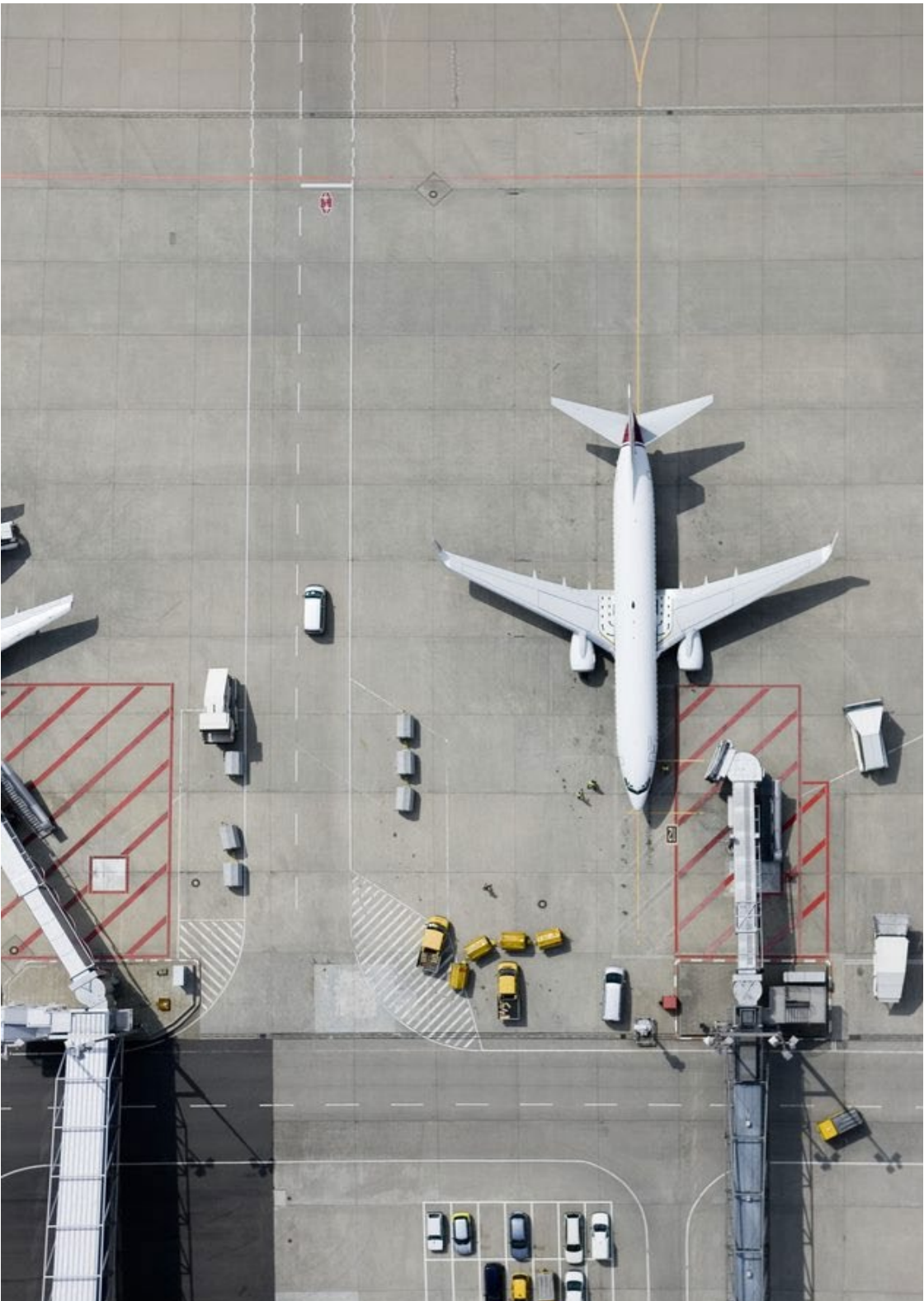
Perth Airport

Airport Operating Standard

Airside Line Marking Requirements

March 2021



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Introduction

Airport Operating Standards have been produced by Perth Airport to ensure the safe trafficking of aircraft, vehicles and people airside at Perth Airport in accordance with the *Civil Aviation Act 1988* (CAA), *Civil Aviation Safety Regulations 1998* (CASR) and *Part 139 (Aerodromes) Manual of Standards 2019* (MOS). The ***Airside Line Marking Requirements*** standard applies to all Perth Airport employees, contractors and service providers under the terms of any planning, designing, modification, service agreements or other contracts where information is to be provided in relation to airfield line markings.

