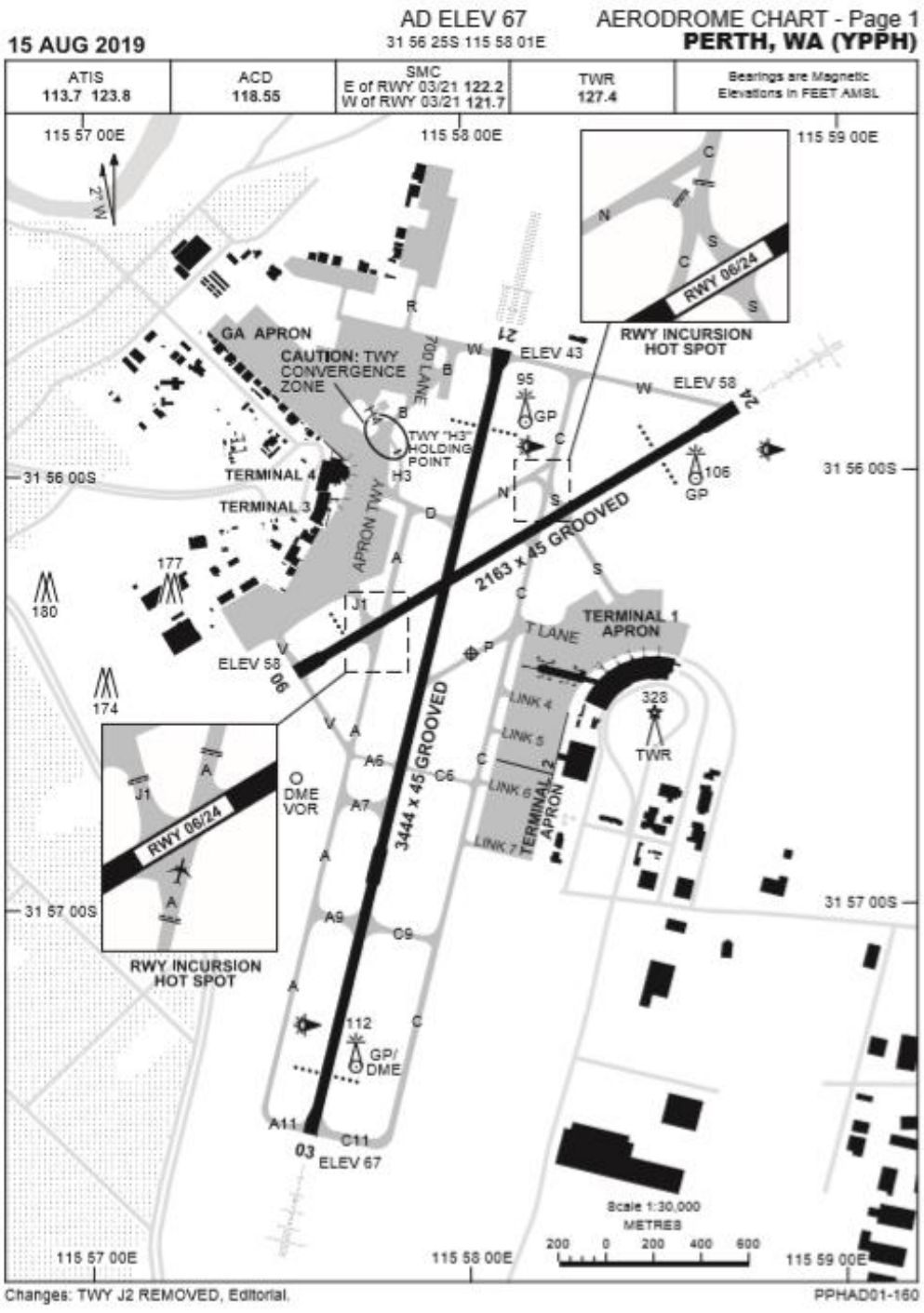
Australian Government
Bureau of Meteorology

YPPH Air Traffic Operations

Perth is the fourth busiest international airport in Australia consisting of two intersecting runways in the direction 03/21 magnetic and 06/24 magnetic.



