

# Wind Analysis for Airport Planning

South Dakota's 36<sup>th</sup> Annual Airports Conference



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# The Basics: Wind, Aircraft, and Runways

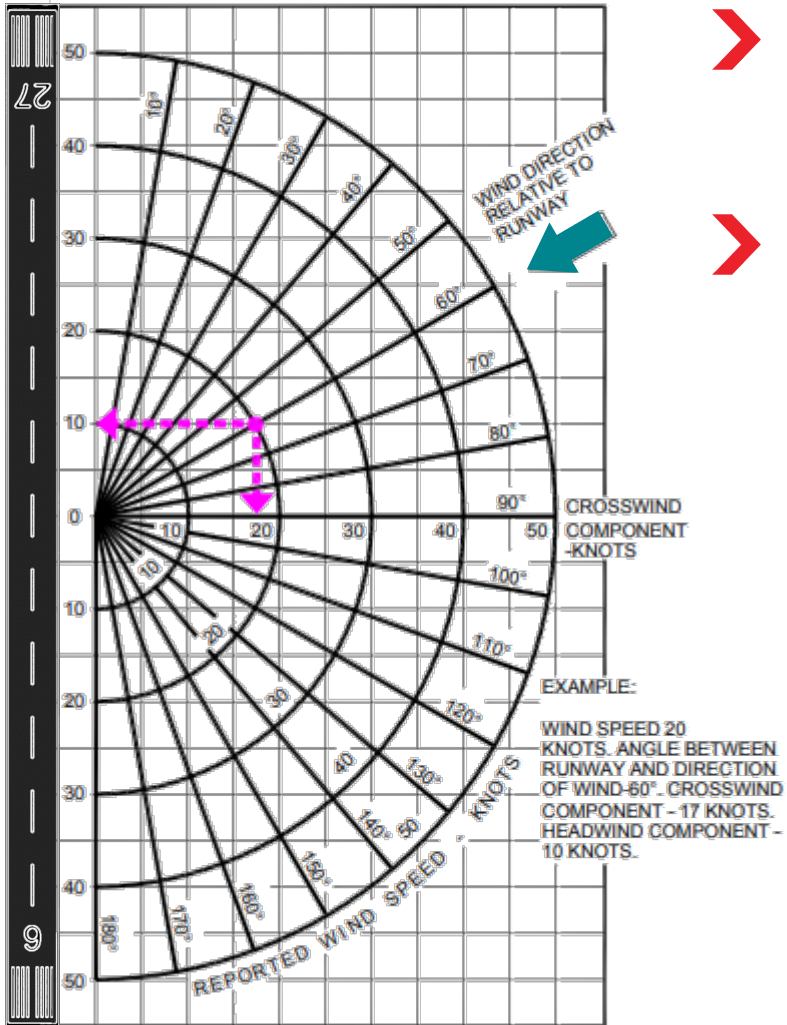


- Aircraft typically takeoff and land into the wind because it increases lift and lowers ground speed.
  - Land at lower (safer) speeds
  - Shorter takeoffs & landings
- Aircraft heading must compensate for crosswinds
- All aircraft have crosswind limits



# The Basics: Crosswind Component

- Determined by wind speed and direction relative to runway heading
- For Runway Analysis, an aircraft's allowable crosswind component based on aircraft size and approach speed



**Table 3-1. Allowable crosswind component per Runway Design Code (RDC)**

RDC	Allowable Crosswind Component
A-I and B-I *	10.5 knots
A-II and B-II	13 knots
A-III, B-III, C-I through D-III D-I through D-III	16 knots
A-IV and B-IV, C-IV through C-VI, D-IV through D-VI	20 knots
E-I through E-VI	20 knots



# The Basics: Crosswind Runways



- Allows aircraft to operate when winds are not favorable for the primary runway



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# Wind Data Analysis

Why Do We  
Analyze  
Wind??



