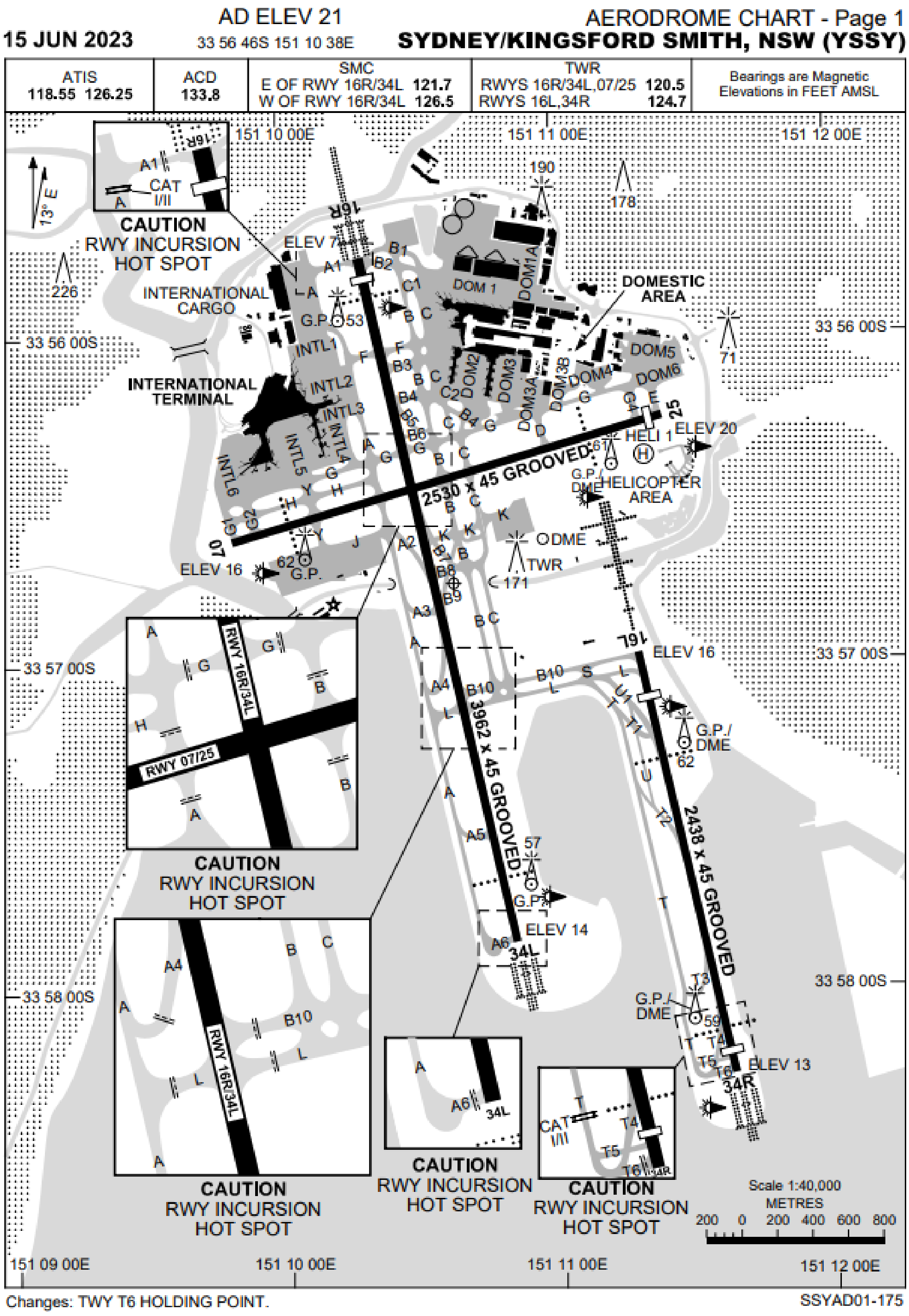
Australian Government
Bureau of Meteorology

YSSY Air Traffic Operations

Sydney is the busiest international airport in Australia consisting of twin moderately spaced parallel runways in the direction 16/34, and a single cross runway in the direction 07/25.



