are examined in the following sections.

Airfield Layout

The arrangement and interaction of airfield components (runways, taxiways, and ramp entrances) refer to the layout or “design” of the airfield. As previously described, Astoria Regional Airport is served by two runways, Runway 8/26 and Runway 13/31, which are both served by partial or semi-parallel taxiways. There are also several runway exit taxiways and connector taxiways that are designed to minimize aircraft runway occupancy time, thus increasing the capacity of the runway system.

Existing landside facilities, which include FBO hangars, T-hangars, aprons, industrial facilities, coast guard facilities, and other various aviation facilities, are located west of Runway 13/31 and south of Runway 8/26. These facilities are well situated to take advantage of the existing taxiway system.

Wind Coverage

Climatological conditions specific to the location of an airport not only influence the layout of the airfield, but also affect the use of the runway system. Surface wind conditions have a direct effect on the operation of an airport, in that runways not oriented to maximum efficiency with respect to prevailing winds will restrict the capacity of the Airport to varying degrees. When landing and taking off, an aircraft is able to operate properly on a runway as long as the wind component perpendicular to the direction of travel (defined as a crosswind) is not excessive in relation to the specific characteristics of that aircraft.

To determine wind velocity and direction at Astoria Regional Airport, wind data were obtained from observations taken at the Airport (from data gathered by the National Oceanic and Atmospheric Administration, National Climatic Data Center) for the period January 1, 1995 – December 31, 2004. This data was used to construct the all-weather wind rose for the Airport. Note that while maximum crosswind components are specific to each aircraft, the FAA has established general standards that are dependent upon the Airport Reference Code (ARC) for the type of aircraft that use the Airport on a regular basis. As stated above, the ARC for the Airport is B-II.

According to FAA AC 150/5300-13, *Airport Design*, for ARC-A-I and B-I airports, a crosswind component of 10.5-knots is considered maximum. For ARC A-II and B-II airports, a crosswind component of 13-knots is considered maximum. For ARC A-III, B-III, and C-I through D-III airports, a crosswind component of 16-knots is considered maximum. Finally, for ARC A-IV through D-VI airports, a crosswind component of 20-knots is considered maximum. In consideration of the Airport's ARC B-II classification, these standards specify that a maximum crosswind of 13-knots be considered in the analysis. In addition, it is known that the Airport will also continue to serve small, single- and twin-engine aircraft, for which the 10.5-knot crosswind component is considered maximum. Therefore, it is important that two crosswind components are analyzed for this airport (the 10.5-knot and the 13-knot). The following illustration, entitled *ALL WEATHER WIND ROSE: 10.5 and 13-KNOT CROSSWIND COMPONENT*, illustrates the all weather wind coverage provided at Astoria Regional Airport.

Figure C1
ALL WEATHER WIND ROSE: 10.5- and 13-KNOT CROSSWIND COMPONENTS

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72791 Astoria, Oregon. Period of Record: 1995-2004.

The following table, Table C1, entitled *ALL WEATHER WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the various runways under all weather metrological conditions.