- Runway Orientation
  - Safety
  - Efficiency (*Minimize Runway/Infrastructure Needs*)
- Airport Utilization
  - Better Understand Operational Impacts
    - Existing “Wind Coverage” Limitations
    - Runway Closures (*temporary or permanent*)
  - Evaluate Instrument Approach Procedures
    - Prioritize Needs
    - “All Weather” vs. IFR Data

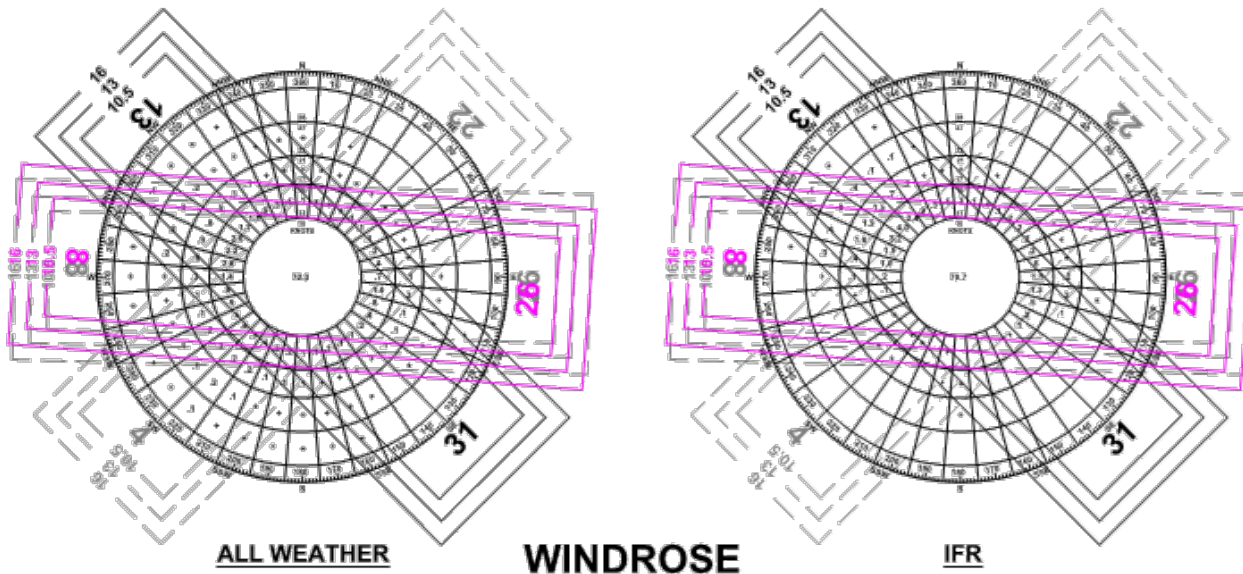


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# Wind Coverage

- Apply true orientation of runways to wind data
- Determine wind coverage for allowable crosswind components
  - 10.5, 13, 16 and 20 knots
- Desirable for wind coverage to be 95% or greater

ALL-WEATHER WIND COVERAGE				
CONFIGURATION	CROSSWIND COMPONENT			
	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
RUNWAY 13-31	93.05%	96.58%	98.19%	-
RUNWAY 8-26	94.42%	97.25%	-	-
	-	-	-	-
<b>COMBINED</b>	<b>97.40%</b>	<b>98.50%</b>	<b>98.19%</b>	<b>-</b>
SOURCE: KSPF AWOS (2009-2018, HOURLY) FROM NATIONAL CLIMATIC DATA CENTER				
82,673 TOTAL OBSERVATIONS				
INSTRUMENT FLIGHT RULES (IFR) WIND COVERAGE				
CONFIGURATION	CROSSWIND COMPONENT			
	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
RUNWAY 13-31	96.99%	99.17%	99.79%	-
RUNWAY 8-26	94.40%	98.09%	-	-
	-	-	-	-
<b>COMBINED</b>	<b>99.52%</b>	<b>99.88%</b>	<b>99.79%</b>	<b>-</b>
SOURCE: KSPF AWOS (2009-2018, HOURLY) FROM NATIONAL CLIMATIC DATA CENTER				
5,179 TOTAL OBSERVATIONS				
IFR = VISIBILITY LOWER THAN 3 MILES OR CEILING LOWER THAN 1,000 FEET				



