



# SELECT THE RUNWAY FOR TAKE-OFF AND LANDING

## 1. Introduction

The term “runway-in-use” shall be used to indicate the runway or runways that are considered by the aerodrome control tower to be the most suitable for use by the types of aircraft expected to land or take-off at the aerodrome.

The TWR controller is responsible for the choice of the active runways.

This documentation is made to help air traffic controllers and pilots in non-controlled areas to select the best runway for landing and taking-off.

### 1.1. Data source

Before any decision, you must have:

- All aeronautics charts of your airfield VFR, IFR (IAC, ARR, DEP...)
- Last METAR of the selected airfield or nearest airfield (if not available for the selected airfield)
- Last TAF of the selected airfield if existing

### 1.2. What do the documents tell

Sometimes constraints are published on charts. You must read all the charts and take these constraints into account:

- Preferred landing runway
- Preferred take-off runway (especially if different than to the landing runway)
- Preferred runway to open under special circumstances (night, heavy, low visibility, noise)
- Runway with or without precision approach procedure (like ILS approach)
- Runway with or without non-precision approach procedure (like VOR, NDB approach)
- Landing minima (weather)

Be aware that sometimes there are local recommendations known by pilots and/or air traffic controllers but not written on charts. These can be applicable if the current traffic flow permits them.

Pay attention that the selection of any real configuration (take-off and landing runways) in IVAO without considering constraints and traffic can be a wrong choice.

Be aware that the IVAO weather is based on the last upload of the METAR information. Sometimes IVAO can have outdated weather information. Do not synchronize with the real time weather; compare the METAR information you have got.

Select the runway in use	Version 2.0	13 December 1016	Page 1
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## 2. Regulation

In selecting the runway in use, the TWR controller shall take into consideration the factors:

- Surface winds and direction
- The aerodrome traffic circuit layout
- The length of the runway
- Approach landing aids available
- Noise abatement procedure in use

Runways should not be selected for noise abatement purposes for landing operation unless they are equipped with glide path guidance (ILS) or a visual approach slope indicator system for operation in visual meteorological conditions.

A pilot can refuse a runway offered for noise-preferential reasons for safety concern.

Noise abatement shall not be a determining factor in runway nomination under the following conditions:

- If the runway surface conditions are adversely affected ( snow, slush, ice, water, mud, oil...)
- For landing in conditions, when the ceiling is lower than 500ft (150m) above the elevation , or the visibility is less than 1900m
- When the approach requires a vertical minimum height greater than 300ft (100m) above aerodrome elevation, and the ceiling is lower than 800ft (240m) or the visibility is less than 3000m
- For take-off when the visibility is less than 1900m
- When wind shear has been reported or forecast or when thunderstorms are expected to affect the approach or departure
- When crosswind component, including gusts, exceeds 15KT (28km/h), or the tailwind component, including gusts, exceed 5kt (9km/h)

Choosing an active runway does not imply that this is the only one that can be used without any alternative

Select the runway in use	Version 2.0	13 December 1016	Page 2
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### 3. Runway selection criteria

We start to study the different criteria. The most important parameter to take into account is the wind.

#### 3.1. Wind direction

An aircraft lands and takes-off into the wind unless safety, the runway configuration, meteorological conditions and available instrument approach procedure or air traffic conditions determine that a different direction is preferable.

Reason being that headwind creates lift.



The wind near the runway is given by the METAR information. The wind group is 5 digits ending with KT or MPS:

- First 3 digits represent the heading of the aircraft which has the wind in front of him
- Last 2 digits represent the wind speed
- KT or MPS is the unit of the wind speed: KT =knot; MPS =meter per second.

Example:

METAR 262100Z **27007KT** CAVOK 08/03 Q1023 NOSIG

The winds come from 270°, speed is 7 knots.

If the wind speed is lower than 5knots, the wind can be considered not important as a selection criteria.