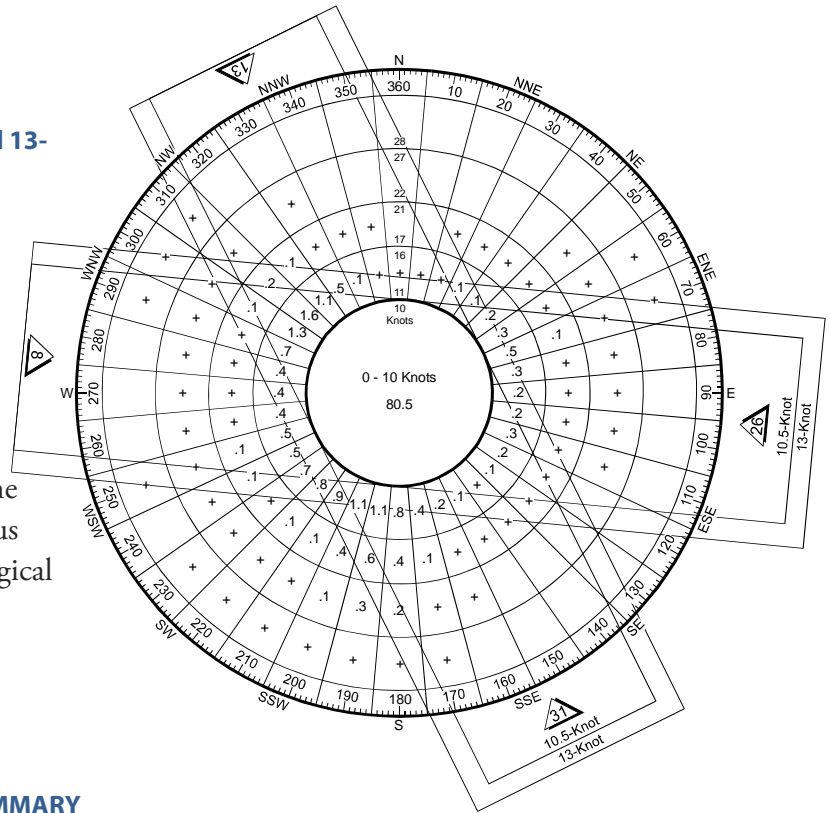


Table C1
ALL WEATHER WIND COVERAGE SUMMARY

Runway Designation	10.5-Knot Crosswind Component	13-Knot Crosswind Component
Runway 8	67.87%	69.66%
Runway 26	76.70%	79.86%
Runway 8/26	91.15%	94.63%
Runway 13	76.22%	79.73%
Runway 31	76.72%	78.88%
Runway 13/31	91.37%	95.58%
Combined Runways	96.13%	98.63%

Source: Wind analysis tabulation provided by BARNARD DUNKELBERG & COMPANY utilizing the FAA Airport Design Software supplied with AC 150/5300-13. Data obtained from National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72791 Astoria, Oregon Period of Record 1995-2004. A maximum 5-knot tailwind component was considered in this analysis.

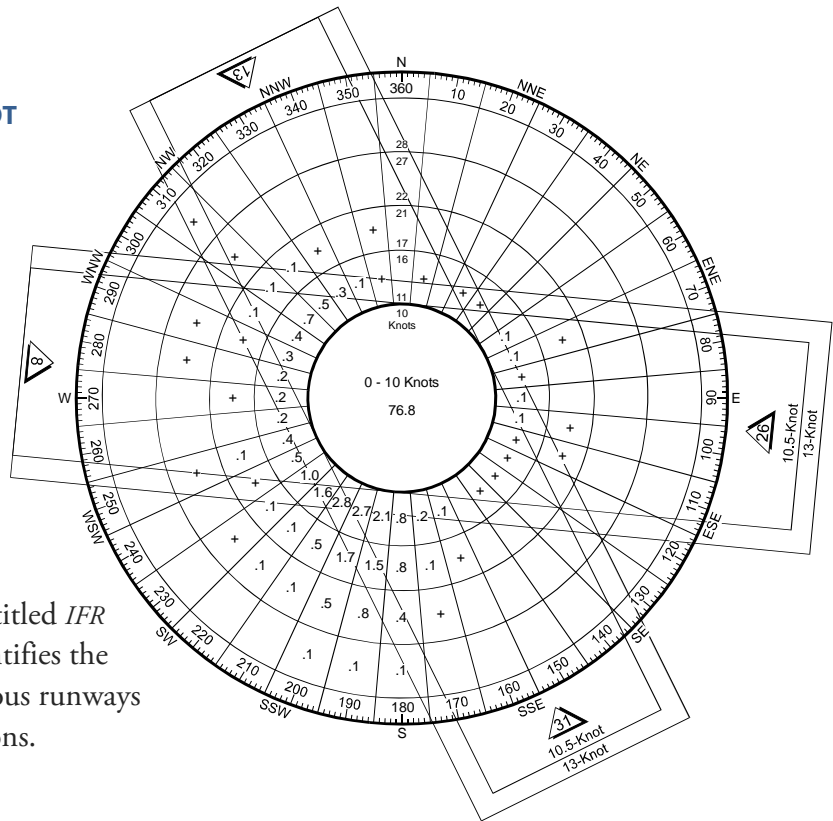
The desirable wind coverage for an airport is 95%, which means that the runway should be oriented such that the maximum crosswind component is not exceeded more than five percent (5%) of the time. Together, the two runways provide 96.13% wind coverage for the 10.5-knot crosswind component and 98.63% wind coverage for the 13-knot crosswind component. This analysis indicates that the existing runway configuration provides adequate wind coverage for the 13-knot and 10.5-knot crosswind components. No new runways will be recommended to provide additional wind coverage.

In an effort to analyze the effectiveness of the Airport’s existing instrument approach capabilities, an Instrument Flight Rules (IFR) wind rose has also been constructed and is presented in the following figure. Again, wind data from Astoria Regional Airport have been used in the construction of this IFR wind rose.

Figure C2
IFR1 WIND ROSE: 10.5- and 13- KNOT CROSSWIND COMPONENTS

Source: National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72791 Astoria, Oregon. Period of Record: 1995-2004.

1. Ceiling less than or equal to 1,000 feet and/or visibility less than three miles and ceiling greater than or equal to 200 feet and visibility greater than or equal to 0.50 miles. Ceiling less than or equal to 1,000 feet and/or visibility less than three miles and ceiling greater than or equal to 300 feet and visibility greater than or equal to ¾ miles.



The following table, Table C2, entitled *IFR WIND COVERAGE SUMMARY*, quantifies the wind coverage offered by the various runways under IFR meteorological conditions.

