Australian Government
Bureau of Meteorology

YMML Air Traffic Operations

Melbourne is the second busiest international airport in Australia, consisting of two intersecting runways in the directions 16/34 magnetic and 09/27 magnetic.

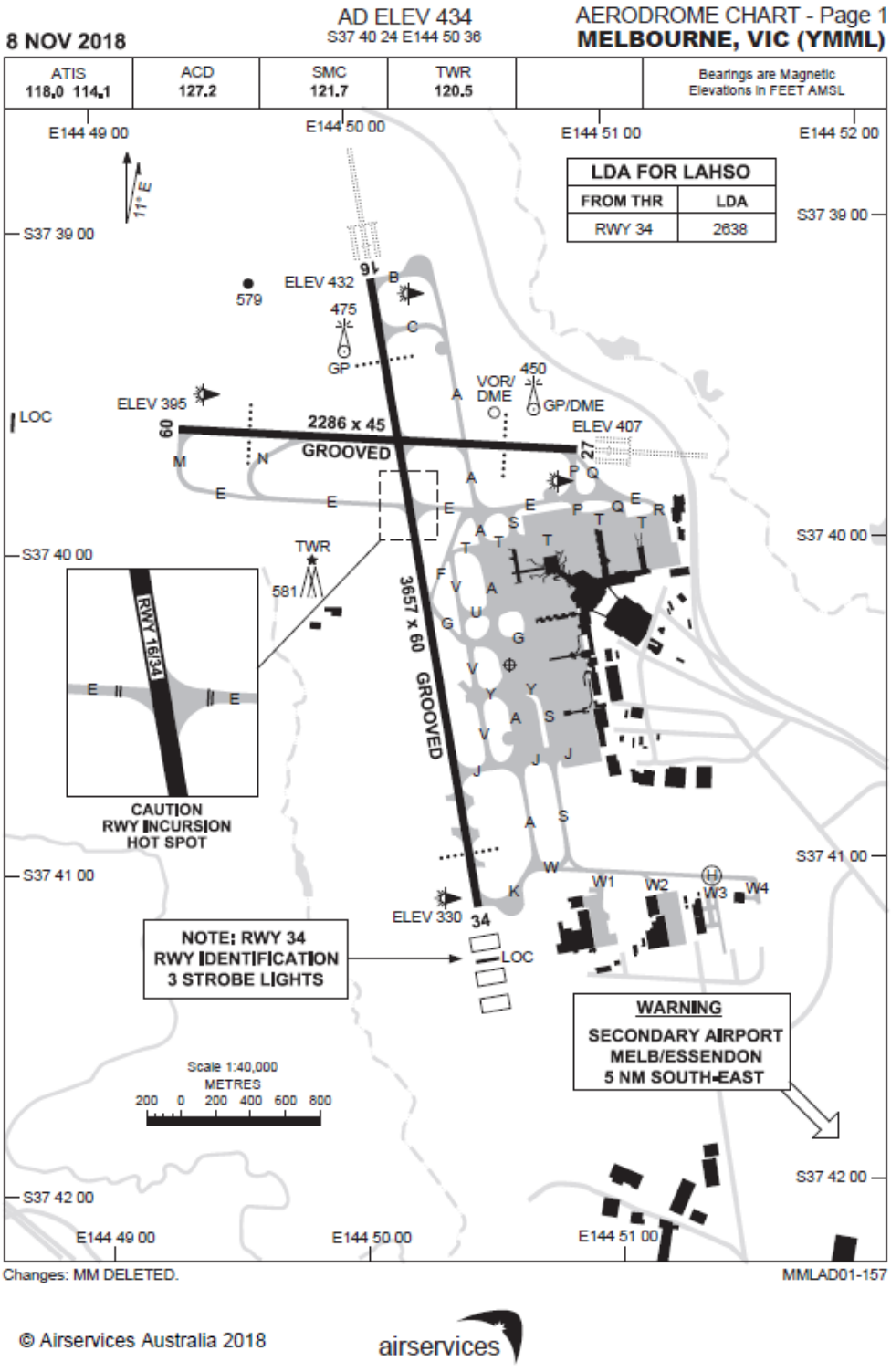

Figure 1. Melbourne Airport Aerodrome Chart. Source, Airservices Australia.

Noise Abatement

There is no curfew at Melbourne airport. However, noise abatement procedures apply. These procedures include a preference to use runway 16 for noise abatement, particularly in the overnight period. Aircraft normally must be routed to avoid over-flight of Bulla, Sunbury, Craigieburn, Keilor, Sydenham, St Albans, Greenvale, Meadow Heights and any other area notified by local instruction.

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 30NM radial area surrounding Melbourne Airport.

