08

AVIATION STRATEGY

OVERVIEW

The Aviation Strategy has been designed to develop and maintain aviation infrastructure that provides the highest standard of efficient, amenable, safe and secure facilities and services, while retaining the flexibility to adapt to changes in demand or technology.

Ongoing extensive engagement with aviation partners, government and industry will continue to provide Brisbane Airport with an up-to date understanding of the challenges and opportunities of the current and future operating environment to ensure future plans allow for appropriate aviation developments.

CHAPTER STRUCTURE

The Aviation Strategy is divided into three parts. The introduction includes aviation forecasts and a discussion around influencing factors, historical performance and the methodology used to produce the forecast data. That data forms the basis for decisions on long term strategy.

Part One of the Aviation Strategy outlines the key initiatives undertaken to improve terminal services and airfield operations since the publication of the 2014 Master Plan. The terminal strategy considers future projects on a precinct by precinct terminal strategy basis and also includes a long-term plan for aviation support. Each of the proposed new initiatives are underpinned by robust guiding principles. Part One also explains the operation of the current airfield and the changes that will take place following the opening of the new runway.

Part Two of the Aviation Strategy provides a level of detail and assurance around airspace and the safeguarding of the airport which is synonymous with previous Brisbane Airport Master Plans. Consideration is given to all the measures in place to support the safe and efficient operation of the new parallel runway system. Part Two also details the development of the 2020 Master Plan Australian Noise Exposure Forecast (ANEF). The ANEF assists government agencies with land-use planning decisions and decisions on future land use.

RESPONDING TO GROWTH

- The aviation and passenger forecasts commissioned for this Master Plan predict an increase in passenger movements of more than double the current level of movements.
- Aircraft movement forecasts, including general aviation movements, are forecast to increase to almost 380,000 annual movements by 2040. Robust long-term aviation capacity planning and extensive consultation are essential to ensure the continued provision of the capacity required to meet increasing demand.

The Terminal Development Strategy outlines how Brisbane Airport Corporation will respond to this growth, including the expansion of existing International and Domestic Terminals, as well as identification of areas for new terminal expansion(s).

The strategy for terminal development is intentionally flexible to allow response to changing drivers in the future, including aircraft fleet design and changes to legislative requirements. The Terminal Development Strategy presented outlines development strategies for the next five years, as well as a potential development pathway in the longer term (20+ years).

Aviation support facilities and services have been considered for both existing operations and future requirements. New precincts are identified, including potential future sites for JUHI expansion. In recognition of the importance of these services, a potential airside road connection which will connect the existing terminal development with future terminal developments adjoining the new runway is also identified.

AIRPORT SAFEGUARDING

Airspace protection is a critical element of airport operations and Brisbane Airport Corporation's strategies for future proofing the Airport's airspace are outlined in part two of this strategy, including airspace protection surfaces. An explanation of existing policies as well as description of Brisbane Airport's future flight paths is included to provide clarity with regard to operations on Brisbane's new runway.

Noise management remains of utmost important to Brisbane Airport Corporation and an updated ANEF is also presented in this chapter, alongside an overview of Brisbane Airport Corporation's noise management strategies and their alignment with global best practice.

BRISBANE AIRPORT AVIATION AT A GLANCE

Operating 24 hours a day, seven days a week, Brisbane Airport has two major terminals accommodating 33 airlines flying to 84 domestic and international destinations.