#### 3.2. Weather minima

METAR information also gives visibility and ceiling information.

You must check the compatibility of the ceiling and the IFR approach minima given by the charts.

Ceiling in METAR is the lowest group BKN or OVC followed by 3 digits. The 3 digits are the height in hundreds of feet of the cloud base level.

Example:

METAR 262100Z 27007KT 8000 **FEW005 OVC012 BKN044 FEW095** 08/03 Q1023 NOSIG

Ceiling is the group OVC012 (the lowest group with OVC or BKN)

Height = 012 \* 100 = 1200 ft

Select the runway in use	Version 2.0	13 December 1016	Page 3
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### 3.3. Published runway use recommendation

Sometimes, in some airfields, the runway in use recommendation is published.

You need to apply the chart recommendation where possible (wind compatible, weather minima ...).

The runway recommendation criteria can be:

- Preferential runway (general)
- Preferential runway during night operation
- Preferential runway due to ground landmark or obstacle
- Preferential runway for noise reduction procedure
- Preferential runway due to activation or presence of restricted areas
- Preferential runway due to dual runway available
- Preferential runway for a reduction of flight time for arrivals and/or departures
- Preferential runway for a reduction of taxi time for arrivals and/or departures
- Specialized runway within a doublet runway
- Specialized runway dedicated for landing
- Specialized runway dedicated for take-off
- Runway restriction for a specific aircraft category (A,B,C,D)

Choosing an active runway does not imply that this is the only one that can be used without any alternative

### 3.4. IFR published approach on runway available

At some airfields, there is no IFR approach published for one or several runways, or an IFR approach is published only for one side of a runway.

We recommend to select a least one active runway with an IFR approach published when the wind favours this selection.

In case of selection of a runway with no published IFR approach procedure, the aircraft shall be authorized by the controllers to fly one IFR approach on another runway then perform a visual approach to the selected runway when reaching the aerodrome circuit altitude or the IFR approach minima and if the pilot has visual on the selected runway.

Select the runway in use	Version 2.0	13 December 1016	Page 4
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### 3.5. Preliminary criteria to check

You must check:

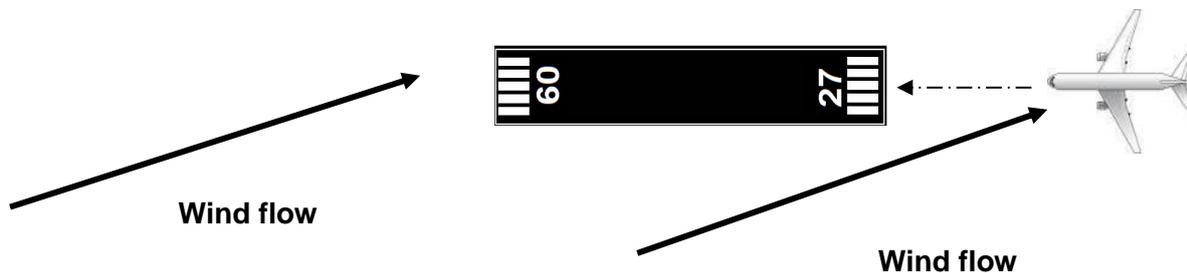
- Approach aircraft category must be compatible with the charts publication
- Runway is not closed on charts (or NOTAM when applicable)
- No land mark obstacles are present

#### NOTAM application is possible and can imply the closure of a runway:

Be aware that the application of real world NOTAMs is not mandatory in IVAO. NOTAM application is optional. Please consider NOTAM application for daily use in IVAO in relation to the realism of the network and the beginners' management.

### 3.6. Headwind, tailwind and crosswind calculation

The wind flow does not follow the runway axis all the time. It often comes from the left or the right.