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# Understanding Weather Stations



- Types of Airport Weather Stations
  - AWOS/ASOS
- Weather Conditions Reported
  - Depends on Type of Station
  - Examples: Temp/Dewpoint, Wind, Altimeter, Ceiling, Visibility, Precipitation
- Other Weather Sources
  - Valuable localized wind information

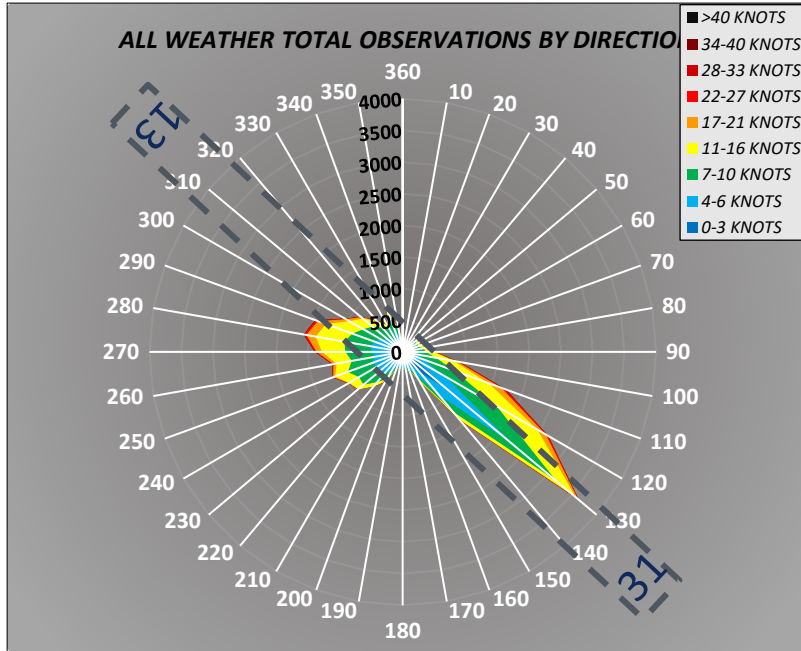


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# Siting Weather Stations



## EKALAKA AIRPORT ALL-WEATHER WIND COVERAGE

CONFIGURATION	CROSSWIND COMPONENT	
	10.5 KNOTS	13 KNOTS
<b>RUNWAY 13-31</b>	95.02%	98.23%

SOURCE: K97M SUPERAWOS (03/2015 - 03/2019, HOURLY)  
FROM NATIONAL CLIMATIC DATA CENTER

31,871 TOTAL OBSERVATIONS

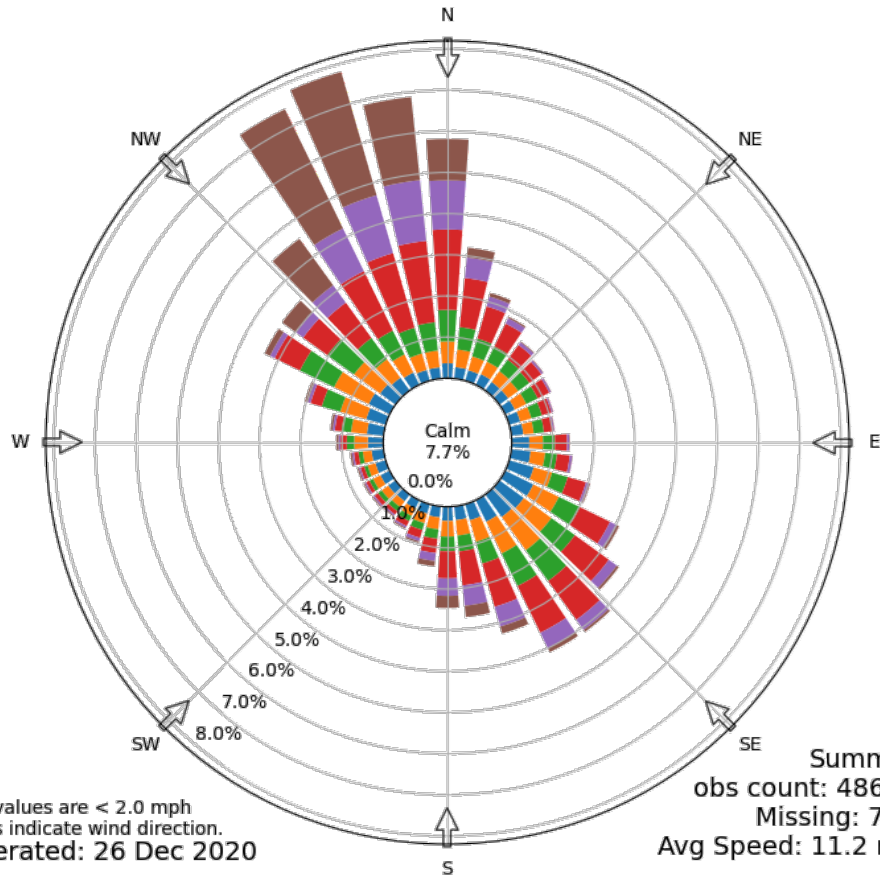