ANNUAL PASSENGER MOVEMENTS

CURRENT ANNUAL INTERNATIONAL PASSENGERS

5,900,000

CURRENT ANNUAL DOMESTIC PASSENGERS

17,500,000

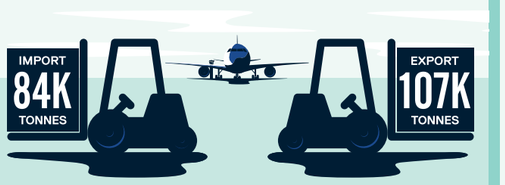
CURRENT TOTAL ANNUAL PASSENGERS

23,400,000

FORECAST TOTAL ANNUAL PASSENGERS BY 2040

51,500,000

INTERNATIONAL & DOMESTIC FREIGHT



SKYTRAX WORLD AIRPORT AWARDS

VOTED 18TH BEST AIRPORT IN THE WORLD

2019 Skytrax World Airport Awards

FUTURE READY INFRASTRUCTURE

BRISBANE AIRPORT CORPORATION INVESTED IN TERMINAL FACILITIES

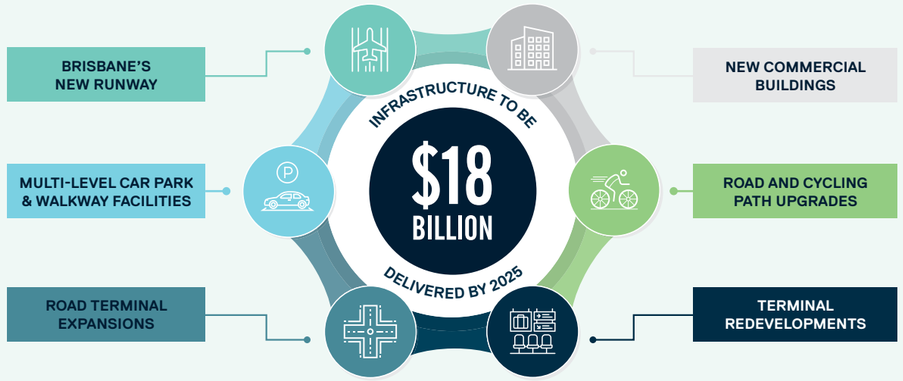
$354 MILLION ACROSS **297 PROJECTS**

INCLUDING

$135M
International Terminal Concourse and Apron expansion

$13M
International Terminal Self-Service Check-Ins and Bag Drops upgrade

$15M
Domestic Terminal retail configuration and upgrades



TOP GROWTH MARKETS - 2018

INTERNATIONAL

CHINA	⬆ +20%
INDIA	⬆ +14.7%
KOREA	⬆ +13.9%
TAIWAN	⬆ +10.2%
UK	⬆ +7.7%

DOMESTIC

PROSERPINE	⬆ +19.4%
MACKAY	⬆ +6.3%
CANBERRA	⬆ +5.5%
SYDNEY	⬆ +2.2%
MELBOURNE	⬆ +1.7%

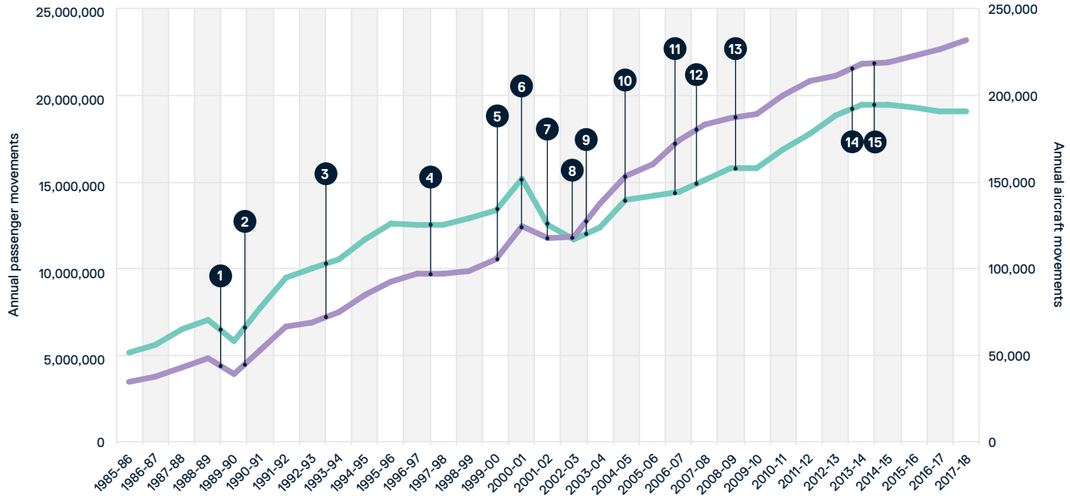
HISTORY OF AIRCRAFT AND PASSENGER MOVEMENTS

In FY2013/14, Brisbane Airport handled almost 195,000 RPT aircraft movements and processed almost 22 million passengers. In FY2017/18, Regular Passenger Transport (RPT) aircraft movements decreased to approximately 186,500 annual movements while passengers increased to more than 23.4 million.

This decrease in aircraft movements is a result of a reduction in small aircraft servicing resource ports in addition to the introduction of larger aircraft servicing international routes.

The graph shown below presents the historical growth in passenger travel and aircraft movements through Brisbane Airport since FY1985/86. This growth has been impacted by many external factors, including global and national events, as well as introduction (and removal) or airlines and aircraft types. Overall, Brisbane Airport has seen steady growth in its history.

HISTORICAL PASSENGER AND AIRCRAFT MOVEMENTS AT BRISBANE AIRPORT



Aircraft movements

Passenger movements

1. AUSTRALIAN PILOTS' DISPUTE
2. OECD RECESSION
3. AUSTRALIAN AIRLINE DEREGULATION
4. BRISBANE AIRPORT CORPORATION AQUIRED THE AIRPORT LEASE
5. VIRGIN BLUE LAUNCHED
6. 9/11 ATTACK
7. ANSETT CEASED OPERATIONS
8. JETSTAR ESTABLISHED
9. SARS OUTBREAK
10. A380 LANDED IN BRISBANE
11. TIGER AUSTRALIA ESTABLISHED
12. GLOBAL FINANCIAL CRISIS
13. SWINE FLU PANDEMIC
14. END OF MINING BOOM
15. G20 HELD IN BRISBANE

NEW SERVICES SINCE 2014

As Queensland continues to grow as a major business and tourism destination, it is anticipated that international airlines will continue to increase their operations through Brisbane Airport. Over the last five years, a number of airlines have either commenced operations, increased service frequency or up-gauged aircraft for operations into Brisbane Airport.

The timeline opposite outlines the changes to services at Brisbane Airport since the last Master Plan.

YEAR (FY)	NEW SERVICES ADDED SINCE 2014
2014	Malaysia Airlines commenced daily services Garuda Airlines re-launch Emirates upgrade to A380 Jetstar service to Denpasar launched Tigerair based two aircraft at Brisbane Airport Philippine Airlines re-launch
2015	Jetstar Honolulu service launched Virgin Australia Los Angeles to daily JetGo launched domestic services
2016	Air Canada launched China Southern Airlines to daily Qantas Tokyo (Narita) launched Singapore Airlines 21 to 24 weekly services Etihad Airways non-stop to Abu Dhabi Qantas Christchurch launched Fly Corporate launched domestic services
2017	China Eastern Airlines launched Malindo Air launched Qantas Port Moresby launched Tigerair based third aircraft at Brisbane Airport
2018	Singapore Airlines 24 to 28 weekly services Hainan Airlines launched Third daily Emirates Dubai service Malaysia Airlines re-launch Philippine Airlines non-stop to Manila Cathay Pacific de-tag from Cairns (seasonal) Qantas Auckland aircraft upgrade Jetstar started a three times weekly service to Uluru in August 2018
2019	Air New Zealand Queenstown and Wellington launched Philippine Airlines to five services a week China Airlines daily year-round Samoa Airways launched Singapore Airlines aircraft upgrade

AVIATION INDUSTRY CHANGES

Since the 2014 Master Plan, there has been significant changes in the aviation industry, including an evolution in aircraft manufacturing and airline fleet strategies shifting towards lower capacity long-range aircraft resulting in Airbus announcing it will end production of the A380 by February 2021.