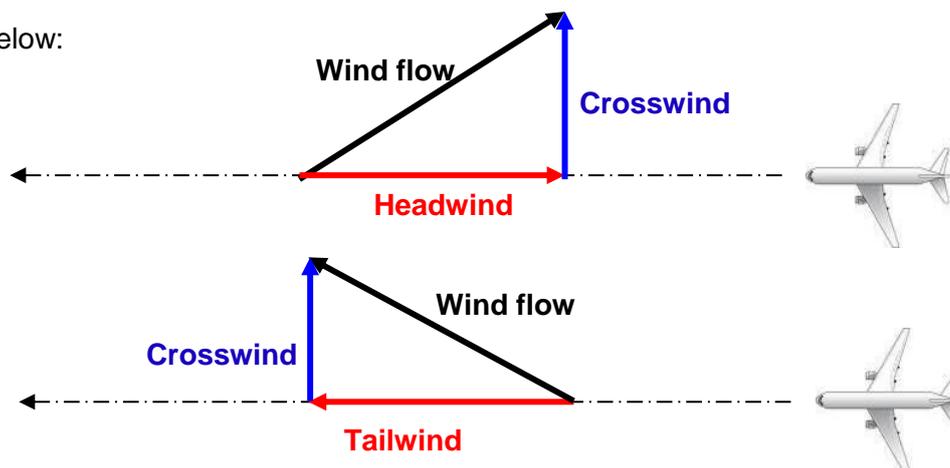


The wind flow can be taken from the METAR information (see chapter §2.1).

There are 2 parts in a wind flow:

- a **headwind** blows **against the direction** of travel or a **tailwind** blows **in the same direction** of travel
- a **cross wind** blows using **perpendicular direction of travel** (from the left or from the right)

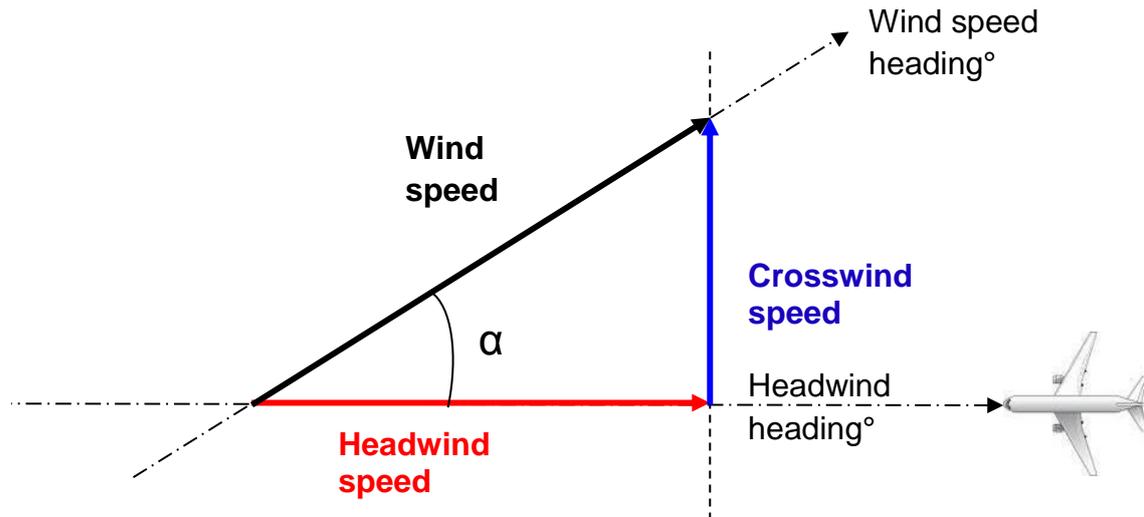
See example below:



Select the runway in use	Version 2.0	13 December 1016	Page 5
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### 3.6.1. Headwind configuration

$\alpha$  is the angle of the wind from direction of travel.