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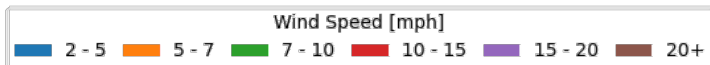
# Wind Data



[RAP] RAPID CITY  
Windrose Plot  
Time Bounds: 01 Jan 1970 02:00 AM - 26 Dec 2020 12:52 AM America/Denver



Calm values are < 2.0 mph  
Arrows indicate wind direction.  
Generated: 26 Dec 2020



- Preferably 10 Complete Years
- Hourly Data
- Nearest Weather Station with Similar Geographical Features
- Source – NCEI (Former NCDC)



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# Using Off-Airport Wind Data



- Surface air at Belle Fourche is impacted by the Black Hills to the south in the same way a rock changes the flow of a stream



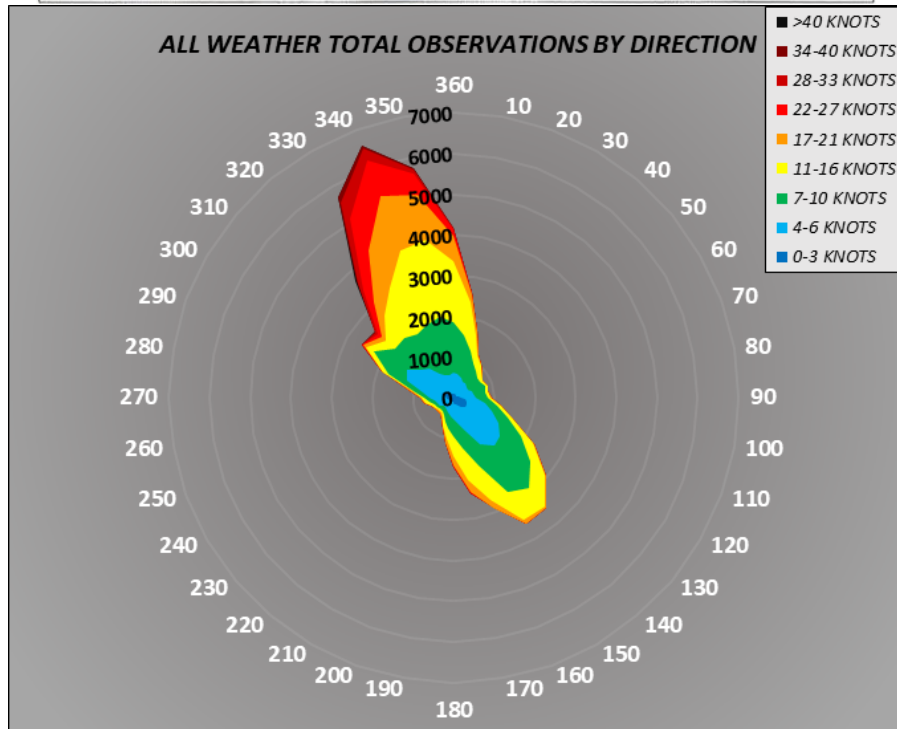
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# Using Off-Airport Wind Data