The TMA is divided into segments called corridors for arriving and departing aircraft. For Melbourne Airport it is the corridors to the N and NE which are estimated to be used by 30% and 60% of traffic respectively.

Airport Acceptance Rates (AAR)

Runway configurations allow up to 65 movements (arrivals plus departures) per hour at Melbourne Airport. A maximum planned airport acceptance rate (AAR) of 40 can occur during the use of both runways for arrivals (refer to section below on LAHSO).

Ground Delay Program

Airservices Australia run a Ground Delay Program (GDP) for Melbourne 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 (i.e. Melbourne).

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) based on the 06Z TAF for planning rates for the next day.

The Bureau's 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, yet will only impact flights that have not departed yet.

MET CDM

Based on the 06Z TAF, NCCMET makes a tailored runway configuration and AAR forecast for ATC. 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 Melbourne 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 Melbourne Airport is as follows:

Table 1: Melbourne Runway Direction Conversion Table.

Runway	Magnetic	True
09	083	094
27	263	274
16	160	172
34	340	352

* 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.

Airservices advises that RWY selection preferences for VRB is RWY16, wind arc 165-255º (true) RWY16A/27D with ultimate fall back RWY 34. Wind arc 255-015º (true) nominates LAHSO if XW limits are not exceeded.

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.

One other thing to keep in mind is that the length of the runway in regards to landing and take-off distances differs per aircraft-type, weight, atmospheric pressure and temperature; the active runway will have to be able to accommodate the majority of traffic.

Forecasting for Melbourne Airport

Forecasters for Melbourne Airport have the ability to contact NCCMET for information on the operational effect caused by a TAF amendment. Alternatively, forecasters may contact Melbourne Centre directly if the need arises.

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

Peak Times

Generally peak demand for traffic movements at Melbourne airport occur between 7-9am and 5-7pm Sunday to Friday. Two minor peak periods also occur between 11am-12pm and 2-3pm. Additional loads occur on both a Monday morning and a Friday afternoon.

The forecasting of holding near or during these hours must be considered carefully. The removal or movement of holding 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 decisions about runway changes.

Accurately forecasting a strong cross wind on a runway is important in planning. Instances can occur where a strong cross wind component is forecast on both runway directions. Air Traffic Control has a process of dealing with this issue.

Excessive surface and upper level winds

Excessive surface winds:

A VMC (wind) rate may be proposed when wind gusts at the surface are expected to exceed 30knots for RWY34 and 40knots for RWY27.

In non-VMC conditions and for remaining runways, Traffic Managers should be informed in the notes section of possible wind gusts at the surface in excess of 40knots and the likelihood of severe turbulence.

Excessive winds aloft not expected to mix to surface:

At times excessive winds aloft will not mix to the surface. Wind strengths exceeding 40 kts at or below 3000ft impact ATC sequencing and the Traffic Manager may wish to apply an x-factor to accommodate additional spacing between aircraft or to allow for the risk of missed approaches.

Although winds at the surface may appear to allow LAHSO, the Traffic Manager must be made aware of conditions that increase the likelihood of unstable approaches such as excessive winds aloft and/or associated wind shear.

Traffic Managers are also interested in the predicted winds at 5000ft for use in Maestro.

Thunderstorms at YMML

Thunderstorm cells within 5-10NM of Melbourne 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 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. This decision is an important part of the duties of the Virgin 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 on a TAF the planned acceptance rate at Melbourne can be dropped 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 in the TMA (30NM)

Thunderstorms within the Terminal Area (TMA – 30NM) also affect operations. Specifically thunderstorms in the entry corridors to the north and northeast of Melbourne airport have major impacts on traffic flow.

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

Within the TMA, any thunderstorms within a 10NM radius present a specific problem for aircraft trying to join the initial approach for an ILS runway.

Fog

Fog can occur at Melbourne Airport at any time of the year. There are around 13 events on average annually, with the majority of these occurring during the cooler half of the year. Winter fogs can persist to around midday.

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 a PROB for fog on the YMML TAF does not necessarily affect the planned AAR into Melbourne Airport. However, if fog is observed at YMML the tactical arrival rate on the day can drop to 10.

Melbourne Airport is Australia's only airport with an ILS CAT III rated runway (RWY16). Runway 16 is the only available runway for aircraft arriving into Melbourne when RWY visibility is below 550m.

The planning of acceptance rates surrounding the cessation of fog at the airport is dependent on the timing on the TAF. It is critical that forecasters amend the fog period or remove fog from the TAF when appropriate.

The planning of arrival rates surrounding the cessation of fog at the airport is dependent on the timing on the TAF and TTF. It is critical that forecasters amend the fog period or remove fog from the TAF when appropriate.