The ***Airfield Line Markings Requirements*** standard sets the standardised format required for the planning, designing, modification and distribution of plans and drawings associated with airside line marking at Perth Airport, including areas leased to third parties. Perth Airport ensures that the requirements documented in this standard are relevant and capable of practical implementation by all staff, contractors and service providers.

This Standard and the procedures described within may be amended from time to time by PAPL on recommendation of the Perth Airport Spatial Data team. PAPL will endeavour to provide sufficient notification of changes to staff, contractors and service providers; however, it is the responsibility each operator/service provider to keep informed of any amendments.

The Standard includes:

- Responsibilities
- What is required
- Requests for designs
- Digital Information
- Design Standards
- Design considerations

The Standard is designed to be read in conjunction with the ***Perth Airport Operating Protocol*** and the ***Spatial Design Requirements*** AOS, which are available via the Corporate page on the Perth Airport website www.perthairport.com.au/AOP.

Responsibilities

Perth Airport Pty Ltd (PAPL)

PAPL is responsible for producing this Standard and consulting with stakeholders as necessary to determine operating requirements and necessary restrictions.

PAPL (Spatial Data Team) have the day-to-day responsibility for implementation of this standard.

The PAPL Senior Airfield and Airspace Planner is responsible for planning, designing and review of changes to line markings and aircraft positions.

The PAPL Spatial Data Officer is responsible for preparing the applicable plans and drawings as well as arranging storage of electronic data into PAPL CAD system and forwarding to GIS Administrator.

The PAPL GIS Administrator is the custodian of data that is located within the GIS system

PAPL Property Managers are responsible for liaising with external parties (i.e tenants and/or service providers) on the nature of design work and any associated costs for design and markings.

PAPL Airfield Operations, Terminal Operations and Airfield Lighting teams are responsible for reviewing the proposed plans for their relevant area.

PAPL will provide a design that is compliant to the current CASA Part 139 Manual of Standards at the time of preparation. PAPL is not liable for any changes to MOS which then requires a change to airside markings for compliance.

Tenants, Contractors and Service Providers

Tenants, Contractors and Service Providers are responsible for ensuring that data is presented to PAPL in the manner described in this Standard as and when requested by PAPL.

What is required

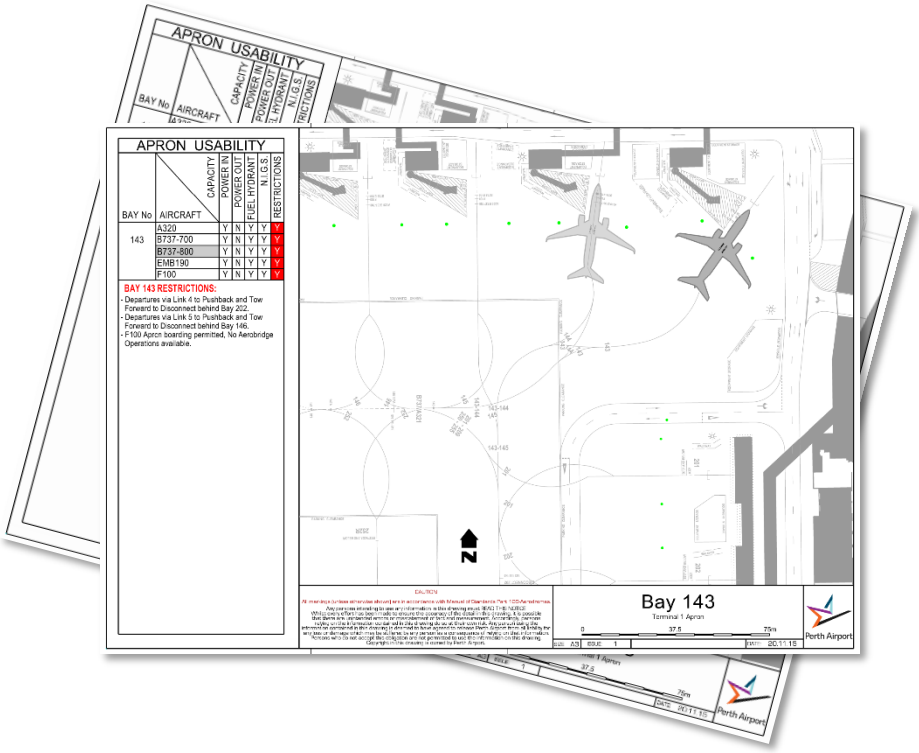
Airside line markings are required by the airline industry to facilitate the safe trafficking of aircraft, vehicles and people airside at Perth Airport.