Table C2
IFR WIND COVERAGE SUMMARY

Runway Designation	IFR1 Conditions Maximum 10.5-Knot Crosswind Component	IFR1 Conditions Maximum 13-Knot Crosswind Component
Runway 8	59.59%	62.31%
Runway 26	77.68%	82.80%
Runway 8/26	82.82%	87.99%
Runway 13	75.70%	81.71%
Runway 31	72.52%	74.09%
Runway 13/31	87.02%	93.37%
Combined Runways	90.10%	95.69%

Source: Wind analysis tabulation provided by BARNARD DUNKELBERG & COMPANY utilizing the FAA Airport Design Software supplied with AC 150/5300-13. Data obtained from National Oceanic and Atmospheric Administration, National Climatic Data Center Station 72791 Astoria, Oregon Period of Record 1995-2004.

1. Ceiling less than or equal to 1,000 feet and/or visibility less than three miles and ceiling greater than or equal to 300 feet and visibility greater than or equal to ¾ miles. A 5-knot tailwind component was used.

From this analysis, it can be stated that Runway 26 offers the best wind coverage capabilities during periods of IFR weather conditions. This fact is important in that it confirms Runway 26's use as the preferential IFR runway, and re-enforces the necessity of its Instrument Landing System (ILS) precision approach capabilities.

Characteristics of Demand

Certain site-specific characteristics related to aviation use and aircraft fleet makeup impact the capacity of the airfield. These characteristics include aircraft mix, runway use, percent arrivals, touch-and-go operations, exit taxiways, and air traffic control rules.

Aircraft Mix. The capacity of a runway is dependent upon the type and size of the aircraft that use the facility. FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, categorized aircraft into four classes based on maximum certificated takeoff weight. This differs from the Airport Reference Code (ARC) defined previously, which classifies aircraft based on aircraft approach speed (A-E). For aircraft mix, aircraft Classes A and B consist of small, single-engine and twin-engine aircraft (both prop and jet), weighing 12,500 pounds or less, which are representative of the general aviation fleet. Classes C and D aircraft are larger jet and propeller

aircraft typical of the business jet fleet, along with those aircraft used by the airline industry and the military.

Astoria Regional Airport has no operations by Class D aircraft (over 300,000 pounds), nor are any expected to occur in the future. Class C aircraft operations at the Airport are primarily executive type prop and jet general aviation aircraft. Aircraft mix is defined as the relative percentage of operations conducted by each of these four classes of aircraft. The aircraft mix for Astoria Regional Airport is depicted in the following table, entitled *AIRCRAFT CLASS MIX FORECAST, 2004-2024*.

Table C3
AIRCRAFT CLASS MIX FORECAST, 2004-2024

Year	VFR Conditions			IFR Conditions		
	Class A & B	Class C	Class D	Class A & B	Class C	Class D
2004 ¹	96%	4%	0%	91%	9%	0%
2009	96%	4%	0%	91%	9%	0%
2014	95%	5%	0%	90%	10%	0%
2019	94%	6%	0%	89%	11%	0%
2024	94%	6%	0%	89%	11%	0%

Source: BARNARD DUNKELBERG & COMPANY.
 Class A – Small Single Engine, <= 12,500 pounds
 Class C – >12,500 - <=300,000 pounds
 1. Actual.

Class B – Small Twin-Engine, <= 12,500 pounds
 Class D – > 300,000 pounds

Runway Use. The use configuration of the runway system is defined by the number, location, and orientation of the active runways, 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 Astoria Regional Airport combine to dictate the utilization of the existing runway system.

According to observations, Runway 8/26 is the most utilized runway at the Airport (approximately 65% of total operations use this runway). With respect to Runway 13/31, Runway 31 is considered the calm wind runway, with 90% of operations occurring on Runway 31 and ten percent (10%) occurring on Runway 13. With respect to Runway 8/26, 75% of operations occur on Runway 26 and 25% of operations occur on Runway 8.

Percent Arrivals. Runway capacity is also significantly influenced by the percentage of all operations that are arrivals. Because aircraft on final approach are typically given absolute priority over departures, higher percentages of arrivals during peak periods of operations reduce the Annual Service Volume. The operations mix occurring on the runway system at Astoria Regional Airport reflects a general balance of arrivals to departures. Therefore, it was assumed in the capacity calculations that arrivals equal departures during the peak period.

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. These operations are normally associated with training and are included in local operations figures. By the end of the 20-year planning period, local operations are expected to increase slightly (up to approximately ten percent (10%) of the total aircraft operations at the Airport) due to increased training activity at the Airport.

Exit Taxiways. The capacity of a runway is greatly influenced by the ability of an aircraft to exit that runway as quickly and safely as possible. Therefore, the quantity and design of the exit taxiways can directly influence aircraft runway occupancy time and the capacity of the runway system.

In consideration of the crossing configuration of the runway system at the Airport and the efficient layout of the existing exit taxiways, the number of exit taxiways appears adequate for existing and future operational expectations.