airservices

Figure 1: Sydney Airport Aerodrome Chart. **Current at time of publication. For reference only, not to be used operationally or for any other purpose. Source: Departure and Approach Procedures (DAP), Airservices Australia. Refer to https://www.airservicesaustralia.com/aip/aip.asp**

Curfew

A curfew at Sydney airport regulates movements at Sydney aerodrome between the hours of 11pm and 6am. A limited number of scheduled and approved take-offs and landings are permitted in the "shoulder periods" of 11pm to midnight and 5am to 6am, by Section 12 of the Sydney Airport Curfew Act 1995.

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 45NM radial area surrounding Sydney Airport.

The TMA is divided into segments called corridors for arriving and departing aircraft. For Sydney airport the main airport arrival corridors are to the N and SW.

Airport Acceptance Rates (AAR)

Sydney Airport has a legislated capacity of 80 aircraft movements per hour which cannot be exceeded. For arrivals only, Sydney Airport has the capacity in benign weather conditions for a maximum planned airport acceptance rate (AAR) of 46 or 50 on the parallel runways and 23 on the cross runway. The AAR is related to the spacing between arriving aircraft and may be adjusted due to a number of factors, including meteorological factors such as cloud ceiling and visibility (see Tables 5a and 5b).

Ground Delay Program

Airservices Australia run a Ground Delay Program (GDP) for Sydney airport. A special software application called Harmony (produced by Metron Aviation) is an 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 domestic aircraft at their location of departure rather than in the air in the vicinity of their destination (i.e. Sydney).

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) and is based on MET CDM for planning rates for the next day.

The Bureau of Meteorology NCCMET staff are co-located at the NCC and supply additional information critical to decisions surrounding the running of the Ground Delay Programs.

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

MET CDM

NCCMET advises a tailored runway configuration and AAR forecast (MET CDM rate) for Air Traffic Control (ATC) based on a forecast of various meteorological parameters for the airport during the period of the GDP. This forecast is discussed with the airline meteorologists and presented to ATC for sign-off, a process which is known as 'Meteorological Collaborative Decision Making' (MET CDM).

The MET CDM forecast is a monitored forecast and currently forms the main input for the Sydney GDP.

Runway Direction

It is important to remember that although runway direction is annotated in magnetic bearings, wind direction is reported in degrees true. The conversion for Sydney Airport is as follows:

Table 1: Sydney Runway Direction Conversion

Runway	Magnetic	True
16	155	168
34	335	348
07	062	075
25	242	255

* Please note that you refer to a runway direction as it is being travelled on. Using RWY16 means landing and departing towards the SSE. This as opposed to how meteorologists report wind direction.

Nomination of Runways

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

ATC shall not nominate a particular 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.

If possible, aircraft will take off and land with a head wind. A tail wind on landing is acceptable up to 5 knots, or not at all when the runway is wet. When departing with a tail wind, the take-off distance increases so the runway length is important. With a crosswind component exceeding 20 knots, an alternative landing runway will have to be planned. 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 Sydney Airport

Forecasters for Sydney Airport should contact NCCMET for information on the operational effect caused by a TAF amendment. Alternatively, forecasters may contact Sydney Approach (TCU) or Melbourne Centre directly if the need arises. It is expected that forecasters can provide meaningful information to Air Traffic Controllers regarding Sydney Airport when requested.

The flow manager is responsible for establishing an arrival sequence for aircraft inbound to Sydney. The Sydney Traffic Manager holds Operational Command Authority for the TMA and is responsible for the arrivals, departures and flow of Air Traffic within the TMA.

Peak Times

Generally, peak demand for arriving traffic at Sydney airport occurs between 7-9am and 5-7pm Monday to Friday. There is also an afternoon peak on Sundays around 5-7pm.

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 provide information about wind speed and directional changes that affect ATC decisions about runway changes. Accurately forecasting a change in wind direction is important in planning and daily operations.