Perth Airport can provide design and drafting services to assist airlines and tenants with airside line marking plans and installation of the markings.

It is recognised that airlines may wish to use consultants to design layouts, however these will require checking by Perth Airport to ensure they are compliant with the requirements of Part 139 MOS and the Perth Airport Master Plan, and in the format used across the airport.

This AOS provides the details a tenant or airline operator (or their consultant) needs to consider when making an application to change or add airside line markings.

All airside line markings, including those on leased aprons, must be reviewed by Perth Airport for compliance with part 139 MOS.
Any non-compliant, non-standard or unapproved markings will be removed at the tenant/contractor expense.



Requests for designs

Requesting a new or amended line marking is a 3-stage process – initial request (concept); feasibility assessment; and, full design. At the completion of each of these stages, there is an optional 4th stage - Install.

Initial request (concept)

All requests for Designs are to be submitted via your Property Manager using the Airside Line Marking request form, located on Operating Procedures section on the Perth Airport website (www.perthairport.com.au/AOP). This includes if you have had plans prepared in accordance with this AOS by an external provider.

When completing the form, please provide as much detail as possible and also include a sketch of the changes or a marked-up copy of the changes on an existing plan with your submission.

A non-refundable application fee of $110 will be charged upon receipt of your application. This is so a preliminary high-level assessment can be undertaken by the Planning & Operations teams of the concept. If further details are required, these will be requested via your Property Manager.

Once this assessment is complete your will be provided with feedback on the concept and information about proceeding to a feasibility assessment and full design.

Feasibility assessment

Prior to proceeding to full design, a feasibility assessment will be undertaken by PAPL to estimate the time and cost required to prepare a full design (design estimate). The cost to undertake a feasibility assessment is included in the initial application fee.

The design estimate will be based on Perth Airport undertaking all elements of full design and planning for the proposed layout, with the exception of designing airfield lighting.

A basic layout will be prepared to determine the design estimate. At the completion of this phase, you will receive the basic layout and a design estimate of cost and time to develop and review a full design. If you are choosing to use an external party for the design, the design estimate will include the cost and time to undertake an assessment of the provided design only.

Please allow 28 days for concept and feasibility assessment to be completed.

Full design development and assessment

Proceeding to full design requires review and input from areas such as airfield operations, airfield lighting, design, planning and ground maintenance to ensure the proposed layout meets all of the requirements of Part 139 MOS. In some instances, other agencies, such as Airservices Australia, may need to be consulted on the proposed layout.

The airfield lighting assessment will only look to measure whether the existing lighting infrastructure will likely provide the required lux outputs and will not include design of additional lighting needs. This must be sourced by an external provider and submitted for review of compliance with Part 139 MOS. Note also if light poles are to be installed, this will require the applicant to undertake the consents / 3rd party works process which may require appointment of a PAPL Project Manager. Further information on consents & 3rd party works can be found on the 'Planning & Projects' tab on the Corporate page of the Perth Airport website.

At the end of this stage, you will receive a full set of drawings/plans consisting of:

- an apron plan
- a setout plan
- a removal plan
- a lighting grid (if applicable).

You will also receive a cost estimate for install of the new markings should you wish for Perth Airport to undertake the install.

Digital Information

Designs for markings must be based on surveyed digital information that is to be made available to Perth Airport for checking purposes.

Perth Airport is a Microstation CAD site and as such prefers all information is provided in this format. Please refer to the *Spatial Design Requirements* AOS for further information.

CAD data depicting existing apron markings will not be available for general use, however this information is readily available in hard copy format or pdf. CAD base detail showing above ground detail exclusive of markings may be available upon request and if provided, any prepared plans must be sent back in this format as part of the application submission.

Final designs must include a geometric layout to enable set out by Perth Airport or the Contractor undertaking the works. This layout is to be based on existing local survey control using Perth Coastal Grid (PCG94).

Design Standards

All designs are initially done with full 100% compliance to the Part 139 (Aerodromes) Manual of Standards (Part 139 MOS) for the section appropriate for that design.

