



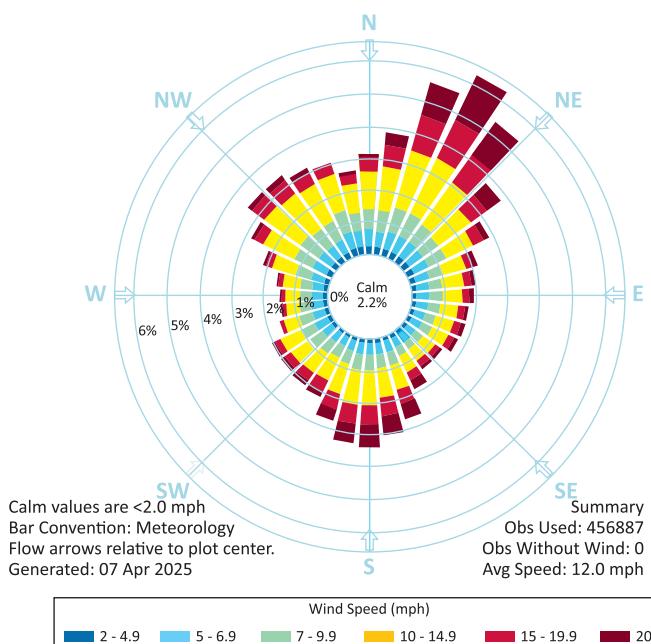
FACT SHEET

January 2026

The Role of Wind Roses in Airport Planning

A wind rose is a circular diagram that shows where the wind comes from and how fast it blows. Wind data collection and analysis dates back to ancient civilizations, long before the advent of aviation, when explorers relied on wind patterns to navigate the seas. Fast forward to today – beyond its historical role in sea navigation, wind data has become a critical element in airport planning and design.

Each “spoke” (or 10-degree quadrant) on a wind rose indicates the direction the wind blows, while the length of the spoke represents the amount of time the wind blows from that direction. Some wind roses, (see below) use colors to highlight the portion of time the wind blows at different speeds. For the Alaska Department of Transportation and Public Facilities (DOT&PF), wind roses are primarily shown on Airport Layout Plans (ALP) and appear more like navigational charts than a colorful rose, as shown on the next page.



Understanding the typical wind speed and direction requires extensive data and is critical to planning and designing functional airports.

Wind Rose Development

Wind roses are generated as part of a wind study or by using historical wind data collected from a variety of sources, including Automated Weather Observing Systems (AWOS), Automated Surface Observing Systems (ASOS), and National Weather Service stations. In ideal conditions, data is compiled over a 10- or 30-year period to ensure statistical reliability. This data is used to create a wind rose depicting typical wind conditions; the wind rose does not show the potential for extreme wind events. For example, while Hooper Bay experienced gusts up to 67 miles per hour during Typhoon Merbok, the wind rose in the airport's ALP only provides information about average wind patterns, such as that wind speeds greater than 32 mph occur 6.3% of the time and are most likely to be blowing from an east-southeast direction.

For airports in Alaska, wind roses are typically developed as part of an airport planning process that involves siting a new runway or in the design process for airport improvements. Wind studies are performed in accordance with the Federal Aviation Administration's (FAA) Advisory Circulars [150/5300-13B¹](#), [150/5070-6B²](#), or by using specialized software, such as the FAA's Wind Generator tool, located on the FAA's Airport Data and Information Portal (ADIP). In Alaska, many airports do not have long-term weather observation systems. In such cases, if an existing airport is considered for major upgrades or relocation, pilot interviews are often conducted to determine if the runway's orientation is an issue. If so, equipment may need to be installed, and generally, a minimum of 2 years' worth of data is collected for evaluation.

¹https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC-150-5300-13B-Airport-Design-Chg1-w-errata.pdf

²https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_150_5070-6B_with_chg_1&2.pdf