Air Traffic Control Rules. The FAA specifies separation criteria and operational procedures for aircraft near an airport that is contingent upon aircraft size, availability of radar, and sequencing of operations, both advisory and/or regulatory, which may be in effect at the Airport. The impact of air traffic control on runway capacity is most influenced by aircraft separation requirements dictated by the mix of aircraft utilizing the Airport. Presently, there are no special air traffic control rules in effect at Astoria Regional Airport that significantly impact operational capacity, although it should be noted that the Airport does not currently have an Air Traffic Control Tower (ATCT).

Airfield Capacity Analysis

As previously described, the determination of capacity for Astoria Regional Airport uses the methodology described in the FAA Advisory Circular 150/5060-5, *Airport Capacity and Delay*, along with the Airport Design Computer Program that accompanies AC 150/5300-13, *Airport Design*.

Several assumptions are incorporated in these capacity calculations:

- **Arrivals equal departures;**
- **The percent of touch-and-go operations is between zero and 50 percent (0-50%) of total operations;**
- **There is a full-length parallel taxiway with ample exits and no taxiway crossing problems;**
- **There are no airspace limitations;**
- **The Airport has at least one runway equipped with an ILS and the necessary air traffic control facilities to carry out operations in a radar environment;**
- **IFR weather conditions occur roughly ten percent (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.**

Applying information generated from the preceding analyses, capacity and demand are formulated in terms of the following results:

- **Annual Service Volume (ASV)**
- **Hourly Capacity of Runways (VFR and IFR)**

Based on the methodology to determine the capacity for long-range planning purposes, the ASV for a runway configuration similar to Astoria Regional Airport's could be as high as 230,000 operations, with a VFR capacity of roughly 98 operations per hour, and an IFR capacity of approximately 59 operations per hour. It is recognized that Astoria Regional Airport does not conform to all of the assumptions listed above (i.e., the Airport does not have an ATCT facility), which results in a loss of capacity from the figures presented. However, if there were sufficient demand and ATCT facilities were operated in the future, the actual capacity could be similar to the projection for long-range planning purposes.

As can be seen, the Airport's Annual Service Volume is significantly greater than not only the existing annual operations (44,290), but also those forecasted for the end of the planning period

(58,308). These capacity computations provide guidance in evaluating the ability of airport facilities to accommodate forecast demand.

Note that even before an airfield reaches its ASV capacity, it begins to experience certain amounts of delay in aircraft operations. As an airport's operations increase toward this capacity, delay increases exponentially. Therefore, it is important to monitor the number of aircraft operations regularly and identify factors that may be acting as capacity constraints. These actions will enable airport management to react to unexpected trends before the lack of operational capacity becomes a critical issue. As a matter of good planning practices, it is considered industry standard that planning occur for capacity enhancements at an airport when it is at 60% of its ASV, and that action on those plans start when it reaches 80% of its ASV.

Facility Requirements

This section presents the requirements analysis for the airside and landside facilities necessary to meet the existing and projected aviation demand at Astoria Regional Airport. For those components determined to be deficient, the type and size of the facilities required to meet future demand are identified. Airside facilities examined include the runways, taxiways, runway protection zones, thresholds, and navigational aids. Landside facilities include such facilities as terminal buildings, hangars, aircraft apron areas, and airport support facilities.

This analysis uses the forecasts presented in the preceding chapter for establishing future development of the Airport. This is not intended to dismiss the possibility that, due to the unique circumstances in the region, either accelerated growth or consistently higher or lower levels of activity may occur. Aviation activity levels should be monitored for consistency with the forecasts. In the event of changes, the schedule of development should be adjusted to correspond to the demand for facilities rather than be set to predetermined dates of development. By doing this, "over-building" or "under-building" can be avoided.

Airfield Dimensional Criteria

The FAA Advisory Circular 150/5300-13, *Airport Design*, recommends standard widths, minimum clearances, and other dimensional criteria for runways, taxiways, safety areas, aprons, and other physical airport facilities. Dimensions are recommended with respect to the Aircraft Approach Category and Airplane Design Group designations (the Airport Reference Code), as well as the availability and type of approach instrumentation.

Airfield dimensional criteria applicable to Astoria Regional Airport are contained in the following tables entitled *RUNWAY 8/26 DIMENSIONAL STANDARDS RUNWAY*, and *RUNWAY 13/31 DIMENSIONAL STANDARDS* (one table is provided for each runway). As identified in the table, the facilities at Astoria Regional Airport meet or exceed most of the appropriate requirements, other than the minimum runway centerline to parallel taxiway centerline separation requirement of 300 feet for a B-II runway with visibility minimum requirements of lower than ¾-mile. This separation is currently at 275 feet.