If any non-compliance issues arise during the design process, they are referred to Perth Airports' Airside Operations Team.

Where compliance cannot be achieved, the compliance issue and apron plan are referred to the Operations Standards Manager for review / consultation with CASA. Redesign may be required when advice received from the Operations Standards Manager/CASA.

When developing a design:

- Operators of certified aerodromes and aerodromes established under the Air Navigation regulations are required under *Civil Aviation Safety Regulation 1998* Part 139.170 to mark the movement area in accordance with the standards set out in Part 139 MOS.
- The markings and associated clearances are defined in Chapter 8, Division 5 and Chapter 6, Division Section 6.5 of Part 139 MOS published by CASA. In addition to this, clearances for fuelling are defined in *Civil Aviation Orders* (CAO) 20.9.
- Apron Markings at Perth Airport must meet the standards laid down in Part 139 MOS. If this is not possible, the Airside Safety team will assess and advise accordingly.
- Design of markings must involve appropriate aircraft tracking and utilise the clearances defined in Part 139 MOS and CAO 20.9.
- Aircraft silhouettes and clearances should be depicted on the design. Appropriate separation factors are to be used for wingtip, undercarriage outer main gear wheel span (OMGWS), length, refuelling and jet blast.
- Preferred CAD software is MicroStation format.
- Datum is to be received in PCG94 and plotted to 2 decimals places (and up to 4 decimal places where possible).

Design considerations

When designing a new bay or parking position or changing one, the following are taken into consideration. This list of considerations is not exhaustive. If not mentioned here, refer to Part 139 MOS.

In order to produce a safe design, the data must be current. This can be done with an airside inspection prior to design. The apron area will be checked against current PAPL records and the Aeronautical Data Package (ADP) information with all engineering services and apron markings being checked.

Naming of bays

- General Aviation bays are to be named on an abbreviated two letter prefix associated with the GA company e.g. SA for Skippers Aviation. Three letters may be used if similar company names exist.
- PAPL-operated bays where only the parking of aircraft is available are prefixed SO. No maintenance or passenger movements can usually occur on SO bays unless otherwise advised on the apron usability plan. Parking restrictions on leased bays are also included on the apron useability chart.

Line of sight

Aircraft in their new parking positions can block critical lines of sight which has the potential to impact airside operations.

Some important lines of sight that need to checked are:

- Parked aircraft to ARFF
- Parked aircraft to ATC
- Parked aircraft to CCTV
- Parked aircraft to Airservices Australia navaids/microwave links.
- ATC to relevant infrastructure (e.g. taxiway intersections, runway holding points).
- ATC to runway threshold.

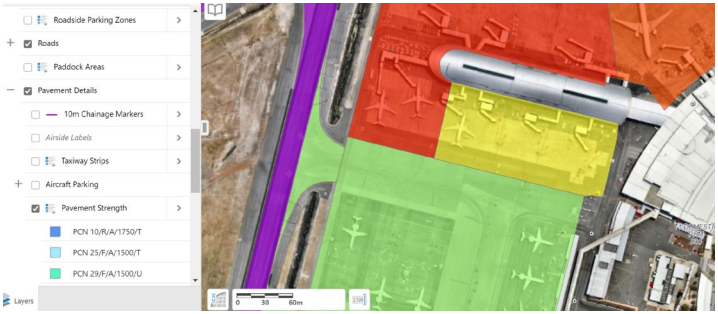
Obstacle Limitation Surfaces (OLS)

- Parking of aircraft must avoid any part of the aircraft infringing the OLS, and in particular transitional surfaces for each runway.
- Changes to existing and/or new flood lighting towers must be designed so as not to infringe the OLS, particularly transition surfaces for each runway.

Pavement suitability

- The pavement strength must be adequate to support the relevant aircraft.
- If the design is over two adjoining pavements and one pavement is not capable of the same aircraft weight as the other, then a parking weight limit line needs to be marked for the weaker pavement to ensure that the heaviest aircraft on the stronger pavement does not go on the weaker pavement.

  For further clarification, refer to MOS Part 139 Sect 8.51.
- The pavement must also be capable of accepting the relevant service vehicles and tugs.