Several existing airline partners at Brisbane Airport have recently commenced (or plan to commence) longer-range narrow body (A321neo/LR variants) services. The ability of airline customers to operate 'long, thin sectors' with these aircraft means that routes within eight hours flying time previously deemed unprofitable or unsustainable can now be considered. This is important given the emerging middle class in the ASEAN market.

The increasing development and implementation of ultra-long haul services will also impact Brisbane Airport in the future.

Ultra-long haul services from Brisbane Airport could provide non-stop services to the east coast of the USA and Europe. This strategy, also referred to as 'hub-busting', would open direct access between new global markets and Brisbane Airport.

The new 'Middle of the Market' (MoM) aircraft has the potential to relieve congestion on routes between Brisbane, Melbourne, and Sydney airports in the short-term, and is also potentially able to service short to medium-haul ASEAN destinations.

The aviation industry is ever-changing, and Brisbane Airport will continue to remain engaged with airline stakeholders in order to understand future fleet plans and route strategies. In any response to airline fleet strategies, Brisbane Airport will continue to play a role as a key hub for passengers travelling from regional parts of Queensland and northern New South Wales to destinations further abroad.

2020 MASTER PLAN FORECAST

At Brisbane Airport, forecasts of passengers, aircraft movements and air freight volumes provide the fundamental basis for airport planning, informing the strategies for terminal and airfield development across the airport. Air traffic forecasts have been independently prepared to ensure that the planning context for 2020 Master Plan is robust and provides confidence for Brisbane Airport stakeholders.

2020 MASTER PLAN FORECASTS

At Brisbane Airport, forecasts of passengers, aircraft movements and air freight volumes provide the fundamental basis for airport planning, informing the strategies for terminal and airfield development across the airport.

Air traffic forecasts have been independently prepared to ensure that the planning context for 2020 Master Plan is robust and provides confidence for Brisbane Airport stakeholders.

Brisbane Airport Corporation has engaged Tourism Futures International (TFI) since 1997 to undertake annual and peak demand forecasts. These forecasts are a key input for internal budget and business processes, overall airport master planning, major aviation facility development and analysis of aircraft noise metrics for Brisbane Airport. In 2019, Brisbane Airport engaged TFI to update its 20-year traffic forecasts for the 2020 Master Plan.

FACTORS AFFECTING THE DECISION TO TRAVEL

The growth of air travel is affected by a range of different factors including:

- The incomes of travellers and levels of consumer confidence.
- The competitiveness (quality, product attributes) of destinations compared to alternative choices.
- The frequency, reliability and quality of services and aircraft.
- Tourism promotion by governments, airlines and industry bodies.
- Consumer trends and available time for travel.
- The process of air travel and the ground component of travel.
- Perceived threats including war and terrorism or the emergence of pandemics such as SARS or avian influenza.

Taking these variable factors into account, a number of approaches have been used in constructing the forecasts that underpin this Master Plan. TFI has prepared air traffic forecasts for Brisbane Airport based on performance and assumed driver assumptions, prepared using data and assumptions available in late-2018/early-2019.

REVIEW MARKETS AND ESTABLISH TREND GROWTH RATES FOR BRISBANE AIRPORT TRAFFIC

REVIEW STUDIES (MACRO LEVEL COMPARED TO A MICRO LEVEL) TO ESTABLISH RELATIONSHIPS BETWEEN TRAFFIC DRIVERS

The 'macro' approach establishes relationships between aggregate passenger numbers for Brisbane Airport and economic factors such as Australian and/or organisation for economic co-operation and development GDP, as well as identifying specific markets for major tourism generating countries and/or regions.

The 'micro' approach provides an additional perspective on growth and is more responsive to developments in specific regions (e.g. the Asian economic crisis). From previous research and comparable studies within Australia and overseas, estimates of various elasticities have been established, mainly for income and fares.

ESTABLISH THE 'REASONABLENESS' OF THE FORECASTS BY REVIEWING OTHER LONG-TERM FORECASTS AND BENCHMARKING OTHER AIRPORTS

GENERATE ANNUAL AND PEAK HOUR PASSENGER AND AIRCRAFT MOVEMENT FORECASTS

MASTER PLAN FORECASTS APPROACH

The approach adopted by TFI in preparing the Brisbane Airport forecasts included consideration of the following;

- Segmentation of Brisbane Airport's international and domestic markets to assess the significance of traffic drivers.
- A review of the traffic history available for Brisbane Airport and an assessment of statistical trends. TFI reviews various periods over FY1984/85 to FY2017/18 to assess correlations and impacts of significant events.
- A review and analysis of the general aviation and business environment and current airline schedules. This assists in the development of capacity assumptions and identification of qualitative factors that might influence traffic outcomes.
- The development and updating of models - macro, micro (segment), econometric and time series - linking drivers and traffic.
- A review of 'official' tourism forecasts in Australia and elsewhere.
- A review of major airline fleet strategies and forward orders for new airframes.