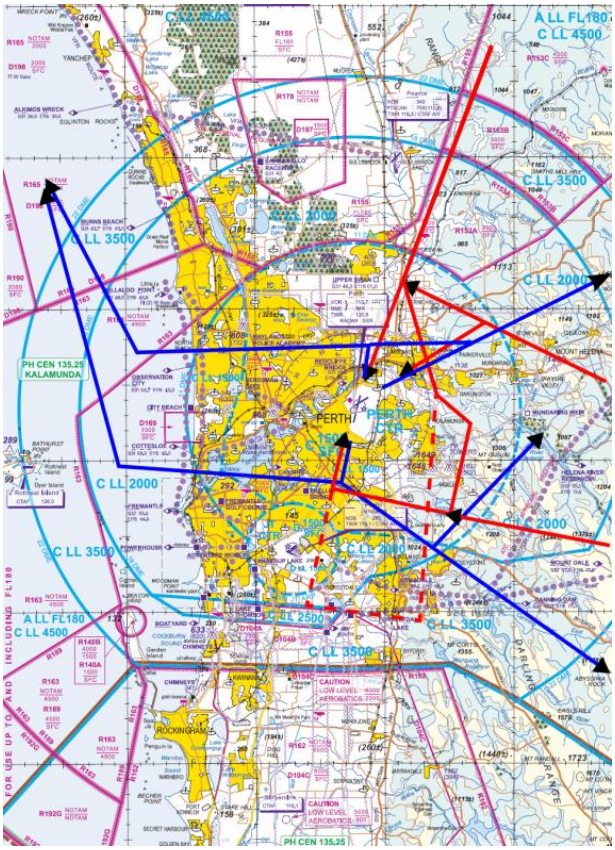
airservices

Figure 1. Perth Airport Aerodrome Chart. Source, AirServices Australia. Valid December 2020.

Noise Abatement

There is no curfew at Perth airport. However, noise abatement procedures apply.

Figure 2: Most common departure (blue) and arrival (red) corridors for Perth Airport (source AirServices Australia). Valid December 2020.



Terminal Area (TMA)

This term is used to describe the designated area of controlled airspace surrounding a major airport where there is a high volume of traffic. The Terminal Area (TMA) is a 36NM radial area surrounding Perth Airport.

The TMA is divided into segments called corridors for arriving and departing aircraft. For Perth Airport the most commonly used corridors are indicated in Figure 2.

It is important to note that large parts of the airspace to the north of Perth airport may be restricted due to military operations from RAAF Base Pearce.

Airport Acceptance Rates (AAR)

Runway configurations allow up to 38 movements (arrivals plus departures) per hour at Perth Airport. A maximum planned AAR of 26 occurs during the use of both runway 21 and runway 24 for arrivals.

RWY 06 has a lower single RWY rate due to limited exit taxiways for most aircraft. This requires a roll through to TWY W, which has quite a sharp turn off the runway. Vacating TWY C to the north is typically only achieved by BE20, B190, DHC8, SF34 and E120 aircraft. TWY C/S is achievable by the same aircraft and the occasional F100. The resulting slower movement and increased occupancy of the runway must be considered whilst allowing for departures.

Ground Delay Program

AirServices Australia run a Ground Delay Program (GDP) at Perth airport. A special software application called Harmony (produced by Metron Aviation) is an advanced Air Traffic Flow Management (ATFM) application, capable of simultaneously managing traffic flows at multiple airports.

Essentially, when delays are foreseen to occur because of demand exceeding the expected capacity, these delays are assigned to the aircraft at their location of departure rather than in the air in the vicinity of their destination.

An aircraft that departs significantly before their assigned Calculated Off-Blocks Time (COBT) will be given enroute delays to meet their programmed time of landing. Aircraft that complied with their assigned COBT will be given priority. The maximum benefit of the system will only occur if all users comply.

The Harmony application is run at the AirServices Network Coordination Centre (NCC).

The ground delay program can be revised at any time and can only impact flights that have not departed.