Table C4
RUNWAY 8/26 DIMENSIONAL STANDARDS (in feet)

Item	Existing Dimension	ARC B-II With Visibility Minimums lower than $\frac{3}{4}$ -mile
<i>Runway 8/26:</i>		
Width	100	100
Safety Area Width	300	300
Safety Area Length (beyond each runway end)	600	600
Object Free Area Width	800	800
Object Free Area Length (beyond runway end)	600	600
Obstacle Free Zone Width	400	400
<i>Taxiway:</i>		
Width	50	35
Safety Area Width	79	79
Object Free Area Width	131	131
<i>Runway Centerline to:</i>		
Holdline	200	200
Parallel Taxiway Centerline	275	300
Aircraft Parking Area	500+	400

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

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area (OFA): A two dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the OFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Table C5
RUNWAY 13/31 DIMENSIONAL STANDARDS (in feet)

Item	Existing Dimension	ARC B-II With Visibility Minimums Greater than ¾-Mile
<i>Runway 13/31:</i>		
Width	100	75
Safety Area Width	150	150
Safety Area Length (beyond each runway end)	300	300
Object Free Area Width	500	500
Object Free Area Length (beyond runway end)	300	300
Obstacle Free Zone Width	400	400
<i>Taxiway:</i>		
Width	35	35
Safety Area Width	79	79
Object Free Area Width	131	131
<i>Runway Centerline to:</i>		
Holdline	200	200
Parallel Taxiway Centerline	290	240
Aircraft Parking Area	400	250

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

Runway Safety Area: An area adjacent to the runway that is cleared and graded and that has no potentially hazardous ruts, humps, depressions, or other surface variations. Under dry conditions, the safety area shall be capable of supporting aircraft rescue equipment, snow removal equipment, and the occasional passage of aircraft without causing structural damage.

Runway Object Free Area (OFA): A two dimensional ground area surrounding a runway that is clear of objects protruding above the safety area edge elevation. Objects are acceptable within the OFA if the location is required for the purpose of air navigation or aircraft ground maneuvering purposes.

Runway Pavement Strength

Runway 8/26 and Runway 13/31 can currently support aircraft with a gross weight of 60,000 pounds single wheel, 76,000 pounds dual wheel, and 119,000 pounds tandem-wheel main landing gear configuration. In consideration of the future forecasted aircraft fleet, these runway pavement strengths are sufficient for the duration of the planning period, assuming routine maintenance is performed at regular intervals.

Runway Length

Generally, runway length requirements for design purposes at an airport like Astoria Regional Airport are premised upon the category of aircraft using the Airport. The categories are small aircraft under 12,500 pounds maximum takeoff weight and large aircraft under 60,000 pounds maximum takeoff weight.

Runway length requirements are derived from the computer based FAA Airport Design Software supplied in conjunction with Advisory Circular 150/5300-13, *Airport Design*. Using this software, three values are entered into the computer, including the airport elevation of 15 feet Above Mean Sea Level (AMSL), the Mean Normal Maximum Temperature (NMT) of 68.8 degrees Fahrenheit, and the maximum difference in runway elevation at the centerline of 4.2 feet. This data generates the general recommendations for runway length requirements at Astoria Regional Airport, which are provided in the following table.

Table C6
RUNWAY LENGTH REQUIREMENTS

Aircraft Category	Dry Runway Length (feet)	Wet Runway Length (feet)
Runway 8/26 Existing Length: 5,796 feet		
Runway 13/31 Existing Length: 4,490 feet		
<i>Airplanes less than 12,500 lbs. with less than 10 seats</i>		
75% of Small Aircraft Fleet	2,290	2,290
95% of Small Aircraft Fleet	2,830	2,830
100% of Small Aircraft Fleet	3,350	3,350
<i>Airplanes less than 12,500 lbs. with 10 or more seats</i>		
	3,900	3,900
<i>Airplanes greater than 12,500 lbs. and less than 60,000 pounds</i>		
75% of fleet at 60% useful load	4,590	5,230
75% of fleet at 90% useful load	5,790	6,620
100% of fleet at 60% useful load	4,820	5,500
100% of fleet at 90% useful load	6,890	7,000
<i>Large Aircraft greater than 60,000 pounds ¹</i>	5,020	5,020

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

Lengths based on 15 feet AMSL, 68.8° F NMT and a maximum difference in runway centerline elevation of 4.2 feet and 500-mile stage length.

As shown in the preceding table, the small aircraft fleet (under 12,500 pounds) requires a runway length between 2,290 and 3,900 feet, while aircraft over 12,500 pounds, but less than 60,000 pounds, require between 4,590 and 6,890 feet. Each of the runway lengths given for large aircraft under 60,000 pounds maximum certificated takeoff weight provides a runway sufficient to satisfy the operational requirements of a certain percentage of the aircraft fleet at a certain percentage of the useful load. Useful load is defined as the difference between the maximum gross takeoff weight and the empty weight of the airplane, exclusive of fuel. Examples of those aircraft that comprise 75% of the general aviation aircraft fleet between 12,500 and 60,000 pounds include Learjets, Challengers, Citations, Falcons, Hawkers, and the Westwind.