KEY DRIVERS FOR PASSENGER MARKET SEGMENTS

INTERNATIONAL TRAVEL BY RESIDENTS

- GSP for Queensland
- Trade Weighted Index (TWI)
- Costs including airfares and other travel costs
- Airline capacity

INTERNATIONAL VISITOR TRAVEL TO BRISBANE

- Incomes per capita for markets (aggregate model uses OECD GDP)
- TWI
- Costs including airfares and other travel costs
- Airline capacity

INTERSTATE MARKET

- Australian GDP and Queensland GSP
- Domestic travel costs
- TWI
- International travel by Queensland residents and overseas visitors
- Domestic airline capacity
- Other factors that can have an influence include consumer confidence, housing prices and stock prices which can have an impact on wealth and travel

INTRASTATE MARKET

- Queensland GSP
- Queensland population
- Travel costs
- Mining employment and construction activity in Queensland

ANNUAL PASSENGER MOVEMENTS FORECAST

During the 20-year period of this Master Plan, passenger growth is forecast to more than double, growing from 23.4 million passengers in FY2017/18 to over 51.5 million annual passengers by FY2039/40.

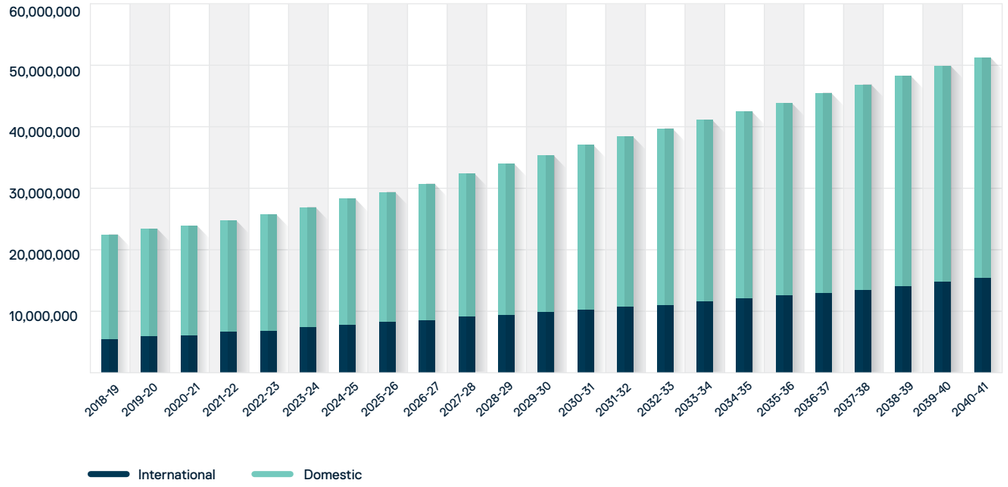
Domestic passengers are expected to grow from 17.5 million annual passengers to 36 million annual passengers by FY2039/40. International passengers are forecast to grow from 5.9 million annual passengers to 15.5 annual passengers over the same period.

New runway capacity in Brisbane (from 2020), Melbourne (between 2022 and 2024) and the second Sydney airport (from 2026) is expected to stimulate domestic traffic growth by providing peak slots in Australia's major east coast airports.

Combined with likely new aircraft deliveries, this will provide a unique opportunity for the airlines to promote additional growth from FY2020/26. Average growth is forecast to increase for the period to FY2028/29 as a result of increased domestic airport capacity on the Australian east coast.

In the long term, the proportion of domestic to international passengers is expected to evolve, with a slight increase in share of international passengers expected. This will result in an increase of international passengers from current levels of approximately 25 per cent to 30 per cent of passenger throughput by FY2039/40.

ANNUAL PASSENGER MOVEMENTS FORECAST



ANNUAL AIRCRAFT MOVEMENTS FORECAST

Annual aircraft movements at Brisbane Airport are forecast to increase significantly during the planning horizon, with an increase from over 213,000 to almost 380,000 movements in FY2039/40.

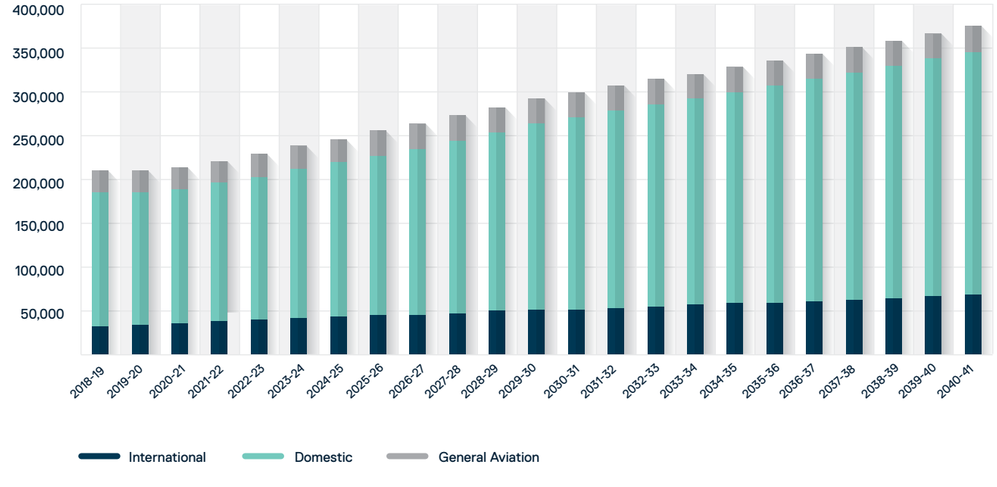
International aircraft movements are expected to grow from 16% of total movements to 19% by FY2039/40, more than 70,000 movements. Domestic aircraft movements are expected to grow from 72% share of total to 73%, resulting in almost 279,000 movements.

GENERAL AVIATION FORECAST

General aviation services will decrease as a proportion of total movements from 12% to 8%, however movements will increase from more than 26,000 movements to almost 31,000 movements.

For the purposes of this forecast, general aviation movements relate to those serviced by the general aviation terminal and supporting infrastructure (i.e. emergency services, charter operations, and training). Regional scheduled-RPT operations are included within the domestic forecast preceding.