MET CDM

NCCMET makes a tailored runway configuration and AAR forecast for ATC based on all factors and uncertainties affecting the GDP. This impact forecast is discussed with the airline meteorologists and then presented to ATC for finalisation. This Meteorological Collaborative Decision Making (MET CDM) forecast is then monitored for significant changes.

Runway Direction

It is important to remember that runway direction is described in magnetic bearings whereas wind direction is reported in degrees true. The conversion for Perth Airport is as follows:

Table 1: Perth Runway Direction Conversion Table.

Runway	Magnetic	True
03	016	014
21	196	194
06	060	059
24	240	239

*Runway direction is along the direction of travel. Using RWY24 means landing and departing towards bearing 240. Winds are reported in true degrees from a bearing.

Nomination of Runways

The nomination of runway is determined by Air Traffic Control (ATC) using a preferred runway or take-off direction.

ATC shall not nominate a runway for use if an alternative runway is available, when:

Table 2: Runway Wind Thresholds

	Dry	Wet
Crosswind	>20 knots	>20 knots
Tailwind	>5 knots	>0 knots

* Please note that thresholds relate to sustained wind gusts as well as mean wind speeds.

AirServices advises that RWY selection wind arc preferences are:

RWY21/24: 150-300° (mag)

RWY03: 300-330° (mag)

RWY06/03: 330-100° (mag)

RWY21: 100-150° (mag)

If possible, aircraft will take off and land with a head wind. A tail wind of up to 5 knots is acceptable in dry conditions. When departing with a tail wind, the Take-off Distance increases so the runway length is a factor.

An alternative landing runway will be planned when crosswinds are expected to exceed 20kts. Departures and arrivals do not have to occur on the same runway if two options are available.

The length of the runway is important. Landing and take-off distances are dependent on aircraft-type, weight, atmospheric pressure and temperature; the active runway must accommodate most of the traffic.

Forecasting for Perth Airport

Forecasters for Perth Airport can contact NCCMET for information on the operational effect caused by a TAF amendment. Alternatively, forecasters may contact Perth Approach (TCU) or Melbourne Centre directly if the need arises.

It is expected that forecasters can provide meaningful information to Air Traffic Controllers regarding Perth Airport when requested.

Peak Times

Generally peak arrival demand for traffic movements at Perth airport occur between 9am-1pm and 5-9pm Monday to Friday. Departure movements at Perth airport peak between 5:30-8:30am and 2-5pm. Additional loads occur on Tuesday, Wednesday and Thursdays due to staff changeover for mining operations.

A forecast requiring additional fuel near or during peak periods must be considered carefully. Any significant changes to forecasts that affects these periods should prompt a call to NCCMET prior to the TAF amendment.

Wind Forecasts

The TAF can be used by forecasters to routinely provide information about wind speed and directional changes that affect ATC runway selection.

Accurate forecasting of strong cross winds is important in planning. Instances can occur where a strong cross wind component is forecast for both runway directions. Air Traffic Control has a process for resolving this issue.

Further evidence of the impact of accurate wind forecasts are:

- runway changes because of afternoon sea breezes.
- potential go-arounds due mechanical turbulence caused by strong Easterly winds, and;
- wind shear between surface winds and 3000ft winds and the resulting speed over ground changes for manoeuvring aircraft.

Further information about these effects can be found in table 3.

Thunderstorms at YPPH

Thunderstorm cells within 15NM of Perth Airport affect the ability of aircraft to land and the provision of services to aircraft once on the ground. The movements of aircraft into and out of bays are also affected.

Airline WHS regulations require the removal of ground staff from the tarmac when a thunderstorm is within 5NM, with an 'on-alert' status for a thunderstorm within 10NM. Advice in relation to this decision is an important part of the duties of the Virgin and Qantas meteorologists.

During prolonged thunderstorm events this can lead to the congestion of aircraft. By accurately forecasting thunderstorms planned acceptance rates at Perth can mitigate airport congestion.

The ability of forecasters to predict or recognise wind outflow from nearby thunderstorms is important in the management of tactical runway changes.