Essential Role of Wind Roses

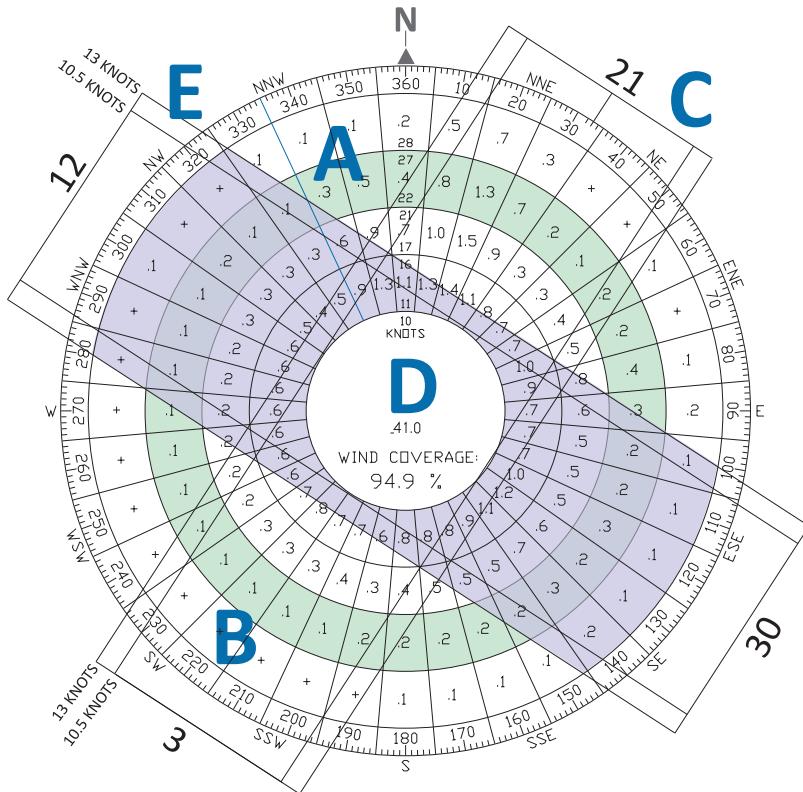
Runway orientation is primarily determined by prevailing wind patterns to ensure safe takeoffs and landings. Crosswinds—winds that blow perpendicular to a runway—can impact the pilot's control of an airplane's movement, leading to unsafe situations. The wind rose provides the necessary information for determining the ideal runway orientation in relation

to prevailing wind directions. A runway should be oriented in a way that allows an aircraft to take off and land parallel to the prevailing wind 95% of the time.

If the primary runway does not provide 95% coverage, a "crosswind runway" will be evaluated to bring the combined wind coverage of the two runways to at least 95%. A crosswind runway may be needed because of frequent variation in wind direction or because a runway cannot be oriented in the ideal direction. Often, this occurs because of terrain (e.g., mountains and waterbodies) or land ownership.

Types Of Wind Roses

The wind analysis for wind roses is based on different criteria depending on the available data and anticipated aircraft operations at



How do you read it?

Typical wind roses include:

- A Wind Speed.** Each concentric ring represents a wind speed range in knots, with the larger radius rings corresponding to greater wind speeds. Ex. The wind speeds between 22 and 27 knots are shown in green.
- B Frequency.** The decimal numbers depict the total percentage of observed wind for a corresponding wind speed and direction. The + symbol denotes percentages less than 0.1%.
- C Runway Orientation.** Runways are shown as rectangular boxes with their long dimensions and names correlating to their real-world orientation. This wind rose shows runways 3-21 and 12-30.
- D Total Wind Coverage.** The center of the wind rose provides both the percentage of time the winds are calm, 41% at this airport, and the total wind coverage by all runways, 94.9% at this airport.
- E Runway Wind Coverage.** The wind coverage for each runway is the sum of all observed wind frequencies within the runway box for a specific crosswind speed. The narrower dimension of the runway box correlates to different crosswind speeds. The wind rose above depicts coverage areas for 10.5- and 13-knot crosswinds.

Example: Using the wind rose diagram, the wind coverage for Runway 12-30 with a maximum crosswind of 13 knots can be calculated by adding up all the frequency percentages that fall within the 13 knot box (shown in purple).

the airport. The following three types of wind roses are utilized for airport planning and design in Alaska:

- All-Weather Wind Roses:** Include all wind data regardless of visibility or ceiling. They are used in long-term planning and infrastructure design.
- VFR Wind Roses (Visual Flight Rules):** Based on wind data during good visibility and cloud clearance. They are useful for general aviation and bush pilots. Where visibility or cloud cover data is not available, wind coverage analysis may be done for daylight hours.
- IFR Wind Roses (Instrument Flight Rules):** Reflect wind patterns during low-visibility or poor weather conditions. They are critical for commercial and medevac operations.

Given Alaska's frequent weather changes, having separate wind roses for VFR and IFR conditions helps pilots, planners, and design engineers understand how wind patterns vary with the weather.

Wind roses may be ancient in origin, but their ability to translate decades of wind data into clear visual guidance continues to be an essential navigational tool, and their modern iterations are critical to the safe planning, design, and operations of airports.



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