## 2002 ALP – Rapid City ASOS

RUNWAY	10.5 KNOTS	13 KNOTS	16 KNOTS	20 KNOTS
14–32	93.99%	97.46%	99.34%	99.87%
18–36	91.66%	95.33%	97.94%	99.25%
8–26	72.43%	79.36%	87.49%	93.30%
COMBINED	99.77%	99.96%	99.99%	100.0%

ALL WEATHER – 83766 OBSERVATIONS  
WIND DATA FROM RAPID CITY, SD  
WEATHER JANUARY 1991 – DECEMBER 2000  
+ = LESS THAN 9.2%

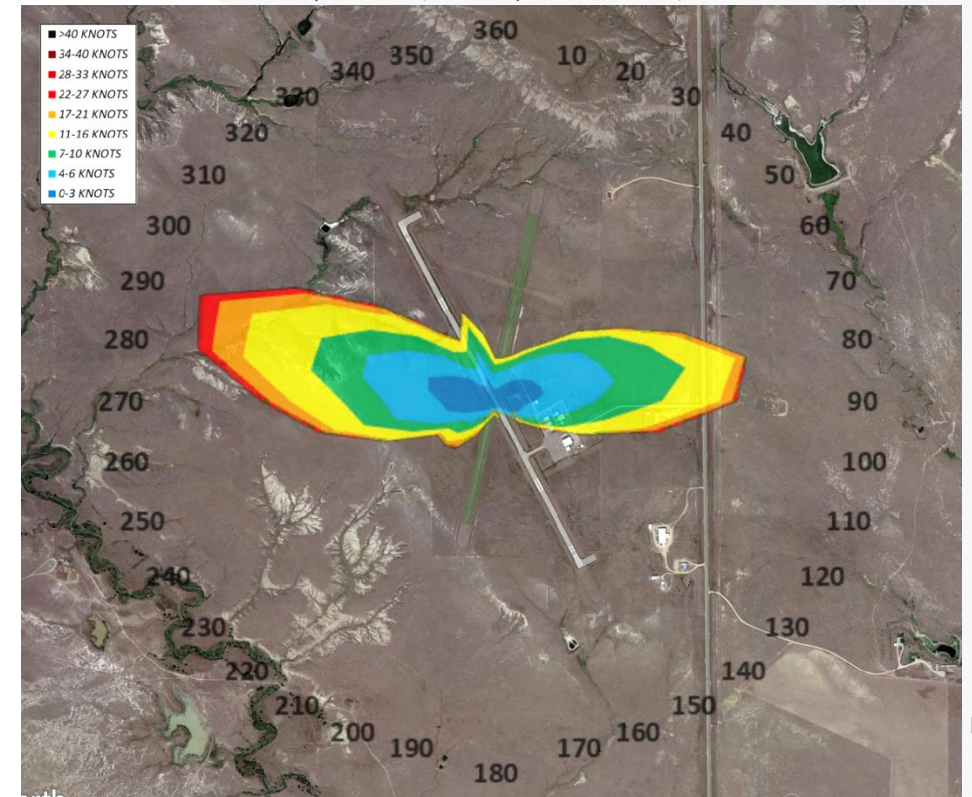


*A few years of the right data is better than 10 years of the wrong data*

## 2020 – Belle Fourche SuperAWOS

CONFIGURATION	CROSSWIND COMPONENT		
	10.5 KNOTS	13 KNOTS	16 KNOTS
<b>RUNWAY 14-32</b>	85.46%	92.24%	96.75%
<b>RUNWAY 18-36</b>	81.48%	88.59%	-
<b>RUNWAY 11-29</b>	96.48%	-	-
<b>COMBINED</b>	99.08%	94.07%	96.75%

SOURCE: KEFC SUPERAWOS (2010-2019, HOURLY) FROM NCDC 86,129 TOTAL OBSERVATIONS



# QUESTIONS



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