$$\alpha = (\text{Wind speed heading}^\circ - \text{Headwind Heading}^\circ)$$

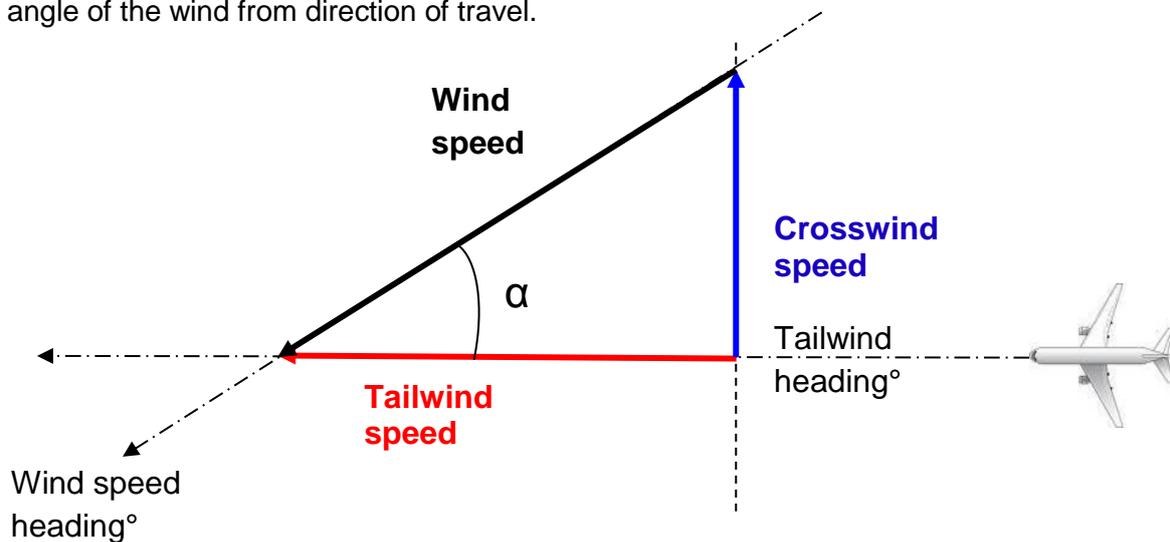
Headwind heading = Aircraft heading

The angle shall be:  $-90^\circ < \alpha < +90^\circ$

Note that METAR heading of the wind is the heading of the aircraft which has the wind in front of him

### 3.6.2. Tailwind configuration

$\alpha$  is the angle of the wind from direction of travel.



$$\alpha = (\text{Wind speed heading}^\circ - \text{Tailwind Heading}^\circ)$$

Tailwind heading = Aircraft heading  $\pm 180^\circ$

The angle shall be:  $-90^\circ < \alpha < +90^\circ$

Select the runway in use	Version 2.0	13 December 1016	Page 6
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### 3.6.3. Calculation

We now calculate the crosswind and headwind (tailwind) speeds using the angle  $\alpha$  and METAR information:

$$\text{Crosswind speed} = \text{wind speed} * \sin(\alpha)$$

$$\text{Headwind speed (or tailwind)} = \text{wind speed} * \cos(\alpha)$$

As the 'sine' and 'cosine' mathematical functions are quite complex, here are some conversion tables:

This table below is the conversion of 'sine' and 'cosine' functions:

$\alpha$	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
sin $\alpha$	0	0.17	0.34	0.5	0.64	0.77	0.86	0.94	0.98	1
cos $\alpha$	1	0.98	0.94	0.86	0.77	0.64	0.5	0.34	0.17	0

We can have a simpler table for wind calculation: here we have approximated crosswind and headwind speeds for a wind speed value = 10.

A	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°
Crosswind	0	0	3	5	6	7	8	9	10	10
Headwind (tail)	10	10	9	8	7	6	5	3	0	0

#### Example:

Wind speed = 8KT

Aircraft heading = 60°

Wind speed heading in METAR = 100°

We are in headwind configuration, so: Headwind = Aircraft heading° = 60°.