Thunderstorms in the TMA (36NM)

Thunderstorms within the TMA also affect operations. Specifically, thunderstorms in the entry corridors to the

north, northeast, and southeast of Perth airport have major impacts on traffic flow (refer to Figure 2).

The ability to forecast organized thunderstorms in these areas can provide AirServices with the capability to open additional corridors and re-route aircraft to minimise delays.

Within the TMA, any thunderstorms within a 15NM radius present a specific problem for aircraft trying to join the initial approach for an ILS runway.

Fog

Perth Airport is situated on the coastal plain between the west coast and the Darling Escapement to the east of the airport. The position of Perth airport relative the escarpment has a strong influence on fog formation.

Fog can occur at Perth Airport at any time of the year but is most common in the cooler months of May to September. There are around 10 fog events on average annually, where a fog event is defined as visibility being below 1000m.

Perth forecasters follow a systematic fog forecasting process every day, supported by the web-based guidance system FDSS (Fog Decision Support System) and Bayesian Networks that probabilistically combine the different elements of this guidance to help produce a final decision.

The inclusion of any probability of fog onto the YPPH TAF does not affect the planned AAR into Perth Airport. If fog is observed at YPPH the situation is handled tactically with an AAR of 10 if Low Visibility Procedures (LVP) are activated (visibility below 2200m or cloud below 200ft).

Cloud/Visibility

Low cloud and/or reduced visibility on approach will necessitate the use of an instrument approach when a visual reference with the runway is not available. Any instrument approach has a specified decision height (landing minima) at which a 'missed approach' must be initiated if the required visual reference to continue the approach still has not been established.

This decision height (DH) will depend on the available equipment that is available for the runway and can vary widely. Instrument Landing System (ILS) category I (CAT I) is the most common instrument approach on runways at Australian major airports with DH's in the order of 250ft AGL. Perth has ILS CAT I for runways 21, 24 and 03 and ILS CAT IIIb for RWY21. These approaches now allow for IMC-C rates on RWY 03/21.

RWY 03/21 was equipped with three sensors to support Runway Visual Range (RVR) measurements in 2016. This equipment allows an automated visibility assessment in Mist and Fog when visibility is below 2000m for report by ATC to pilots.

Visibility and cloud are less critical during take-off, with most commercial jet aircraft allowed to depart with visibility over 550m.

21/24 Runway Operations

The most favourable runway mode for arrivals into Perth is using both runway 21 and runway 24. Using this mode of operation means that the maximum allowable arrival rate for Perth of 26 aircraft per hour can be utilised in Visual Meteorological Conditions (VMC).

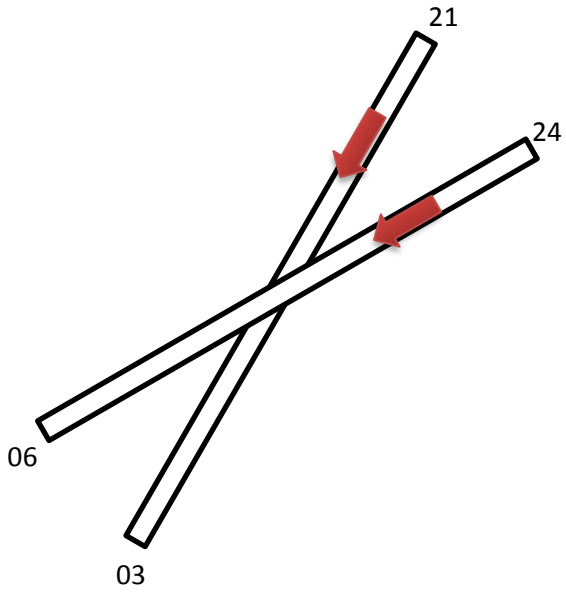


Figure 3: Depiction of 21/24 Runway Operations

03A/06D Runway Operations

In a northerly wind regime Perth can use runway 03 for arrivals and runway 06 for departures.