Jet blast and propeller wash

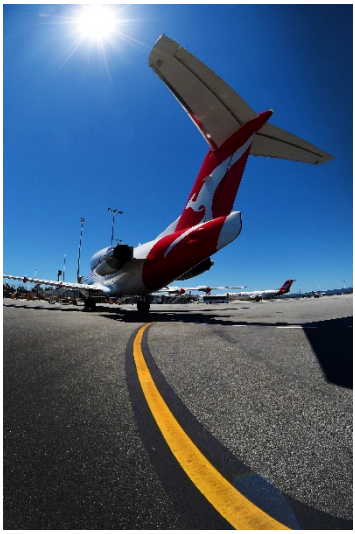
Consideration needs to be given to the effects of jet blast and propeller wash. MOS outlines the maximum wind velocities that ground staff, passengers and buildings should be exposed to.

Areas affected by jet blast need to be checked with MOS Ch 6 Division 5 to ensure they are compliant. CAO 20.9 must also be checked by the aircraft operator to ensure compliance on jet blast/propeller wash into buildings and hangars.

Listed below are typical scenarios where jet blast needs to be checked:

- Breakaway jet blast should be checked at all velocities when an aircraft has completed a pushback from the bay.
- Breakaway jet blast should be checked at all velocities when the aircraft is on the bay and is doing a power out manoeuvre.

Lead-in lines



- Lead-in lines should allow for all the aircraft to easily turn with an aircraft's nose wheel deflection angle being 15-18 degrees under the maximum effective nose wheel deflection angle.
- Aircraft must comply with separation distances outlined in MOS Ch 6 Table 6.58(1) and 6.53(1)-2.
- Lead-in lines must have the bay designators placed in a position where it can be clearly visible to the pilot of the aircraft and that the pilot has enough notice of the turn.
- In some instances, bay designators may need to specify the critical aircraft that can utilise that bay.
- With the designing of clover leafs, consideration should be given whether the bay will be a NIGS or marshal-in bay.
- If NIGS are to be used, an assessment will be undertaken by the terminal maintenance team.
- IATA aircraft codes are to be used for marshaller stop lines/pilot stop lines.
- Where possible, stop bars should be consolidated for multiple aircraft types, showing the largest aircraft type for that fleet.

Aircraft wheel positions

- Aircraft parking positions must be designed so that they are not directly over drainage grates.
- If possible, earthing points and disused hydrant points shouldn't be in the line of the wheels as constant running over them can contribute to tyre wear and tear.

Tug parking position

- Adequate space needs to be provided in front of aircraft for tugs.

  The space required will vary depending on what size tugs are being used. A distance of 14- 15m is recommended in order to allow the tug to straighten up. In the case of GA operators moving turboprops, approximately 7m is required.
- Consideration needs to be given to the marshaller's stance. The marshallers should be able to conduct their duties with minimal exposure to airside hazards such as ramp vehicles.

Clearances

Taxilane/Taxiway clearance – aircraft coding

- The taxiway/taxilane which the proposed aircraft will be using needs to be checked to ensure that the aircraft can use it. For instance, if a bay is being designed for Code C aircraft then the taxi lane needs to be checked to ensure that it is capable of being used for Code C aircraft.
- For details regarding taxi lane dimensions and which category aircraft they can handle, refer to MOS Ch 6 Table 6.53(1)-2 and Figure 6.53(1).

Wingtip clearances (all adjacent bays/areas)

- All aircraft that will utilise the bay design must comply with the minimum wingtip clearances outlined in MOS Ch 6 Table 6.58(1).
- If service bays are being designed, a wingtip clearance of 7.5 metres is required to allow service vehicles to move safely and efficiently around the aircraft.
- Reduced wing tip clearances may be provided on a bay serviced by VDGS following a safety assessment. Any reduction must be included on the apron plan and in the Aerodrome Manual.
- For designing apron markings adjacent to a lease boundary, then the aircraft being used on the adjacent apron lease need to be considered for allowing wingtip clearance.

  For instance, if you are designing markings for Code B aircraft and the aircraft using the adjacent apron lease are Code C aircraft, then you will need to allow for Code C wingtip clearances (MOS Ch 6 Table 6.58(1)).

  What will occur is that with Code C clearance being 4.5m, then 2.25m clearance is allowed on one side of the apron lease and 2.25m clearance is allowed on the adjacent apron lease.

Parking clearance

- Parked aircraft must not have any part protruding over the parking clearance line into the taxiway/taxilane.
- If service bays are being designed, then at least three metres space should be allowed between the rear of the aircraft and the parking clearance line in order to allow service vehicles to safely pass behind the aircraft without venturing into the taxi lane. The taxi lane must be free of objects with the exception being navigational aids.