Cross Runway Winds

Accurately forecasting a strong cross wind on the parallel runways is critical because of the reduction in AAR caused by the change to single runway operations. For that reason, confidence needs to be high if applying single runway AAR and requires consultation on likelihood, duration, and impact. An interim rate (AAR 34) can be applied when less confident to hedge risk and impact to airlines.

A forecast cross wind (including gusts) of greater than 20 knots should be applied for forecasting 07/25 operations.

Instances can occur where a strong crosswind component is forecast for both crossing and parallel runway directions. Parallel runways would normally be selected in this instance, refer to Tables 5a and 5b.

Strong Wind Change

The forecast of an expected strong wind change, resulting in an immediate 180-degree runway change, may see an AAR reduction of up to 6 applied to the lower runway rate for the hours either side of the change.

Strong Headwinds, Wind Shear and Severe Turbulence

Strong headwinds, wind shear and/or severe turbulence can impact ATC sequencing and the Sydney TCU Shift Manager may wish to apply an additional x-factor to the MET CDM to accommodate additional spacing between aircraft or to allow for the risk of missed approaches.

The MET CDM process can apply an x-factor of up to -2 for strong winds of more than 30 knots at 3000ft on the parallel runways.

In addition, Sydney TCU Shift Managers should be informed in the notes section of the MET CDM of:

- the possibility of wind gusts at the surface of more than 40 knots,
- the likelihood of severe turbulence,
- wind shear; when winds aloft exceed 40 knots at or below 3000ft but may not mix down to the surface.

Thunderstorms

Thunderstorms within 5-10NM

Thunderstorms within 5-10NM of Sydney Airport affect the ability of aircraft to land and the provision of services to aircraft once on the ground. Ramp closures and the removal of ground staff from the tarmac affect the movements of aircraft into and out of bays.

Airline 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. This decision is an important part of the duties of the Virgin Australia and Qantas meteorologists.

In prolonged thunderstorm events this can lead to a queue of aircraft waiting on the ground to be handled. By accurately forecasting thunderstorms the planned acceptance rate at Sydney may be reduced, thereby mitigating airport congestion.

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

Thunderstorms within the TMA (45NM)

Thunderstorms within the TMA also affect operations. A reduced AAR can be applied, and a range of rates are available (Table 5b), based on the impact of thunderstorms on air traffic flow.

Specifically, thunderstorms in the entry corridors to the north and southwest of Sydney airport (see blue sectors in Fig 2) have major impacts on air traffic flow, while isolated thunderstorms in the outer east sector over the sea could have a minimal impact on air traffic flow.

Figure 2: 20NM and 45NM range rings (red) around Sydney Airport with entry corridor sectors 330-020° and 210-260° (blue).

Thunderstorms inside 20NM

A reduced AAR may be applied for any thunderstorm activity, but a lower range of rates are available when thunderstorms occur inside the 20NM range of the airport. Table 5b provides starting point acceptance rates for the MET CDM and these can be lowered or increased based on the expected impact of thunderstorms on air traffic flow. There are many factors to consider but the primary factors include the following:

- Probability of thunderstorms occurring.
- Spatial extent of thunderstorm activity, including occurrence of squall lines.
- Location of thunderstorm activity to primary air corridors, entry sectors and nearby airports.
- Expected severity of thunderstorms including the chance of hail, very heavy rain, flooding risk and squall outflow winds.
- The speed of movement or duration of the event, and whether thunderstorms will be weakening as they approach.

The MET CDM discussion should include all thunderstorm impact risks on air traffic flow when applying x-factors to modify the recommended starting point thunderstorm AAR.

Fog

Fog can occur at any time of the year at Sydney airport but is most prevalent during winter. Fog at Sydney Airport is a rare event and a difficult forecasting task due to the location of the airport on the coast with runways protruding over the Bay. Forecasters have developed the Sydney Airport Fog Aid (SAFA) which provides a systematic approach to forecasting fog at Sydney Airport. During the primary Fog Season (March to September) this systematic approach is followed every day.

