

Encyclopedia

- [Aerodrome Reference Code](#)
- [Parallel runway operation](#)
- [Wake turbulence category](#)
- [Wake vortex turbulence](#)
- [Runway Change Guide](#)

Aerodrome Reference Code

Definition

The [ICAO](#) Aerodrome Reference Code is a two part categorisation of aircraft types which simplifies the process of establishing whether a particular aircraft is able to use a particular aerodrome. It is included in ICAO Annex 14. It has two 'elements', the first is a numeric code based on the Reference Field Length for which there are four categories and the second is letter code based on a combination of aircraft wingspan and outer main gear wheel span.

Element 1 - Reference field length

Code number	Aeroplane reference field length	Typical aeroplane
1	< 800 m	DE HAVILLAND CANADA DHC-6/PIPER PA-31
2	800 m, but < 1200 m	ATR ATR-42-300/320/BOMBARDIER Dash 8 Q300
3	1200 m, but < 1800 m	SAAB 340/BOMBARDIER Regional Jet CRJ-200
4	1800 m and above	BOEING 737-700/AIRBUS A-320

Field length means the balanced field length (which is when the take-off distance required is equal to the accelerate-stop distance required) if applicable, or take-off distance in other cases.

Aeroplane reference field length is defined as "the minimum field length required for take-off at maximum certificated take-off mass, at sea level, in [International Standard Atmosphere](#) conditions in still air and with zero runway slope as documented in the [Aircraft Flight Manual \(AFM\)](#) or equivalent document.

Element 2 - Wingspan

Element 2 of the Code is derived from the most restrictive of either the aircraft wingspan or the aircraft outer main gear wheel span. The categories are as follows:

Code letter	Wingspan	Typical aeroplane
A	< 15 m	PIPER PA-31/CESSNA 404 Titan
B	15 m but < 24 m	BOMBARDIER Regional Jet CRJ-200/DE HAVILLAND CANADA DHC-6

Code letter	Wingspan	Typical aeroplane
C	24 m but < 36 m	BOEING 737-700/AIRBUS A-320/EMBRAER ERJ 190-100
D	36 m but < 52 m	B767 Series/AIRBUS A-310
E	52 m but < 65 m	B777 Series/B787 Series/A330 Family
F	65 m but < 80 m	BOEING 747-8/AIRBUS A-380-800

It should be noted that Element 2 is often used on its own since it has direct relevance to detailed airport design.

Source: www.skybrary.aero

Parallel runway operation

Definitions

Parallel Runways: Two or more runways at the same airport whose centerlines are parallel. In addition to runway number, parallel runways are designated as L (left) and R (right) or, if three parallel runways exist, L (left), C (center), and R (right).

Source: FAA JO7110.65 Air Traffic Control

Near Parallel Runways: Non-intersecting runways whose extended centre lines have an angle of convergence/divergence of 15 degrees or less.

Source: ICAO Annex 14 Aerodromes

Objective

The main objective of implementing simultaneous operations on parallel or near-parallel runways is to increase runway capacity and aerodrome flexibility. The largest increase in overall capacity often includes the use of independent approaches to parallel or near-parallel runways.

The safety of parallel runway operations in controlled airspace is affected by several factors such as the accuracy and use of the associated radar monitoring system, the effectiveness of the process of controller intervention when an aircraft deviates from the correct [ILS](#) localiser or [RNAV](#) course and the precision with which aircraft can and do fly the approach.

Modes of Operation

In ATC terms, the various modes of operation available for the use of parallel or near-parallel instrument runways are distinguished as:

Simultaneous parallel approaches

- **Mode 1, independent parallel approaches:** simultaneous approaches to parallel instrument runways where radar separation minima are not prescribed between aircraft using adjacent ILS; and
- **Mode 2, dependent parallel approaches:** simultaneous approaches to parallel instrument runways where radar separation minima between aircraft using adjacent ILS are prescribed.

Simultaneous parallel departures

- **Mode 3, independent parallel departures:** simultaneous departures for aircraft departing in the same direction from parallel runways.

It should be noted that when the spacing between two parallel runways is lower than the specified value determined by [wake turbulence](#) considerations, the runways are considered as a single runway with regard to vortex wake separation.

Segregated parallel approaches/departures

- **Mode 4, segregated parallel operations:** simultaneous operations on parallel runways where one runway is used for approaches and landings, and one runway is used for departures.

In the case of segregated parallel approaches and departures there may be semi-mixed modes of operations.

Semi-mixed parallel operations

1. One runway is used exclusively for approaches while approaches are being made to the other runway, or departures are in progress on the other runway.
2. One runway is used exclusively for departures while other is used for both departures and arrivals.

Mixed mode parallel operations

At least one runway is used for both take offs and landings.