ANNUAL AIRCRAFT MOVEMENTS FORECAST



COMPARISON WITH PREVIOUS MASTER PLAN FORECASTS

The tables presented following compare the passenger and aircraft movement forecasts from the three most recent Master Plans (2003, 2009, and 2014) with forecasts for the 2020 Master Plan.

The international forecasts are lower than the previous forecasts reflecting weaker airline capacity growth expectations allied with marginal downgrades of longer term economic and demographic forecasts. The main international variance is in the short term.

Compared with the 2014 Master Plan, the domestic forecasts are lower. This is due to subdued growth since the end of the mining boom, reduced airline capacity expectations in the medium-term, and downgrades of longer term economic and demographic forecasts for Queensland.

Brisbane Airport continually evaluates actual versus forecast movements and adjusts infrastructure development accordingly. A good example of this is the deferment of delivering the new runway from 2015 to 2020.

PASSENGER MOVEMENTS FORECAST COMPARISON

MASTER PLAN YEAR	FORECAST MASTER PLAN PERIOD	PASSENGER TYPE	FY2008	FY2013	FY2018	FY2023	FY2029	FY2034	FY2040
2003	2003 – FY2023	International	3,800,000	5,200,000	6,900,000	9,100,000			
		Domestic	13,100,000	16,600,000	20,700,000	25,900,000			
		Total	**16,900,000**	**21,800,000**	**27,600,000**	**35,000,000**			
2009	2009 – FY2029	International	4,100,000	5,300,000	6,900,000	8,800,000	11,800,000		
		Domestic	14,400,000	18,400,000	22,100,000	26,600,000	33,300,000		
		Total	**18,500,000**	**23,700,000**	**29,000,000**	**35,400,000**	**45,100,000**		
2014	2014 – FY2034	International	4,100,000	4,500,000	5,500,000	7,200,000	9,300,000	11,300,000	
		Domestic	14,400,000	16,800,000	20,600,000	25,600,000	31,800,000	37,000,000	
		Total	**18,500,000**	**21,300,000**	**26,100,000**	**32,800,000**	**41,100,000**	**48,300,000**	
2020		International	4,100,000	4,500,000	5,900,000	7,500,000	10,000,000	12,200,000	15,500,000
		Domestic	14,400,000	16,800,000	17,500,000	19,600,000	25,600,000	30,500,000	36,000,000
		Total	**18,500,000**	**21,300,000**	**23,400,000**	**27,100,000**	**35,600,000**	**42,700,000**	**51,500,000**

AIRCRAFT MOVEMENTS FORECAST COMPARISON

MASTER PLAN YEAR	FORECAST MASTER PLAN PERIOD	PASSENGER TYPE	FY2008	FY2013	FY2018	FY2023	FY2029	FY2034	FY2040
2003	2003 – FY2023	International	24,000	30,000	37,000	45,000			
		Domestic	122,000	153,000	190,000	237,000			
		General aviation	15,000	15,000	15,000	15,000			
		Total	**161,000**	**198,000**	**242,000**	**298,000**			
2009	2009 – FY2029	International	26,000	33,000	40,000	46,000	56,000		
		Domestic	136,000	173,000	204,000	240,000	289,000		
		General aviation	13,000	14,000	14,000	14,000	15,000		
		Total	**175,000**	**22,000**	**258,000**	**300,000**	**360,000**		
2014	2014 – FY2034	International	26,000	29,000	33,000	39,000	45,000	48,000	
		Domestic	136,000	165,000	194,000	227,000	266,000	290,000	
		General aviation	13,000	18,000	19,000	20,000	21,000	22,000	
		Total	**175,000**	**212,000**	**246,000**	**286,000**	**332,000**	**360,000**	
2020	2020 – FY2040	International	26,000	29,000	34,000	42,000	52,000	59,000	70,000
		Domestic	136,000	165,000	153,000	172,000	214,000	244,000	279,000
		General aviation	13,000	18,000	26,000	27,000	29,000	30,000	31,000
		Total	**175,000**	**212,000**	**213,000**	**241,000**	**295,000**	**333,000**	**380,000**

FORECAST PEAK PERIOD DEMAND

FORECAST OF INTERNATIONAL STAND DEMAND

It is anticipated that an additional eight international aircraft stands will be required to meet demand by FY2024/25.
Current forecasts indicate an additional 16 international stands will be required to meet 2040 demand.

AIRCRAFT CODE	EXISTING PROVISION	FORECAST STAND DEMAND			
		2020	2025	2040	ULTIMATE
C	26	10	13	14	12
E	12	13	14	24	35
F	7	1	2	2	2
TOTAL STANDS	**19** including 7 Code F and 1 Code E MARS stand	**19** including the use of 5 Code E/F MARS stands	**27** including the use of 4 Code E/F MARS stands	**35** including the use of 5 Code E/F MARS stands	**49**

FORECAST OF INTERNATIONAL PASSENGERS BUSY HOUR

The current 2019 peak hour international passenger arrivals flows is 2,770 per hour and this is forecast to increase to 6,960 per hour in FY2040. Similarly, the current 2019 departure passenger flow of 2,101 per hour is expected to increase to 5,550 by FY2040.

YEAR	ARRIVALS	DEPARTURES
Existing	2,770	2,101
2020	2,770	2,210
2025	3,860	3,080
2040	6,960	5,550

FORECAST OF DOMESTIC STAND DEMAND

It is anticipated that six additional domestic stands will be required by FY2024/25.
Current forecasts indicate that an additional 34 domestic stands will be required to meet 2040 demand.