Equipment servicing clearances

- Equipment Storage and Equipment Clearance areas should allow adequate space for at least a tug and a set of air stairs.
- They must be placed in a position where they won't be an obstacle to vehicles servicing the aircraft or the aircraft itself.

Aerobridge travel

- If the designed bay is to include an aerobridge, an 'As Constructed' aerobridge drawing is required in order to check if the aerobridge can be used with the proposed parking positions.

  This can be done by requesting a survey of the aerobridge extents. The full outline of the aerobridge should be captured in its home position and its full extents.

  Also required are the precise locations of the fixed link and the rotunda. This is also done in order to establish the location of the 'Keep Clear' markings.

- For some of the larger wide body aircraft, it may be more effective to dock the aerobridge to the second door. In some cases, an aerobridge may facilitate first and second door docking.

  This information needs to be established and included in the design if dual door docking. For smaller aircraft, second door docking will not be available.

- Door sill heights of aircraft need to be checked to ensure aircraft can be properly serviced both by the aerobridges and service vehicles.

- The clearance between the aerobridge and the engine cowling should also be checked.

- Operation of the aerobridge should be within normal tolerance limits. Proposed operation below lower limits must be assessed by the Terminal Maintenance team prior to design approval.

- Ensure that local area lighting from ground handling services (e.g. under aerobridges) is sufficient.

Walkways

- Passenger movement must be kept well away from the engines.

- Depending on the aircraft - 1st door, 2nd door and rear exits need to be considered when taking into account passenger movement to and from the aircraft.

- Rear exit walkways are generally not supported where arrivals are on level 1 and only stairs are available to that level. Safety case consideration is required before design approval.

- Adequate separation must be provided between service vehicles and passengers.

Refuelling of aircraft

- Locate where the refuelling points are on the aircraft involved in the design.
- Locate where the nearest fuel hydrants are in relation to the parked aircraft.
- The refuelling distance needs to be checked to ensure that the parked aircraft in its proposed location can refuel if required.
- Adequate physical clearance needs to be provided for fuel vehicles from adjacent aircraft and other objects.
- Hydrants (if available) need to be checked for clearances to wings, engines, main and nose gear tracking of aircraft.
- Refuelling of aircraft must comply with CAO 20.9. This involves checking the distances from the refuelling points of the aircraft away from any buildings, the location of where passengers will walk to and from aircraft and the location of where the ramp staff will be working on the apron.
- Hydrants need to be checked for serviceability.
- Drainage infrastructure including fuel interceptors must be installed on bays where refuelling is expected in accordance with NFPA 415, *Standard on Airport Terminal Buildings, Fueling Ramp Apron Drainage and Loading Walkways, 2008 Edition, 2007*.

Aircraft pushback

- Pushback guidance markings must be adequate to allow for all the aircraft to easily pushback with an aircraft's nose wheel deflection angle being at least 20 degrees under the maximum effective nose wheel deflection angle.
- Aircraft must comply with separation distances outlined in MOS Ch 6 Table 6.58(1).
- Consideration must also be given to the pushback limit, towbar disconnect marks and for breakaway jet blast.
- Pushback vehicle operator guidance markings must be based on the nosewheel of the aircraft. If unable to be based on nosewheel, this must be notified to PAPL and the Operations Standards Manager.

Pushback limit & towbar disconnect markings

- Pushback limit and towbar disconnect marks are to be designed in accordance with subsections 8.73 and 8.74 of Part 139 MOS.
- Pushback limit markings may be omitted if a hazard is not present.

Airside roads

- To allow for all vehicles which use an apron, an airside road should ideally be 10m wide with a 5m wide lane in either direction.

  This may be reduced to 8m wide with 4m wide lanes in either direction where space is limited. For use by cars only, the lane width may be reduced to 3m wide.
- All apron related objects including parked aircraft should be a minimum of 3m away from the edge of the airside road.
- Wherever possible, airside roads must be placed in an area where they can have minimum impact on aircraft operations.