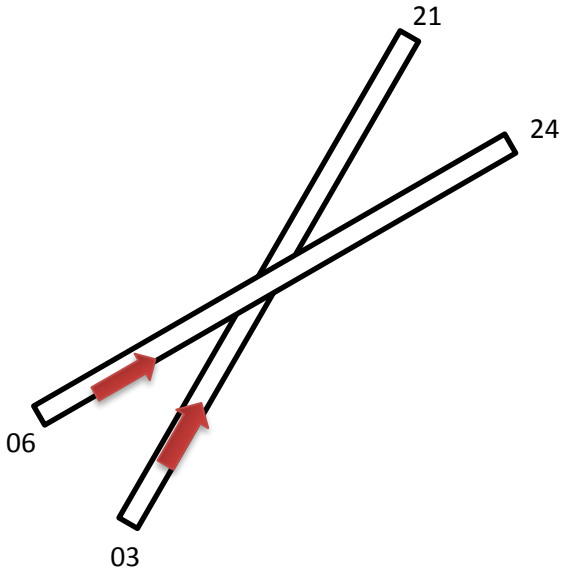


Figure 4: Depiction of 03A/06D Runway Operations

Jandakot

Jandakot is the busiest secondary airport in Australia and is located about 10NM to the SSW. Jandakot Airport has a multi-runway configuration, comprising two parallel runways (06/24) and a cross runway (12/30). When Perth is operating in instrument approach weather conditions using a mode that utilises runway 03 for arrivals the aircraft landing at Jandakot must be accounted for in the sequencing for Perth AAR's. To account for aircraft operating from Jandakot, the Perth AAR is planned at approximately 20 arrivals per hour with a period each hour blocked off for Jandakot arrivals.

Pearce RAAF Base

RAAF Base Pearce is the main Royal Australian Air Force (RAAF) base in Western Australia located just to the north of Perth. Pearce is the busiest RAAF base in the country in terms of total aircraft movements. RAAF Base Pearce has two intersecting runways in the magnetic direction of 05/23 and 18/36. Like Jandakot, RAAF Base Pearce is located within the TMA of Perth Airport and operates within Perth controlled airspace. The RAAF maintain a staff of air traffic controllers in Perth Approach Centre for operations out of RAAF Base Pearce.

The effect of RAAF Base Pearce on Perth Airport air traffic flow can be alluded to in the following situations:

- In a northerly wind regime RAAF Base Pearce would typically use runway 36 whilst Perth Airport might use runway 03. Collectively these runway modes can present problems to air traffic controllers due to the short final of aircraft into RAAF Base Pearce.
- It is possible for Perth to be using runway 21 whilst RAAF Base Pearce is using runway 36.
- IFR operations on runway 18 at RAAF Base Pearce must ensure that any missed approach procedure does not infringe upon Perth controlled airspace.
- When Pearce airspace is operational, R153/R155 restricted airspace will be active.

Summary - Weather Effects on Runway Modes

The effect of weather on the availability of runway modes and corresponding ATFM Business Rules at Perth Airport is summarised in Table 3(a). The rationale and weather criteria to apply METCDM runway rates are summarised in Table 3(b).

Table 3(a): Weather effects on Airport Acceptance and Departure Rates at YPPH.

ATFM Business Rules					
RWY	**Configuration**	**Cloud Ceiling (ft)**	**Visibility (m)**	**AAR**	**AAR Peak****
21/24	VMC	> 2900	≥ 8000	26	
21/24	IMC_A	1500 ≤ 2900	≥ 8000	26	
21/24	IMC_B	< 1500	< 8000	22	
03 or 03A 03/06D*	VMC	> 2900	≥ 8000	22	24
03 or 03A 03/06D*	IMC_A	≥ 1500 to ≤ 2900	≥ 8000	22	24
03 or 03A 03/06D*	IMC_B	< 1500	< 8000	18	19
21, 24	VMC	> 2900	≥ 8000	24	
21, 24	IMC_A	≥ 1500 to ≤ 2900	≥ 8000	24	
21, 24	IMC_B	< 1500	< 8000	20	
06*	VMC	> 2900	≥ 8000	22	
06*	IMC_A	≥ 1500 to ≤ 2900	≥ 8000	22	
06	IMC_B	< 1500	< 8000	20	
03, 21	IMC_C	LVP nominated on ATIS		10	
TSRA within 15NM				20	
Winds aloft or Mech Turbulence	VMC/IMC			AAR-2	AAR-2
*AAR reduced due to limited exit taxiways leading to increased RWY occupancy ** The peak rate to be selected Mon-Fri during the hours of 0100-0500 and 0900-1300UTC					
Departure rates					
Cloud ceiling (ft)	> 4,000	> 3,000	> 2,000	≤ 2,000	
Visibility (m)	> 10,000	> 10,000	> 6,000	≤ 6,000	
RWY03/06	40	38	37	35	
RWY21	40	38	37	35	
RWY03	38	36	35	33	
RWY26	35	34	33	31	
RWY24	34	33	32	31	