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, 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 and visibility have a large effect on runway arrival rates at Melbourne Airport. Scattered or more cloud below 2300ft can affect operations, as seen in Tables 3 and 4 below.

DEDRAT

DEDRAT is an acronym for "Dedicated Departure Runway Management". When using the DEDRAT runway mode aircraft arrivals occur on runway 27 while departures occur on both runways 27 and 34. This runway configuration is particularly useful when there is a backlog of departures that can occur after the clearance of a significant weather event.

LAHSO

LAHSO is an acronym for "Land and Hold Short Operations." Land and hold short operations are an air traffic control procedure intended to increase

airport capacity without compromising safety. The illustration below shows aircraft arriving to land on both runways. Although this does not represent the magnetic runway directions of Melbourne it is included to further clarify how LAHSO works.

In case of Melbourne, RWY34 is the runway where aircraft are cleared to land and hold short before the RWY09/27 intersection, with RWY27 used in its full length.

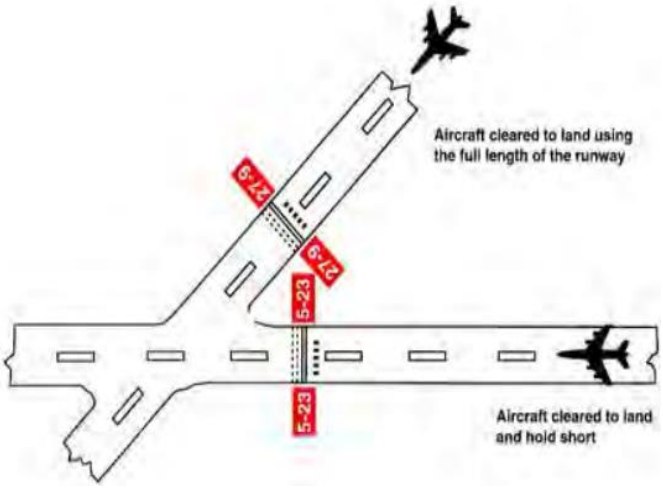

Figure 2: Depiction of Land and Hold Short Operations (LAHSO) mode

Meteorological conditions that affect the decision of LAHSO procedures include cloud amounts of scattered or more at or below 2000ft or visibility 8km or less. These criteria are in addition to the wind thresholds for the runways. Melbourne ATC has the ability to run LAHSO on RWY 27/34. The availability of LAHSO roughly doubles the planned airport acceptance rate into Melbourne. Specifically a forecast NW wind direction producing less than 20 knots crosswind on the runways is optimal for LAHSO.

LAHSO shall be proposed when an 80% or greater certainty exists. When LAHSO availability is more likely than not (>50% but <80%), a "Probable LAHSO" rate of 30 may be proposed. This rate can be used to express uncertainty in timing of LAHSO availability, as well as uncertainty in the overall availability of LAHSO.

Phenomena to consider that may impact the availability of LAHSO are turbulence, wind shear, highest tailwind component of one minute wind variations and marginal cloud or visibility.

'Probable LAHSO' is suitable for short periods of uncertainty and/or transition periods. Prolonged periods should be avoided due to the inherent uncertainty of the full LAHSO rate being achieved and the risk that consecutive hours of holding could build as a result.

When a "Probable LAHSO" rate is proposed, liaison between NCCMET, the ATFM supervisor and Melbourne Traffic Manager is required.

Essendon Airport Effects

The effect of low visibility conditions (<5000m or <1600ft) on operations at Essendon Airport can also affect Melbourne Airport. In some conditions it is necessary to operate the ILS approach onto runway 16 into Melbourne as well as the ILS approach onto runway 26 into Essendon.

When this configuration occurs there is a requirement to sequence the aircraft arrivals into Essendon onto the Melbourne flow. Slot allocation to aircraft for Essendon is primarly available outside of peak arrival times at Melbourne Airport.

This procedure aims to circumvent a mid-air collision if both aircraft complete a missed approach.