Factors Affecting Simultaneous Operations on Parallel Instrument Runways

Factors which may have an impact on the maximum capacity or the desirability of operating parallel runways simultaneously are not limited to runway considerations. Taxiway layout and the position of passenger terminals with reference to the runways may make it necessary for traffic to cross active runways, a situation which may not only lead to delays but also to a decrease of the safety level due to the possibility of [runway incursions](#) by either arriving or departing aircraft.

Factors to Consider When Determining the Mode of Operations

Theoretical studies and practical examples indicate that maximum aerodrome capacities can be achieved by using parallel runways in a mixed mode of operation. In many cases, however, other factors such as the land-side/air-side infrastructure, the mix of aircraft types, and environmental considerations result in a lower achievable capacity.

Other factors such as non-availability of landing aids on one of the parallel runways or restricted runway lengths may preclude the conducting of mixed operations at a particular aerodrome.

Because of these constraints, maximum runway capacity may, in some cases, only be achieved by adopting a fully segregated mode of operation, i.e. one runway is used exclusively for landings while the other is used exclusively for departures.

The advantages to be gained from segregated parallel operations as compared to mixed parallel operations are as follows:

- a) separate monitoring controllers are not required;
- b) no interaction between arriving and departing aircraft on the same runway and a possible reduction in the number of [missed approaches](#);
- c) a less complex ATC environment overall for both radar approach controllers and aerodrome controllers; and
- d) a reduced possibility of pilot error following undetected selection of the wrong ILS.

Operational Issues

Parallel Runway Operation need to be carefully managed in such a manner as to minimise the risk of runway incursion or [wrong runway use](#). Closely-spaced parallel runways may affect the pilots' situational awareness or lead to their distraction or confusion.

A potential problem with close parallel runway spacing is the possibility that an aircraft may make an approach to the wrong runway. Two scenarios can be considered:

1. The wrong ILS frequency is selected. Pilot [SOPs](#) for approach clearance acceptance and subsequent setting of the required navigation equipment should be robust and attract 100% compliance. The role of the [PM](#) (and if present the augmenting crew occupying supernumerary seats) in a multi crew flight deck in cross checking that correct actions are taken is crucial.
2. The wrong runway is visually acquired. If a pilot cleared for an instrument approach acquires visual reference with the aerodrome when some distance from landing, it is possible in the absence of the right level of crew discipline and interaction for alignment with the wrong runway to follow.

Safety-Related Issues Affecting Dependent Approaches to Closely-Spaced Parallel Instrument Runways

The minimum spacing between two aircraft in the event of a deviation is calculated using techniques similar to those used for independent parallel approaches.

Two factors apply:

1. since the radar separation is applied diagonally, less distance between runways means a greater in-trail distance between the aircraft; and
2. less distance between runways also means that the deviating aircraft crosses the adjacent approach track more quickly.

Near-Parallel Runways

No special procedures have been developed as yet for simultaneous operations to near-parallel runways. Each situation is considered on a case-by-case basis and is dependent on a number of variable conditions.

New Concepts and Procedures

In order to maximise the capacity there are some concepts such as High Approach Landing System (HALS) that were developed and deployed (for a given period of time only) to allow aircraft to land simultaneously on closely spaced parallel runways at Frankfurt Airport. The concept involved adopting a second, strongly displaced landing threshold for the southern runway to mitigate against wake turbulence by flying above the vortices of the leading aircraft.

Source: www.skybrary.aero

Wake turbulence category

The [ICAO](#) wake turbulence category (WTC) is entered in the appropriate single character wake turbulence category indicator in Item 9 of the ICAO model flight plan form and is based on the maximum certificated take-off mass, as follows:

- **J** (Super) aircraft types specified as such in Doc 8643 (Aircraft type designators). At present, the only such type is the Airbus [A380-800](#) with a maximum take-off mass in the order of 560 000 kg. (see [Airbus A380 Wake Vortex Guidance](#))
- **H** (Heavy) aircraft types of 136 000 kg (300 000 lb) or more (except those specified as **J**);
- **M** (Medium) aircraft types less than 136 000 kg (300 000 lb) and more than 7 000 kg (15 500 lb); and
- **L** (Light) aircraft types of 7 000 kg (15 500 lb) or less.

Variants of an aircraft type may fall into different wake turbulence categories, (e.g. L/M or M/H). In these cases, it is the responsibility of the pilot to enter the appropriate wake turbulence category indicator in the flight plan.

Source: www.skybrary.aero

Wake vortex turbulence

All aircraft generate vortices at the wing tips as a consequence of producing lift. The heavier the aircraft and the slower it is flying, the stronger the vortex. Among other factors, the size of the vortex is proportional to the span of the aircraft which generates it.

At low altitudes, vortices generally persist for as long as 80 seconds, but in very light or calm wind conditions, they can last for up to two and a half minutes. Once formed, vortices continue to descend until they decay (or reach the ground). Decay is usually rapid and occurs more quickly in windy conditions. Cross-winds can carry a vortex away from the flight path of the aircraft.