AIRCRAFT CODE	EXISTING PROVISION	FORECAST STAND DEMAND			
		2020	2025	2040	ULTIMATE
Regional	10	10	10	17	22
C	45	46	50	66	89
E	5	2	4	9	12
TOTAL	**58** including 2 Code E MARS stands	**58**	**64**	**92**	**123**

FORECAST OF DOMESTIC PASSENGERS BUSY HOUR

The current 2019 peak hour domestic passenger arrivals flows is 3,123 per hour and this is forecast to increase to 5,440 per hour in FY2040. Similarly, the current 2019 departures passenger flow of 3,228 per hour is expected to increase to 5,940 per hour by FY2040.

YEAR	ARRIVALS	DEPARTURES
Existing	3,123	3,228
2020	3,170	3,260
2025	3,790	3,840
2040	5,440	5,940

ULTIMATE STAND DEMAND

Brisbane Airport Corporation considers very long-term or ultimate capacity scenarios for elements of major airport infrastructure beyond the 2040 planning horizon of this Master Plan.

Planning has been undertaken to ensure when the runway operations reaches its maximum sustainable peak throughput, there is a balance of capacity between the main elements of the airport system including the runways, taxiways, aprons, terminals and landside infrastructure. Analysis and benchmarking indicates that the runway system will reach its ultimate peak operating capacity by mid-2050's when annual aircraft movements are between 450,000 to 500,000. This ultimate hourly runway capacity translates into an equivalent potential stand demand of up to 172 aircraft stands (contact and remote positions).

The assessment of ultimate capacity scenarios is based on current standards: a consistent demand profile across the day, aviation infrastructure, airspace management and current aircraft fleet technologies.

Future assessments of the ultimate operating capacity of Brisbane Airport could change as a result the introduction of new and more efficient aircraft, changes to growth forecasts or changes to airspace management.

The terminal and apron areas have been sized to accommodate the long-term aircraft demand (including consideration of aircraft fleet mix) matching the potential runway capacity. While long-term forecasts show consistent growth in both domestic and international passengers, shorter-term forecasts in any given period can have larger or smaller rates of growth, as well as variability in the predominant aircraft type. With this in mind Brisbane Airport Corporation will adopt strategies including flexible aircraft parking layouts, integrating domestic and international aprons and MARS stands to ensure aircraft parking aprons servicing all terminal precincts can offer the long-term capacity to match the aircraft demand that the runway system can deliver to the airport.

Multiple Apron Ramp System (MARS) arrangements allow for flexibility of aircraft size and number using an apron parking bay. This allows a pair of aerobridges to service one larger aircraft or two smaller aircraft.

AIR FREIGHT FORECAST

Air freight is an important source of revenue for passenger airlines. The International Air Transport Association reports that air freight contributes one per cent of world trade by volume, but over 35 per cent by value.

Combined throughput of domestic and international freight (inbound and outbound) was approximately 190,500 tonnes in FY2017/18. Based on current growth rates, this is forecast to reach approximately 526,700 tonnes by FY2039/40.

DOMESTIC FREIGHT FORECAST

Domestic air freight is mainly overnight parcel express business carried by dedicated scheduled freighter aircraft operating Australia wide networks. The efficiency of these essential services is highly dependent on Brisbane Airport being fully operational 24 hours a day.

In FY2017/18 Brisbane Airport had a combined inbound and outbound domestic freight throughput of just over 68,400 tonnes. This is forecast to grow to 107,700 tonnes by FY2039/40.

INTERNATIONAL FREIGHT FORECAST

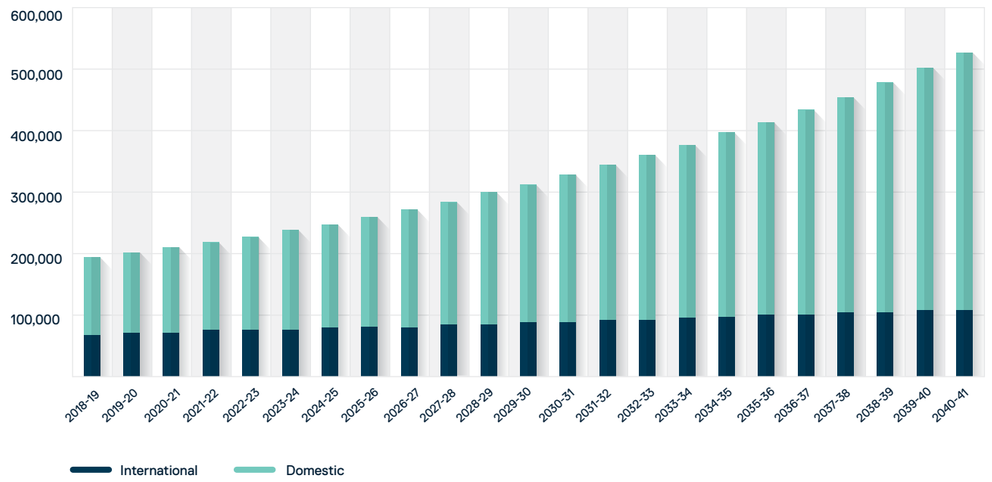
Brisbane Airport handles approximately 12 per cent of Australia's international air freight and ranks third after Sydney and Melbourne. Brisbane is an important international export airport for Queensland and Australian goods, especially perishable produce.

In FY2017/18 Brisbane Airport had a combined inbound and outbound international freight throughput of just over 122,100 tonnes. This is forecast to grow to 419,000 tonnes by FY2039/40.

Approximately 25 per cent of air freight movements into Australia are via dedicated freighter aircraft. The balance of air freight imported into Australia is carried in the cargo holds of passenger aircraft. At Brisbane Airport, future growth in this air freight sector is dependent on increases in the number of RPT services to Brisbane by international network carriers.

Special consignments such as bulky industrial plant, livestock and airframe deliveries are transported by dedicated charter air freighter aircraft. Current trends suggest that this pattern will continue.