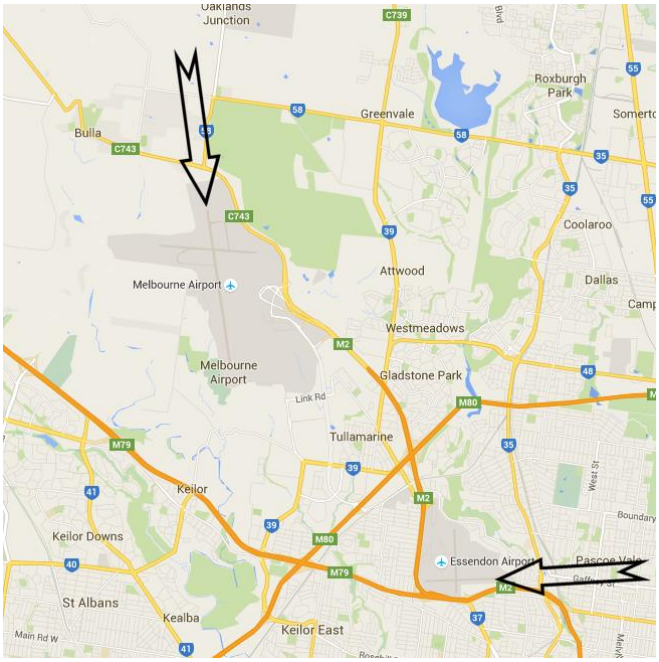

Figure 3: Map showing location of Essendon and Tullamarine Airport. Source: Google Maps

Summary - Weather Effects on Runway Modes

The effect of weather on the availability of runway modes at Melbourne Airport is summarised in Table 3a whilst the ATFM business rules and AARs applicable to YMML are in Table 3b. Adapted from Melbourne TCU Local Instructions, (ATC-PROC-0122) effective 08 November2018. Recent changes are highlighted in yellow. VMC (Wind) are an agreed rationale and associated AAR for inclusion in the METCDM matrix which are not included in the local instructions. These will be applied via x-factor.

Table 3a: MET CDM Weather Criteria and Rationale

Application	AAR	Rationale
Probable LAHSO (PR LAHSO)	30	Numerous meteorological conditions will rule out LAHSO. If the probabilities of these adverse conditions add up the estimated likelihood of LAHSO being greater than 50% but less than 80%, a Probable LAHSO configuration shall be nominated. Reasons as to why LAHSO cannot be guaranteed shall be discussed with the Traffic Manager and ATFM LM and CDM. 'Probable LAHSO' is suitable for short periods of uncertainty and/or transition periods. Prolonged periods should be avoided due to the inherent uncertainty of the full LAHSO rate being achieved and the risk that consecutive hours of holding could build as a result.
VMC (Wind) **RWY 27 RWY 34 only**	22	1. In VMC conditions only, where winds at the surface are expected to exceed: -30kts for RWY 34 or -40kts For RWY 27 2. Additional x-factors may be considered with greater wind speeds over the ground and aloft and in non-VMC conditions. VMC conditions: cloud >1600ft Vis >8000m
MET CDM X Factor	'+2 to -2 Positive numbers cannot be applied to exceed the maximum rate An X Factor down to -10 can be applied for extreme weather events.	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. In consideration of the need for further x-factors, Traffic managers should be informed of possible wind gusts at the surface in excess of 40knots; winds at or below 3000ft exceeding 40 kts, wind shear and severe turbulence. 3. Certainty in a severe event (i.e. +TSRA could reduce by -2) 4. Transition creating closer acceptance rates, i.e. 24, 27, 30 instead of 24, 24, 30 over a 3-hour period. 5. Overcomes hourly granularity and other TAF limitations 6. MET CDM X Factors may be applied to end up between two configurations when forecasting confidence is moderate or low.

Table 3b: Melbourne ATFM Business Rules and Transitional AAR's.

Adapted from Melbourne TCU Local Instructions, (ATC-PROC-0122) effective 08 November2018.
* Asterix denotes recently agreed AARs which are not included in the local instructions. These will be applied via x-factor with a corresponding note.

ATFM Business Rules and AAR					
RWY	**Configuration**	**Cloud Ceiling (ft)**	**Visibility (m)**	**Exclusions**	**AAR**
34	VMC	≥1600	>8000	wind on ground >30kts	24
34	*VMC (wind)	≥1600	>8000		*22
34	IMCA	≥1200	>8000		20
34	IMCB	<1200	>0550		18
16	VMC	≥1600	>8000		24
16	IMCA	≥1200	>8000		22
16	IMCB	<1200	>0550		20
16	IMCC	≤0200	≤0550		10
09	VMC	≥1600	>8000		21
09	IMCA	≥1200	>8000		20
09	IMCB	<1200	>0550		18
27	VMC	≥1600	>8000	wind on ground >40kts	24
27	*VMC (wind)	≥1600	>8000		*22
27	IMCA	≥1200	>8000		22
27	IMCB	<1200	>0550		20
16/27	VMCA (daytime)	≥2300	>8000		27
16/27	VMCB	≥1600	>8000		25
16/27	IMCA	≥1200	>8000		23
16/27	IMCB	<1200	>0550		20
16/27	IMCC	≤0200	≤0550		15
27/34	LAHSO (daytime)	≥2000	>8000		40
27/34	LAHSO (nighttime)	≥2000	>8000		36

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 on 26/11/2018 – Version 7.4, but 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 particular 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.