A significant factor to consider when analyzing the generalized runway length requirements given in the above table is that the actual runway length required for a particular flight is a function of elevation, temperature, aircraft stage length, and sometimes internal operational standards. As temperatures change on a daily basis, the runway length requirements change accordingly (i.e.,

the cooler the temperature, the shorter the runway necessary). Therefore, if a runway is designed to accommodate 75% of the fleet at 60% useful load, this does not mean that at certain times a larger or more heavily loaded aircraft cannot use the runway. However, the amount of time such operations can safely occur may be restricted.

Based on the runway length data presented, it was determined that the existing runway lengths of Runway 8/26 and Runway 13/31 are adequate to accommodate the projected aircraft operational requirements at the Airport.

Taxiways

Taxiways are constructed primarily to enable the movement of aircraft between the various functional areas on the Airport and the runway system. Some taxiways are necessary simply to provide access between aircraft parking aprons and runways, whereas other taxiways are necessary to enhance airfield safety and operational efficiency. All taxiways at the Airport currently meet or exceed the required width according to the appropriate ARC criteria.

However, from an operational perspective, there are deficiencies in this system that are due primarily to the basic taxiway layout. Originally designed to meet the specific operational requirements of a World War II era Naval Air Station, the Airport's taxiway system does not fully meet the requirements of a modern civil aviation facility. Shortcomings include the following:

- A lack of parallel taxiway access to the departing ends of Runway 8 and Runway 13;
- A lack of a straight, continuous, full-length parallel taxiway for the primary instrument runway (Runway 8/26);
- A lack of a full-length parallel taxiway for Runway 13/31;
- The lack of a runway exit taxiway stub for aircraft landing on Runway 8 prior to the runway end; and,
- The lack of hold aprons at all runway ends.

While the system currently operates adequately given the existing service levels, the deficiencies inherent in the basic taxiway configuration will likely contribute to increasing inefficiencies as operational demands increase over the long term.

Runway Protection Zones (RPZs)

The function of the RPZ is to enhance the protection of people and property on the ground beyond the runway ends. This safety enhancement is ideally achieved through airport control of the RPZ areas. The RPZ itself is trapezoidal in shape and centered about the extended runway centerline. It begins 200 feet beyond the end of the area usable for takeoff or landing. The RPZ dimensions are functions of the type of aircraft operating at the Airport and the approach visibility minimums associated with each runway end.

In consideration of the existing instrument approach minimums and the type of aircraft each runway is designed to accommodate, the following table, entitled *RUNWAY PROTECTION ZONE DIMENSIONS*, lists existing RPZ dimensional requirements, along with the requirements for improved approach capabilities.

Table C7
RUNWAY PROTECTION ZONE DIMENSIONS

	Width at Runway End (feet)	Length (feet)	Width at Outer End (feet)	Airport Controls Entire RPZ
<i>Existing RPZ Dimensional Requirements:</i>				
Runway 8	1,000	2,500	1,750	Yes
Runway 26	1,000	2,500	1,750	Yes
Runway 13	500	1,000	700	No
Runway 31	500	1,000	700	Yes
<i>Required RPZ Dimensions for Various Visibility Minimums:</i>				
Visual and not lower than 1-mile, Small Aircraft Only	250	1,000	450	---
Visual and not lower than 1-mile, Approach Categories A & B	500	1,000	700	---
Visual and not lower than 1-mile, Approach Categories C & 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 Advisory Circular 150/5300-13, *Airport Design*. --- Not applicable. TBD – To be determined.

As the above table highlights, it appears that the Airport owns all of the areas associated with the Runway 8/26 RPZ. Recent studies at the Airport with respect to declared distance and runway threshold relocations require additional analysis before firm conclusions can be drawn with regard to these issues.

The potential for providing improved instrument approaches at airports throughout the country at a reduced cost is increased with the continued development of Global Positioning System (GPS) technology. This indicates that planning for enhanced approach capabilities, and the impact of the RPZs, should be incorporated in this study.

Threshold Siting

Each runway threshold should be evaluated for deficiencies regarding approach obstacle clearance requirements, according to guidelines contained in FAA Advisory Circular 150/5300-13. Like the RPZ criteria, the threshold siting criteria is a function of the type of aircraft and approach visibility minimums associated with each runway end.

Extensive work and analysis has recently been completed at the Airport with regard to threshold locations and obstruction surveying. The Master Plan Update will further review the findings of this surveying to ensure that appropriate actions have been taken to provide clear, obstruction free approach surfaces.

Navigational and Landing Aids

Airport navigational aids, including instrument approaches and associated equipment, airport lighting, and weather/airspace services, were detailed in the *Inventory* chapter of this document. The Airport is currently equipped for an ILS instrument approach to Runway 26, VOR and GPS instrument approaches to Runway 8, and a COPTER/ LOC/DME approach for helicopters.