COMBINED DOMESTIC AND INTERNATIONAL (EXPORT AND IMPORT) AIR FREIGHT FORECAST



NEW PROJECTS SINCE THE 2014 MASTER PLAN

The 2014 Master Plan outlined potential options for future aviation and terminal development. Since the publication of that Plan and in consideration of the forecast growth in passenger demand, Brisbane Airport has invested in a range of high profile projects designed to upgrade and improve the services provided. Details of nine of those projects are listed here.

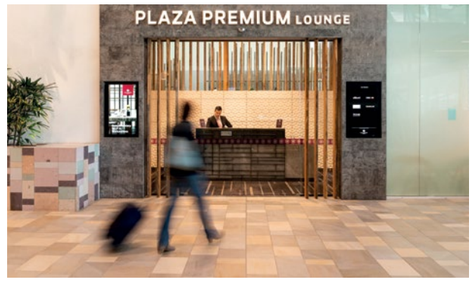
INTERNATIONAL TERMINAL REDEVELOPMENT

In 2015, Brisbane Airport Corporation invested $45 million in a redevelopment of the departure level and retail precinct at the International Terminal. The project has since received accolades from the aviation industry at home and abroad.

Elements of the redevelopment included a themed departures lounge, new 'walk through' Duty Free shopping areas in departures and arrivals, new specialty retail and food and beverage outlets offering the best of local produce and products and improved way-finding for passengers.

Queensland artists were selected to provide key pieces within the terminal and local materials used for a variety of aspects to support Queensland and Australian suppliers.

The stunning fitout features locally sourced stone, timbers, fittings and plants to define dedicated dwell, work and relaxation areas. The construction part of the project created 750 jobs.



INTERNATIONAL TERMINAL LOUNGE EXPANSIONS

In 2016, an underused retail space of 1,800 square metres on Level 4 of the International Terminal was repurposed to create three modern airline lounges and a new day spa.

Following the redevelopment, Air New Zealand's new premium lounge opened in mid-March 2016, with an estimated 70 per cent more physical space than the previous lounge as well as panoramic city views. The new lounge provided an enhanced food and beverage offering with capacity for 200 customers and was followed in May by the opening of Singapore Airlines' new SilverKris lounge which in addition to a larger lounge area with seating for 80 guests includes business pods, a dedicated dining area and a separate VIP area.

In the final part of the redevelopment, in June 2016, Plaza Premium opened Australia's first independent lounge, providing comfortable seating, food and beverage and Wi-Fi services to passengers regardless of airline or ticket class.

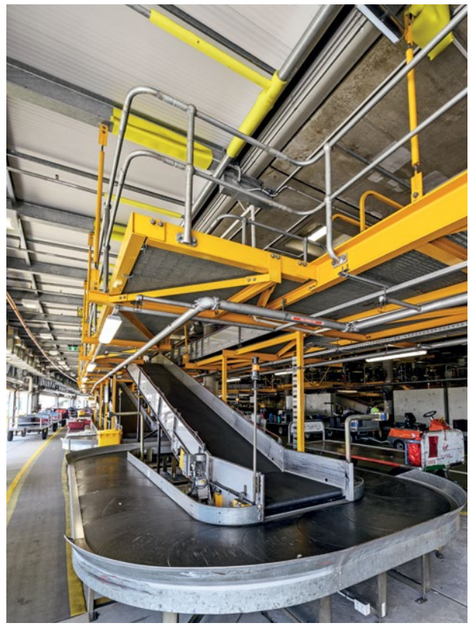
With an upgraded lobby, the new facilities are linked to Level 3 Departures via two newly installed escalators and a lift. The project overall created 70 jobs.

DOMESTIC TERMINAL RETAIL UPGRADE

In addition to the improvements to the International Terminal, Brisbane Airport Corporation also completed a redevelopment of the southern end of the Domestic Terminal building in 2016.

This project included a reconfiguration and upgrading of food halls, the creation of a new, premium bar and restaurant and facilities for new speciality retailers. The work was carried out in stages and at mostly off-peak hours to ensure minimum disruption to passengers and airport operations.

Following the redevelopment, the terminal welcomed 16 new retail tenancies providing a range of new services for passengers, with the project overall resulting in the creation of more than 100 construction jobs. A second stage of development of the retail areas of the terminal commenced in 2018.



BAGGAGE HANDLING SYSTEM UPGRADE

Towards the end of 2017, the baggage handling system at the southern end of the Domestic Terminal was upgraded and expanded, with a total budget of $12 million. The construction phase of the project created more than 50 jobs.

This new multi-million dollar facility has provided the Domestic Terminal with a larger, faster and more efficient baggage handling system. Included in the scope of the project were three new baggage carousels, an upgrade of the existing baggage conveyer belt, improved bag sortation software and an extended canopy airside from the terminal to cover new belts. A new extended mezzanine and gantry also increased bag sortation and was complemented by the installation of new x-ray machines.

INTERNATIONAL TERMINAL NORTHERN CONCOURSE AND APRON EXPANSION

Brisbane Airport's new $135 million expansion of the northern concourse and apron provides significant benefits with the integration of the latest technology, increased aircraft docking and parking space, as well as improved passenger experience and processing efficiency to cater for future growth.

After two years of construction across three levels, the expansion provides an additional 11,000 square metres of space at the International Terminal, including new arriving and departing passenger zones, two new walk-out gates and four new aerobridges.

The expansion project, which created more than 450 jobs during the construction phase also delivered 55,000 square metres of new concrete pavement for aircraft taxiways and three new aircraft parking bays capable of accommodating A380, B747, A330, A340, A350 and B787 aircraft.