It has been agreed that the lowest pre-tactical rate for the risk of fog, as determined by the MET CDM process, is to be limited to ILS C (or as otherwise based on the most likely visibility or cloud indicated by Table 5a). This is due to a combination of factors that include the rarity of fog events at Sydney airport, the difficulty in reliably forecasting fog events more than 18 hours ahead, and the impact on industry in applying significantly reduced rates for fog risk.

However, the imminent arrival of fog at Sydney Airport will result in a revised AAR of 15 in accordance with Table 3.

When the MET CDM process determines that fog is a 20% or greater risk of occurring at the airport, the MET CDM should include a percentage risk in the comments section and an alternative plan.

The alternative plan will be discussed during the MET CDM teleconference for increased situational awareness and to aid a faster morning MET CDM revision for when fog is imminent.

Table 3: Planned AAR* for fog cessation

Time commence	Time End	Rate
0600 or fog formation.	From first light till +2 hours	15
2 hours after first light	+1 hour or until the fog is forecast to clear	24
Previous end time	+1 hour	34
Then normal rates		

* Note: The application of rates in table 3 are rounded to the nearest Harmony 15 min block.

It is critical that forecasters amend the fog period or remove fog from the TAF when appropriate.

The planning of tactical arrival rates surrounding the cessation of fog at the airport is informed by the TAF. It is important that forecasters communicate any potential forecast changes and amendments to NCCMET as soon as possible, so that this information can be incorporated in the MET CDM rate assessment and inform ATFM decision-making.

Instrument approaches

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. The decision height (DH) will depend on the equipment that is available for the runway and can vary widely but is of the order of 250ft AGL for an Instrument Landing System (ILS) category 1, the most common instrument approach on runways at major Australian airports.

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

Cloud/Visibility

Cloud and visibility have a large effect on runway arrival rates at Sydney Airport. Cloud below 4000ft and/or visibility less than 8000m will affect arrival spacing, with resulting arrival rates indicated in Table 5a.

Even forecasting a few oktas of cloud (below 3000ft) will require a reduced AAR, as mitigation for those occasions when the cloud does affect the approach path.

Cloud at and below 3000ft/2500ft (runway dependent) ensure the use of the ILS and may trigger the PRM system described below. Similarly, visibility below 5000m also may trigger the use of the ILS and PRM system.

PRM

The Precision Runway Monitor (PRM) is a highly accurate air traffic surveillance system designed to maximise ATF on parallel runways during periods of inclement weather. Higher AARs are achieved with PRM.

PRM permits ATC to utilise reductions in lateral separation standards during ILS approaches to parallel runways separated by less than 1310m but not less than 1035m.

PRM is typically only available on weekdays between 0700 – 1100 local and requires additional staff rostered on to operate the system. Due to this constraint, ATC normally make this decision as early as possible the day before, when initiating PRM for the following day.

A specialised controller interfaces alert ATC when an aircraft is deviating towards the adjacent centerline. A ‘No Transgression Zone’ (NTZ) with a width of 610m is established between the parallel approach paths to provide for a suitable safety buffer between aircraft on adjacent ILS approaches.

Meteorological conditions that ATC take into account when deciding on using PRM include cloud amounts of scattered or more at or below 2500ft, or visibility below 5000m.

PRM is unlikely to be achieved when thunderstorms are occurring within 25nm and may be disregarded from the ATFM plan when there is high likelihood of thunderstorms eventuating.

Forecasting conditions at Sydney which may result in the use of PRM for the following morning should be discussed and communicated to NCCMET staff.