Within the near future, Global Positioning System (GPS) approaches are expected to be the FAA's standard approach technology. As noted previously, with GPS, the cost of establishing improved instrument approaches should be significantly reduced. Because of the expected increased use of sophisticated business and corporate aircraft at Astoria Regional Airport, and to increase safety and operational use of the Airport during adverse weather conditions, the ability to implement improved instrument approaches will be analyzed in the next chapter.

Airport Lighting

Presently, all Runways are equipped with Medium Intensity Runway Lights (MIRL). A Precision Approach Path Indicator (PAPI) is located on Runway 31 and a Visual Approach Slope Indicator (VASI) is located on Runways 8 and 13. Runway 8 and 13 are equipped with Runway End Identifier Lights (REILs). Additionally, Runway 26 is equipped with a Medium Intensity Approach Light System with Runway Alignment Indicator Lights (MALSR). In conjunction with the examination of improved instrument approaches described above, improved airport lighting will also need to be evaluated. The type of airport lighting will be dependent on the type of instrument approach capabilities and will be examined in the next chapter. For increased safety purposes, PAPIs should be programmed for all runways, and REILs should be planned for all runways not equipped with approach lights.

Landside Facilities

Landside facilities are those facilities that support the airside facilities, but are not actually part of the aircraft operating surfaces. These consist of such facilities as passenger terminal facilities, aprons, storage hangars, Fixed Base Operators (FBOs), fuel storage facilities, access roads, support facilities, and terminal buildings. Following an analysis of existing facilities, current deficiencies can be noted in terms of accommodating both existing and future needs.

Terminal Building

With the potential for scheduled passenger service at the Airport, definition of an appropriately sized space for passenger terminal functions will be an important outcome produced by this Master Plan Update. Additional information will be provided in this section, as more is understood about the type of service, which is likely to be offered. In addition, improvements and costs will be outlined in the following chapters to provide an understanding of the capital expenses that are likely to be encountered with the initiation of commercial passenger service activity.

Aircraft Storage

Aircraft based at Astoria Regional Airport are currently stored in multi-aircraft hangars, individual hangars, and T-hangars, or on the apron. There are 60 existing based aircraft at the Airport, almost all of which are being stored in hangars. Note that hangar storage of aircraft is typically very desirable at most airports, since it protects aircraft from adverse weather conditions. This is of particular concern at Astoria where the combinations of fog, rain, and salty air can have detrimental effects on aircraft airframes.

Over the course of the 20-year planning period, the number of based aircraft is forecast to increase to 98, indicating that an increase in storage facilities to accommodate approximately 38 new aircraft will be required. In addition, there is a known existing demand for additional aircraft hangar facilities. The trend of increasing general aviation aircraft size also plays a role in defining future development needs. It is assumed that future storage spaces will reflect the characteristics of current storage patterns, with most aircraft owners preferring some form of hangar storage.

Perhaps the most important influence contributing the need for a comprehensive analysis of the future development needs for general aviation is the configuration of the existing facilities in consideration of space currently available for development. Two key issues that will be

considered in the development of a plan for the configuration of future general aviation facilities at Astoria Regional Airport as follows:

- The existing development area for conventional hangars (corporate, FBO, etc.) is minimal. This area is located on the south side of the Airport adjacent to the main apron. The Master Plan Update will define where on the Airport additional conventional hangars can be built. In addition, the new development areas will be identified that can accommodate commercial and industrial aviation development.
- The T-hangar development area can be expanded to the south as demands dictate.

It should be noted that the issues above are more “qualitative” than “quantitative,” but each is an important facility development consideration and are important to recognize as part of this facility requirement review.

Tie-down Storage Requirements/Based Aircraft. Aircraft tie-downs are provided for those aircraft that do not require, or are able to secure hangar storage. Because of the great value of even small, unsophisticated general aviation aircraft, most aircraft owners prefer some type of indoor storage. While demand for based aircraft tie-down areas will continue, it is anticipated that the Airport has enough area on the existing aprons to accommodate future demand. Note that additional tie-down areas will be created as a result of providing required taxiway access areas for new hangar construction.

Tiedown Storage Requirements/Itinerant Aircraft. In addition to the needs of the based aircraft tie-down areas, transient aircraft also require apron parking areas. This storage is provided in the form of transient aircraft tie-down space. In calculating the area requirements for these tie-downs, an area of 400 square feet per aircraft can be used for planning purposes; however, it is known that during high demand periods, the currently available area for transient aircraft parking is adequate.

Hangars. The development plan for future hangars at the Airport will include identifying potential parcels, in consideration of the ability to provide roadway and taxiway access in a manner that is efficient and secure. The number of based aircraft at the Airport is forecast to increase by almost 40 during the next 20 years; therefore, the proposed plan will accommodate indoor storage space for a minimum of 40 additional aircraft.