$\alpha = 100^\circ - 60^\circ = 40^\circ$

True calculation: Crosswind =  $8 * \sin(40^\circ) = 5.14$  KT ; Headwind =  $8 * \cos(40^\circ) = 6.12$  KT

First table calculation: Crosswind =  $8 * 0.64 = 5.12$  KT ; Headwind =  $8 * 0.77 = 6.16$  KT ; error < 1%

Second table calculation: Crosswind =  $8 * 6/10 = 4.8$  KT ; Headwind =  $8 * 7/10 = 5.6$  KT ; error < 10%

Tailwind and Crosswind values are different for each runway!

For runway 24, if the headwind is +5KT, then for opposite runway 06, the headwind is transformed into a tailwind. So, for the runway 06, Headwind is -5KT or tailwind is +5KT.

Select the runway in use	Version 2.0	13 December 1016	Page 7
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## 4. How to select runway : method

### 4.1. Selection order for a runway

The selection order to choose a runway outside any weather parameter is:

1. Select a published preferred IFR runway or usual runway known as a real usage
2. Select a runway with precision IFR approach (like ILS)
3. Select a runway with one non-precision IFR approach at least
4. Other runway with visual approach minima published for IFR flights

Be aware that in IVAO, the weather condition should be good enough in order to let the pilots perform an approach safely.

If the visibility and ceiling conditions are too low, we recommend selecting a runway with a precision approach available (like ILS). If you do not have a precision approach, select the runway with an IFR approach with the lowest minima. If the wind speed is high, we recommend selecting the runways with headwind.

### 4.2. Use of the published IFR runway (or usual runway)

If a preferred runway is published or, if it is a runway usually used in real aviation, this runway can be selected as the main landing runway. The table below can help you to decide if you can choose this runway.

Published preferred IFR runway					
Ceiling is	Compatible with minimum one published IFR approach	Not compatible with any IFR approach			
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT	All winds configuration
Can this runway be opened?	Yes	Possible	ATC Analysis	No	No

#### Notes:

**Yes:** means that this runway can be opened with no restrictions for IFR.

**Possible:** means that this runway can be opened with no ceiling restriction but with presence of light tailwind for the pilot.

ATC Analysis: means that an analysis must be done by ATC to check if another runway can be selected or not according to the current weather and chart publications.

**No:** means that this runway cannot be selected and is not usable with present conditions; check other chapters in order to select your runway configuration in function of IFR approach types.

In case of selection of a runway with tailwind, the pilot-in-command shall be informed about the wind configuration when:

- Tailwind is greater than 6 KT for Light aircraft category
- Tailwind is greater than 8 KT for Medium and Heavy aircraft category

Select the runway in use	Version 2.0	13 December 1016	Page 8
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### 4.3. Use of runway with an IFR precision approach (ILS type)

If one runway has a precision approach published (example ILS), this runway can be selected as the main landing runway. The table below can help you to decide if you can choose this runway.

Published preferred runway					
Ceiling is	Compatible with precision approach minima	Not compatible with precision approach minima			
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT	All winds configuration
Can this runway be opened?	Yes	Possible	ATC Analysis	No	No

#### Notes:

**Yes:** means that this runway can be opened with no restrictions for IFR.

**Possible:** means that this runway can be opened with no ceiling restriction but with presence of light tailwind for the pilot.

**ATC Analysis:** means that an analysis must be done by ATC to check if another runway can be selected or not according to the current weather and chart publications.

**No:** means that this runway cannot be selected and is not usable with present conditions.

The precision approach minima are the lowest minima required in real aviation. If the precision approach minima are not available, you can be sure that your airfield is closed for traffic.

In case of selection of a runway with tailwind, the pilot-in-command shall be informed about the wind configuration when:

- Tailwind is greater than 6 KT for Light aircraft category
- Tailwind is greater than 8 KT for Medium and Heavy aircraft category

Select the runway in use	Version 2.0	13 December 1016	Page 9
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#### 4.4. Use of runway with a non-precision IFR approach

A classical approach can be a VOR, NDB, RNAV non-precision approach. The table below can help you to decide if you can choose this runway.