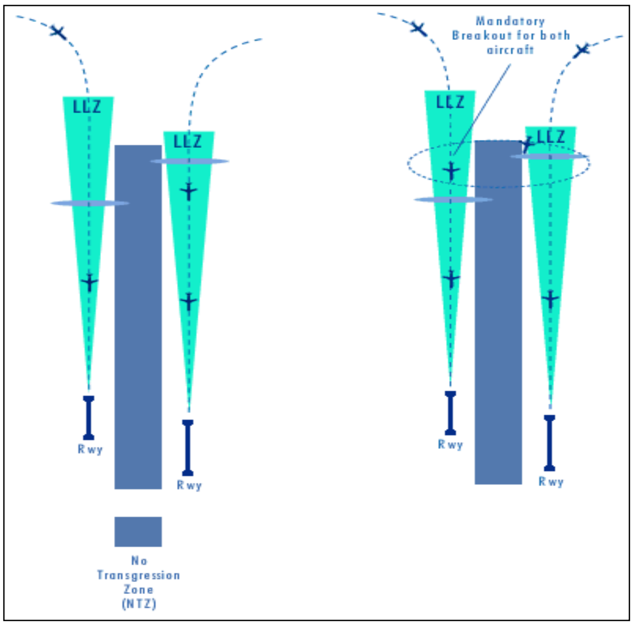


Figure 3: Illustration of Sydney Airport PRM

SODPROPS

It is always a requirement of air traffic management to undertake noise abatement procedures at Sydney. During times of low traffic demand and under certain meteorological conditions, simultaneous opposite direction parallel runway operations (SODPROPS) is one method at their disposal. SODPROPS involves the arrival of aircraft on runway 34L with the departure of aircraft on runway 16L.

Summary

The meteorological conditions which affect AAR are summarised in Table 4.

Table 4: Summary of Decision Trigger Points

Phenomena	Criteria	Potential Effect
Cloud (SCT or more)	≤ 4000ft	Reduced AAR
	≤ 3000ft / 2500ft	Reduced AAR / PRM
Cloud (FEW)	< 3000ft	Reduced AAR
Visibility	≤ 8000m	Reduced AAR
	≤ 5000m	Reduced AAR, PRM
Crosswind	> 20 knots	Change of runway
Tailwind	> 5 knots/0 knots (dry/wet)	Change of runway
Headwind	> 25 knots	Reduced AAR
Thunderstorms	Range and impact dependent	Reduced AAR
Strong Wind Change	During 2-hour bracket of ETA	Reduced AAR
Fog	High certainty at airport	Reduced AAR

The effect of weather on the availability of runway modes at Sydney Airport is summarised in Table 5a and 5b.

Table 5a: Weather effects on Airport Acceptance Rates at YSSY

ATFM Business Rules Sydney			
RWY	**Configuration**	**Cloud (ft) and Visibility (m)**	**AAR**
16//	IVA	CLD>4000 & VIS>8000	46
16//	PRM		42
16//	FEW030	FEW CLD<3000	42
16//	DVA A	CLD>3000 & VIS>8000	42
16//	DVA B	CLD>2000 & VIS>5000	38
16//	ILS A	CLD>1500 & VIS>5000	36
16//	ILS B	CLD>1000 & VIS>3000	34
16//	ILS C	CLD≤1000 OR VIS≤3000	32
34//	IVA	CLD>3500 & VIS>8000	50
34//	PRM		46
34//	FEW030	FEW CLD<3000	46
34//	DVA A	CLD>2500 & VIS>8000	44
34//	DVA B	CLD>2000 & VIS>5000	40
34//	ILS A	CLD>1500 & VIS>5000	36
34//	ILS B	CLD>1000 & VIS>3000	34
34//	ILS C	CLD≤1000 OR VIS≤3000	32
07/25	VSA	CLD>3000 & VIS>5000	23
07/25	IMC	CLD≤3000 OR VIS≤5000	20
07/25	TURB	Severe turbulence forecast or observed	20
*	TSRA	Refer to Table 5b for guidance	20-34
//	XW	Transition or hedging rate when a reduced/low confidence of forecast cross wind > 20 knots, cross wind > 20 knots on both the parallel runways and RWY 07/25. Refer to Table 5b for guidance.	34