Table 3(b): MET CDM considerations for Airport Acceptance Rates at YPPH

MET CDM: Application	AAR	Rationale
1. Thunderstorms	20	In general, a thunderstorm rate of no less than 20 shall be used when traffic flows will be affected or forecast thunderstorms within 15NM will occur. X-factors may be discussed for circumstances listed in point 6 or when planning for recovery post thunderstorm event.
2. Seabreeze	X Factor -3 to 0	If the sea breeze change forces RWY03 arrivals onto RWY21 arrivals, 3 slots will be lost to allow for the runway end change. If the change forces RWY03 onto RWY24, no slots will be lost.
3. Winds aloft	X Factor -2 to 0 to lower limit of 20	Strong winds aloft (>35kts at 3000ft) affect the AAR due to a greater arrival sequencing requirement. If these winds are significantly stronger or from a different direction than surface winds, consider a note for reduction in AAR of up to 2. This would not generally be used in conjunction with point 4.
4. Mechanical Turbulence	X Factor -2 to lower limit of 20	Strong Easterly winds over escarpment increase the potential for go-arounds due to mechanical turbulence. Where greater than 40KTs is expected aloft (1500–3000ft) a reduction of 2 shall be applied. This would not generally be used in conjunction with point 3.
5. Observed fog	10	A fog rate of 10 shall be used with any fog occurring within the Perth airport precinct (not just the Basin) and requiring LVP (IMC-C) X-factors may be discussed when planning for recovery post fog event.
6. MET CDM X Factor	+2 to -2 Positive numbers cannot be applied to exceed the maximum rate	1. There may be phenomena that affect traffic flow that are not conveyed in the TAF or are not part of the business rules. i.e. TMA TS, TS, TS with PROB below 30%, low level wind shear, gusts 20–24kts and other meteorological factors. 2. Certainty in a severe event (i.e. +TSRA could reduce by -2) 3. Overcomes hourly granularity and other TAF limitations 4. MET CDM X Factors can be applied to end up between two configurations when forecasting confidence is moderate or low. 5. A MET CDM rate of 20 would be suitable for most adverse weather situations. Any additional x-factors resulting in a rate below 20 would generally not be required but may be considered for recovery post weather event.

Table 4: Summary of Decision Point Triggers

Phenomena	Criteria	Potential Effect
Cloud (SCT or more)	≤2900ft	Reduced rate, Instrument approach
	<1500ft	Reduced rate, Instrument approach
Visibility	<8000m	Reduced rate, Instrument approach
Crosswind	>20kts	Change of runway
Tailwind	>5/0kts (dry/wet)	Change of runway

This is a reference card intended to educate users on the phenomena that affect Air Traffic Flow Management (ATFM) and is based on information obtained from AirServices Australia. The card was accurate in December 2020 and will be updated by December 2021 – Version 5.4 may be subject to short term changes that are not reflected in this document. There may also be other factors beyond the meteorological conditions affecting ATFM on any day. AirServices Australia, NCC should be contacted for all day of operations information related to arrival/departure rates and runway configurations. Please email any feedback, corrections or comments to NCCMET_TL@bom.gov.au

Note: Changes to the previous version have been highlighted in yellow.