Air Cargo. At this time, air cargo is not a significant component of the activity at Astoria Regional Airport. However, it is anticipated that the demand for air cargo capabilities will increase similarly to national, regional and local trends during the next two decades. It is also anticipated that air cargo requirements will increase at the Airport once commercial air service is restored. Additional area to accommodate air cargo landside operations will be identified.

Support Facility Requirements.

In addition to the facilities described above, there are several airport support facilities that have quantifiable requirements and that are vital to the efficient and safe operation of the Airport.

Air Traffic Control Tower (ATCT). It is not anticipated that the number of aircraft operations will increase to a point that the construction of an ATCT will be justified at the Airport in the near future.

Aircraft Rescue and Fire Fighting (ARFF) Facility. As stated previously, the Coast Guard provides ARFF facilities at the Airport through a mutual assistance agreement with the Port of Astoria. If scheduled passenger service activity commences at the Airport, the requirement for ARFF equipment, along with the hours of operation and staffing requirements could be impacted. According to Code of Federal Regulations (CFR) Part 139.317, ARFF equipment and staff requirements are based upon the length of the largest air carrier aircraft that serves the Airport with an average of five or more daily departures. Therefore, there is presently no FAA requirement concerning the number of fire fighters or the amount of fire fighting equipment that should be available at Astoria Regional Airport. These requirements will have to be reviewed in relation to the standard ARFF operations in place at the Airport at the point when scheduled commercial passenger service is restored.

Fuel Storage Facility. The Airport currently has facilities adequate to serve existing aircraft operations. The capacity of the existing storage area can be increased as needed in the future; however, its expansion will likely reduce the area available for aircraft parking apron. It should also be noted that if future aviation facilities are constructed on other areas of the Airport, additional fuel storage units may be required.

Service Roads. An important consideration at Astoria Regional Airport is programming for an appropriate service road system that will accommodate the need for maintenance, emergency, security (including wildlife management observations), and fueling vehicles to access all areas on airport property without the need to drive on public roads or the taxiway/runway surfaces. An

adequate service road system is a great asset in minimizing the potential for runway incursions by ground vehicles. This will become even more critical if aviation use facilities are developed on other areas of airport property.

Summary

The information provided in this chapter provides the basis for understanding what facility improvements at the Airport might help in the effort to safely and efficiently accommodate future demands. Following are the major airport development considerations:

- The Airport's runway layout and capacity is well structured to accommodate forecast operational activity. No recommendations will be made with regard to the need for additional runways or for the need to lengthen the existing runways.
- The largest aircraft using the Airport on a regular basis are medium sized business jets such as the Cessna Citation II, Cessna Citation V and Dassault Falcon 20. These aircraft are included in using ARC B-II criteria. This is the same ARC as has been used in previous planning documents. The Airport is utilized to a lesser degree by some business jet aircraft with "C" approach speeds (greater than 121 knots but less than 141 knots); however, these aircraft do not use the Airport on a frequent enough basis to be warrant "design aircraft" considerations.
- The dimensional standards related to pavement widths, safety setbacks and object-clearing standards, are driven by the ARC for individual runways and taxiways. There are no known dimensional standard deficiencies at the Airport.
- The taxiway system at the Airport functions well to provide access between the landside and airside. Improvements can be made by programming for full parallel taxiway systems to serve both runways; however, the priority for construction of these improvements will remain low until aircraft operational levels increase.
- The instrument approach capabilities currently available at the Airport (including the precision ILS approach to Runway 26) will be maintained and the potential to improve the approach capabilities to all runways, for both fixed wing and helicopters, will be considered in the formulation of the Development Plan for the Airport.

- Improvements related to the terminal building location, size, and function will be explored in the formulation of the Development Plan for the Airport. This could involve the relocation of the terminal facility to another area of the Airport.
- Additional area will be needed to accommodate future general aviation storage facilities, maintenance and FBO facilities. This will likely include the recommendation to construct hangar facilities on some areas on the Airport that are currently undeveloped.
- Landside access and automobile parking will be an important consideration in programming for future facility development at the Airport. This will include provisions for an access roadway system that is separate and secure from the aircraft operating areas.
- The Master Plan for the Airport must be formulated in a manner to make efficient use of the limited amount of property associated with the Airport, while also providing the flexibility to construct needed facilities in response to evolving and sometimes unanticipated needs.

It is important to note that the recommendations in this Master Plan Update are provided to best understand what facilities improvements might be needed at the Airport, and where those facilities might be best placed. In other words, the Master Plan Update provides recommendations on how various parcels of the Airport might be best developed, in consideration of potential demand and community/environmental influences. One of the basic assumptions for a master plan, for a complex facility like an airport, is that if a future improvement is identified on the recommended Development Plan; it will only be built if there is actual demand, if the project is financial feasible, and if environmental impacts are insignificant.