Table 5b: MET CDM considerations for Airport Acceptance Rates at YSSY

MET CDM Considerations Sydney		
Phenomenon	**AAR**	**Rationale**
Thunderstorms	20-34	MET CDM process for estimating thunderstorm impact on ATFM will be based on the following thunderstorm and forecast factors: 1. Probability of occurring. 2. Spatial extent of storms. 3. Location of storms. 4. Severity. 5. Speed of movement or duration of event. AAR rates are to be set within the range of 20-34, following the range related starting rates and after considering all air traffic flow impact factors.
TSRA <20NM	Starting point 26	A reduction in the AAR of up to 6 to a minimum 20 AAR when all thunderstorm air traffic flow impact factors are considered higher than average. An increase in the AAR of up to 6 to a maximum of 32 AAR when all thunderstorm air traffic flow impact factors are considered lower than average.
20NM < TSRA < 45NM	Starting point 34	An AAR of 34 is the starting point for thunderstorms within the TMA, but not expected to impact within 20NM of the Airport. A reduction in the AAR to between 26-34 can be applied when all thunderstorm air traffic flow impact factors are high. **Notes:** For thunderstorms in the outer TMA, particular attention should be taken into account on how storms will impact air traffic flow into and out of entry/exit sectors. For thunderstorms in the outer east of the TMA (well out to sea), not expected to impact the airport or traffic corridors (i.e. expected to move away or move parallel to the coast), the METCDM process can agree to not apply a reduced AAR for thunderstorms.
Single RWY 07/25 Operations (Crosswinds)	20,23,34	When the confidence of single runway operations due to forecast cross wind (including gusts) exceeding 20 knots is high, then: • AAR of 34 on commencement and end of the forecast cross wind risk period (as a suggested transition rate). • AAR prescribed for single RWY 07/25 operations (20 or 23) for the remaining core (highest confidence) period. An interim rate of 34 can be used as a hedging rate for when single runway operations are less certain. For example, when forecast cross winds gusts above 20 knots are expected to be infrequent, the overall period of cross wind

		risk is uncertain, or when all MET CDM participants do not agree. A rate of 34 can also be used when cross wind on both parallel runways and on RWY 07/25 exceeds 20 knots.
Strong Southerly Change	Up to -6 from lowest AAR	When a strong wind change is expected and would necessitate an immediate runway change: • Subtract up to 6 from the applicable post event runway AAR for the hours either side of the forecast wind change.
Strong Headwinds on parallels	X-factor -2	While on parallel runways with a headwind greater than 30 knots at 3000ft, reduce AAR by 2.
Strong Winds aloft, Wind Shear and Severe Turbulence	Consideration for additional x-factor	The Sydney TCU Shift Manager will be informed of the following wind-related risk factors in the notes section of the MET CDM, and additional x-factors may be considered: • Winds exceeding 40 knots at/below 3000ft. • Wind gusts exceeding 40 knots at the surface. • Wind shear events - when strong winds do not mix down to the surface. • Severe turbulence.
Heavy Showers	30	Shower activity heavy enough to result in aircraft deviations in the circuit typically requires a tactical AAR around 30. An x-factor may be applied in the MET CDM process to result in a minimum AAR of 30. This may be considered only when forecast confidence is very high. Note: Conditions for heavy showers are likely to have an ILS rate of 32 or at least 34 on the parallel runways due to cloud and/or visibility rules.
MET CDM x-factor	-10 to +2 Positive numbers cannot be applied to exceed the maximum rate	The MET CDM process may propose other changes to business rules rates based on forecast meteorological conditions and confidence but shall not exceed the maximum AAR for the anticipated runway configuration. The reasoning for applying x-factors shall be noted in the MET CDM. For example, MET CDM x-factors may be applied: • To account for phenomena[#] that affect traffic flow that are not part of the business rules. • To account for severe weather phenomena if confidence is high and not accounted for elsewhere. • To end up between two scenarios (such as INTER conditions) or when forecasting confidence is reduced. • To transition between MET CDM rates more smoothly and overcome hourly granularity. [#]For example, reduced vertical visibility due to the presence of an elevated smoke layer. In this case: • A negative x-factor greater than 10 may need to be applied to the AAR that would be indicated by the prevailing meteorological conditions otherwise. • Alternatively, if there is high confidence about the height of a smoke layer then the corresponding AAR for the equivalent height of cloud may be proposed.

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 correct as of August 2023. The information contained within 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 the National Coordination Manager Aviation at av-NCM@bom.gov.au.

Note: Changes to the previous version have been indicated by red text**.**