Non-precision IFR approach runway					
Ceiling is	Compatible with one IFR approach minima	Not compatible with one IFR approach minima			
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT	All winds configuration
Can this runway be opened?	Yes	Possible	ATC Analysis	No	No

#### Notes:

**Yes:** means that this runway can be opened with no restrictions for IFR.

**Possible:** means that this runway can be opened with no ceiling restriction but with presence of light tailwind for the pilot.

**ATC Analysis:** means an analysis must be done by ATC to check if another runway can be selected or not according to the current weather and chart publications.

**No:** means that this runway cannot be selected and is not usable with present conditions.

If the non-precision minima are not available and if your airfield has no IFR precision approach, you can be sure that your airfield is closed for traffic.

In case of selection of a runway with tailwind, the pilot-in-command shall be informed about the wind configuration when:

- Tailwind is greater than 6 KT for Light aircraft category
- Tailwind is greater than 8 KT for Medium and Heavy aircraft category

Select the runway in use	Version 2.0	13 December 1016	Page 10
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## 4.5. Use of runway with visual approach

If you select a runway with only visual approach with or without prescribed tracks, the pilot shall perform an IFR approach using another runway before switching to a visual approach of the selected runway at the minima or at the aerodrome circuit altitude. The table below can help you to decide if you can choose this runway.

Published preferred runway					
Ceiling is	Compatible with Visual approach minima	Not compatible with Visual approach minima			
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT	All winds configuration
Can this runway be opened?	Yes	Possible	Disadvantageous	No	No

### Notes:

**Yes:** means that this runway can be opened with no restrictions for IFR.

**Possible:** means that this runway can be opened with no ceiling restriction but with presence of light tailwind for the pilot.

**Disadvantageous:** means that configuration is not really good for incoming aircraft. If you have a better solution, use it!

**No:** means that this runway cannot be selected and is not usable with present conditions.

Be aware that selecting a visual approach, the weather condition shall be good enough in order to perform a safe approach on your airfield. Choose when possible a runway with a minimum of one IFR approach available.

Select the runway in use	Version 2.0	13 December 1016	Page 11
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## 4.6. VFR only airfield

We are in the case of a VFR airfield only. These tables below can help you to decide if you can choose this runway.

VFR runway under VMC				
Ceiling is Visibility is	> 1500 ft > 5000 m	> 1500 ft > 5000 m	> 1500 ft > 5000 m	> 1500 ft > 5000 m
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT
Can this runway be opened?	Yes	Possible	Disadvantageous	No

## 4.7. Special VFR conditions

The table below is applicable if your national regulations allow special VFR clearances. The minima of ceiling or visibility can be different with regards to your national regulations. The values given are typical.

VFR runway below VMC				
Ceiling is Visibility is	1500ft > C > 1000ft 5000m > V > 1500m	1500ft > C > 1000ft 5000m > V > 1500m	1500ft > C > 1000ft 5000m > V > 1500m	1500ft > C > 1000ft 5000m > V > 1500m
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT
Can this runway be opened?	Yes Special VFR only	Possible Special VFR only	Disadvantageous Special VFR only	No
	No If Special VFR not allowed	No If Special VFR not allowed	No If Special VFR not allowed	No

VFR runway under low visibility in IMC				
Visibility is	< 1500 m	< 1500 m	< 1500 m	< 1500 m
Wind direction is	Headwind > 0 KT or wind = 0 KT	Tailwind < 6 KT	6 KT < Tailwind < 15 KT	Tailwind > 15 KT
Can this runway be opened?	No	No	No	No

Pay attention that some countries can allow helicopter VFR flight under 1500m. Please check your national regulations.

Select the runway in use	Version 2.0	13 December 1016	Page 12
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