Apron lighting

- Proposed light pole positions must be carefully considered. They need to be in a location where they aren't an obstacle to airside operations. This must take into account aircraft movements, vehicle movements (which may include, but not limited to tugs, catering trucks, air stairs and fuel trucks) and staff/passenger movements.
- Both proposed light poles and aircraft need to be checked to ensure that they don't encroach on OLS.
- If apron pavement areas or the position of light poles are expected to change, then the lighting levels will need to be checked by an experienced aviation lighting consultant. The lighting levels need to be adequate in order to allow the efficient and safe working of ramp personnel around a parked aircraft in accordance with Part 139 MOS.
- A building application will be required if apron light towers or other structure are required to be installed. For further information go to https://www.perthairport.com.au/Home/corporate/planning-and-projects/building-applications

Taxiway lighting

- On the taxiway leading into the apron parking position, apron lighting must meet subsections 9.77(1) and 9.80 of Part 139 MOS otherwise centreline lights required.

Plans

The following plans are required for review to compliance with Part 139 MOS prior to any line marking works being undertaken:

- Apron plan
- Setout plan
- Removal plan for old markings that are required to be removed (if applicable)
- Lighting grid (if applicable)

Changes may also be required for the following drawings:

- AIP charts
- Tower plan
- APT marks

Apron plans, once finalised, are made available on Perth Airport's Apron Markings sharepoint site at https://perthairport.sharepoint.com/sites/markings/SitePages/Home.aspx

When preparing the apron plan, it must include the following:

- Bay number
- Apron name
- Scale and size of plan (A3 preferable)
- Direction marker showing North
- Alignment lines
- Light poles (if applicable)
- Equipment storage areas (if available)
- Roadways and walkways (if applicable)
- Emergency response equipment such as fire extinguishers, fire hose reels and/or eye wash station in vicinity of the bay
- An 'Apron Usability' legend in the top left-hand corner of the plan which includes:
    - Bay designator
    - Each design aircraft
    - Stop bar position for each aircraft
    - Power in availability (Y/N)
    - Power out availability (Y/N)
    - Hydrant fuel availability (Y/N)
    - NIGS availability (Y/N)
    - Restrictions (Y/N) and notes on each restriction
    - Reduced wing tip information
    - Nose gear pushback confirmation

A final check with the tenant/airline is undertaken before plans are finalised and uploaded onto the Sharepoint site. Any changes to the cost to install will be advised to the tenant/airline at this time.

Installing new markings

Before any design plan will be released to survey teams or pavement markings teams (internal or external providers), the design needs to be reviewed for compliance by Perth Airport and the tenant/airline.

An additional airside inspection prior to set out and the painting of the new apron markings may be required.

Should the tenant/airline proceed with Perth Airport installing the new markings, the following steps shall occur once the request has been uploaded into MMS.

Action	Description
Survey	Complete the set-out of the markings on the pavement. Update status in MMS once complete.
Paint	Paint new markings and remove old redundant markings. Update status in MMS once complete.
Inspection	Confirmation markings align with design.
Finalise	Update plans and data to current date and add initials to plan. Create PDF's and upload to Apron Markings sharepoint site.

External contractors

Should you engage an external party to undertake the works, please liaise with Airfield Operations to ensure they have the necessary qualifications and permissions to work airside at Perth Airport.

External contractors will require an ASIC to work airside and will also require a Works Safety Officer to be present.

Where an external contractor is used, PAPL will still undertake the 'Inspection' and 'Finalise' steps above to ensure the markings are compliant with Part 139 MOS.

Further Enquiries & Contacts

Further enquiries

If you have any questions in relation to this standard, please contact:

Head of Perth's New Runway & Infrastructure
Perth Airport Pty Ltd
PO Box 6
Cloverdale, Western Australia, 6985
Phone: (618) 9478 8820
Fax: (618) 9478 8889

For proposed changes to this standard, please email document.controller@perthariport.com.au.

Important contacts

Aeronautical Property & Leasing Manager

Phone: 6278 8313

Airfield Safety & Operations Manager

Phone: 9478 8441

Definitions and Acronyms

Term	Definition
AA	Airservices Australia
ArcGIS	Specialist user software for updating GIS data
ARFF(S)	Aviation Rescue & Firefighting (Service)
CAD	Computer Aided Design software
GA	General Aviation
GDA	Geocentric Datum of Australia
GIS	Geographic Information System
MMS	Maintenance Management System
MOS	Part 139 (Aerodromes) Manual of Standards
NIGS	Nose In Guidance System, a type of VDGS
OLS	Obstacle Limitation Surface
PCG94	GDA 1994 Perth Coastal Grid (mapping grid coordinate system)
WGS84	World Geographic System 1984 (mapping grid coordinate system)
VDGS	Visual Docking Guidance System

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