Wake vortices are also a hazard at en-route altitudes.

Source: www.skybrary.aero

Runway Change Guide

Runway changes might be tricky, especially during phases with a lot of traffic. This guide should help you to manage this situation. Example of a runway change at Frankfurt/Main EDDF from 07 ops to 25 ops.

When is a runway change initiated?

For this, a look at the **METAR** and the **TAF** is useful. Basically, runway 25 is preferred in case of a definite 25-wind (between 160 and 340 degrees) or variable wind (according to the regulations, up to a tailwind component of 5 knots, although it does not depend on one knot). In many cases, 07 is still used with constant weak 07 wind, e.g. 030/5, although the tailwind component on 25 is therefore less than 5 knots. The reason for this are smaller gusts, which are briefly larger than 5 knots, but are not displayed in the METAR).

In case of doubt, a look at FR24 helps, which configuration is operated in real. However, in individual cases, there may be other reasons for a runway change in real (police helicopter mission, failure of navigation equipment, etc.).

Who decides, when a runway change is initiated?

The **tower supervisor/coordinator** decides to rotate, but Approach is involved in deciding exactly when to rotate (see below).

How does the Runway Change work once the decision has been made?

Tower calls Approach and informs about the upcoming runway change. In addition, the center controllers or, if available, a center supervisor should be informed so that other STARs can be cleared if necessary. Depending on the traffic situation, Approach then decides who will be the **last inbound for 07L and 07R** respectively.

Apart from inbound rushes, it is usually quite simple: those who are already more or less across the field still get 07 in any case, while those who have just flown into the TMA are cleared for 25. Approach can either assign vectors or change the STAR for the pilot, depending on personal preference.

In the inbound rush, however, Approach should try to find a suitable gap where there are not so many inbounds for a few minutes. If the wind is acceptable, the runway change can be postponed a bit if the inbound situation does not improve in the next few minutes. Nevertheless, after 20 minutes at the latest, a decision should be made as to who will be the last inbounds for 07L and 07R.

In the optimum case, these are two aircraft that land at approximately the same time. **The call signs of these two aircraft are then passed on to the tower as well as an approximate landing time.**

“DLH123 last for 07L, DLH456 last for 07R, both landing in about 15 minutes”.

If the tower knows this, it must then be considered **for all outbounds whether they must be cleared for 25, or whether they can still depart from 07**. This consideration is primarily the task of the tower supervisor/coordinator. What must be avoided is that another outbound takes off from 07 even though the first planes are already on the 10-mile final approach of 25. Of course, the pilots should also be given a reason for the reclearance.

“We are changing runway direction, therefore you will be recleared, are you ready to copy?...”.

If, as in the example above, the last aircraft lands on 07 in 15 minutes, the tower can still allow take-offs from 07 for another 10 minutes. Based on the taxiing time, it is, therefore, necessary to estimate who will still get the 07. If in doubt, calculate conservatively and reclear too early rather than too late.

Aircraft that are with apron control and are to be recleared must be sent back to Delivery since apron control is not allowed to issue route clearances. Delivery will contact Apron and ask them to send aircraft XY to Delivery for a reclearance. Outbounds, which are already at the tower frequency, may of course also be cleared by the tower.

As soon as the aircraft are recleared, taxi instructions to holding point runway 25 are issued. Ideally, the aircraft will reach the holding point 25 when the last inbound 07 has just landed. However, a few minutes delay at the holding point is not a problem in such a situation.

Exceptions: SULUS is cleared to 18 and KOMIB does not exist at 25, instead CINDY must be filed.

As soon as the last inbound for 07 is safely on the ground, the tower should inform Approach directly and, to be on the safe side, ask for a **release for the first 25 departure**.

Approach, conversely, must time the inbounds so that the first 25-inbound is approximately on the **10-mile final approach** when the last 07-inbound is just touching down. In case of a missed approach at the last second, this gives enough room to turn away.

If there is a lot of traffic, the downwind and final will automatically be very long. If necessary, aircraft will have to enter a holding for a short time, but this is usually not necessary, since the runway change should be timed as described above so that there is not so much traffic. Within the TMA, Approach can also get creative, e.g. with three-sixties, so that the downwind does not

become too long.

As with everything, it is important that the individual ATC stations **communicate and coordinate** so that everyone is fully aware of each other's traffic and plans.

Summary

- The decision is based on the METAR and TAF
- The decision is made by the tower supervisor/coordinator, but approach is also involved in the decision
- Approach decides the last arrivals for 07L and 07R
- Tower can issue the last takeoff clearances for 07 until approximately 5 minutes before the last inbounds
- The first inbound for 25 can be on a 10-mile final approach when the last 07-inbound is just touching down
- The first 25 departure should be released by Approach