INTERNATIONAL TERMINAL CHECK-IN AND BAG DROP UPGRADE

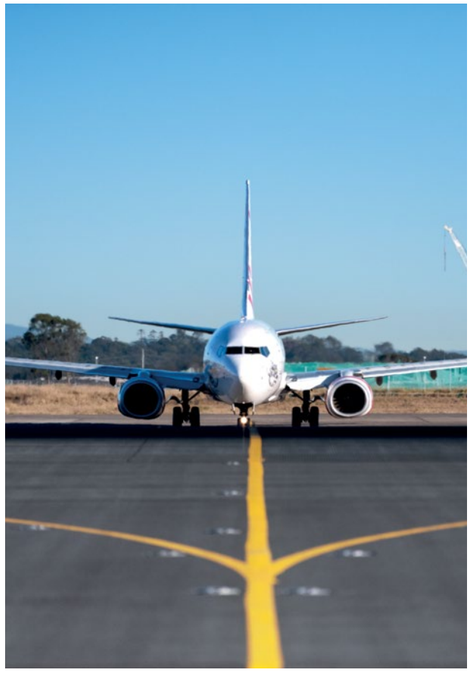
To continue to meet passenger demand, between June 2015 and June 2018, Brisbane Airport delivered innovative new self-service check-in and automatic bag drop facilities at the International Terminal. In total, 96 new self service kiosks were added on Level 4 of the International Terminal.

The project, with a budget of more than $12.5 million, included the creation of 32 new automatic bag drops, with 110 jobs created in the construction phase of the project. Each of the innovations saw passengers overall enjoy quicker and more seamless check-in, as well as creating shorter queues for passengers requiring assistance.

RUNWAY 01R/19L OVERLAY

In 2016, Brisbane Airport completed a maintenance overlay of the central section of the main 01R/19L runway. Brisbane Airport is open 24 hours a day, seven days a week and to preserve the highest standards of safety, maintenance programs are not permitted to hamper normal operations.

Working in five hour overnight shifts, the project involved two key elements, firstly the laying of 42,000 tonnes of asphalt over a total area of 275,000 square metres and, following that, laying of 43 kilometres of electrical cable to update the complex aeronautical ground lighting system. The successful project, essential to maintain safe operations, was completed in six months.



TAXIWAY H UPGRADE

In April 2018, Brisbane Airport upgraded Taxiway H to allow weight restricted Code E aircraft to access the maintenance, manufacturing and aviation services facilities located in Airport East.

Taxiway H is restricted to Code E aircraft in a maintenance configuration with a mandated maximum payload.

More than 40 jobs were created in the construction of high strength shoulder and blast protection taxiway pavements, as well as the installation of ground lighting and movement area guidance signs, construction of stormwater drainage, lateral restraint kerbs, line marking and the demolition of existing pavement.

DIGITAL INNOVATION

In 2015, Brisbane Airport became the first airport in Australia to launch an airport app compatible with the Apple Watch. The airport app won the 'Best in Class' award at the Interactive Media Awards, the highest honour bestowed by the IMA.

Constantly evolving, the smartphone app now includes a special 'My Trip' function allowing passengers to include personalised information details about where they parked at the terminal, while also tracking flights and receiving notifications of flight status and schedule changes.

More recently, passengers are benefiting from real-time passenger information systems on terminal buses and an automated taxi call system that reduces waiting times for drivers and passengers alike.

AVIATION STRATEGY PART ONE TERMINALS AND AIRFIELDS

TERMINAL OPERATIONS

Brisbane Airport has two main terminals, the International Terminal and the Domestic Terminal. The International and Domestic Terminals at Brisbane Airport are located 1.5 kilometres apart, with the International Terminal located to the south of the Domestic Terminal.

Together they handle more than 23 million passengers a year, a number that continues to grow.

Brisbane Airport's International Terminal first opened in 1995 and currently provides services to international airlines, flying to a total of 32 international destinations.

The design of the International Terminal purposely reflects South East Queensland's sense of place, with abundant use of natural light within the terminal with the external and internal landscaping and finishes reflecting the area's enviable outdoor lifestyle.

Brisbane Airport's Domestic Terminal hosts airlines flying to more than 52 destinations across Australia, including 27 destinations in Queensland, making Brisbane Airport Australia's most domestically connected airport.

The smaller general aviation Terminal is located north-east of the Domestic Terminal.

This section of the Master Plan includes details of significant new developments in the terminals since the publication of the 2014 Master Plan including a more detailed overview of each terminal and its current operations.

TERMINAL INITIATIVES SINCE 2014

INTERNATIONAL TERMINAL NORTHERN CONCOURSE AND APRON

The $135 million expansion provides an improved passenger experience and processing efficiency to cater for future growth. After two years of construction across three levels, it provides approximately 11,000 square metres of new terminal structure including:

- Gates 73 and 74, designed for full Multi Aircraft Ramp System with 2 aerobridges, providing connectivity for either a Code E or F or 2 Code C aircraft. Future connectivity is provided for a third aerobridge on gate 73.
- New bathroom amenities on Levels 2 and 3.
- Boarding lounges for new walk out Gates 69-72.
- Future proofing lounge space for Gates 65–68.
- 55,000 square metres of new pavement.

Using digital engineering tools including Augmented Reality and Building Information Modelling, a staged program of works kept stakeholders informed on the course of the project and identified operational measures to avoid disruption.

The fact that this project took place in a live airport environment made its success all the more worthy of recognition. The application of digital tools allowed the works to be designed and staged in a live virtual environment ahead of the actual construction.

The new concourse meets the IATA level of service “Optimum” and creates attractive options for new international carriers looking to commence services to Australia and for existing airlines carriers seeking to increase the frequency of services to meet demands.

A significant feature of the terminal expansion is a 90 metre floor to ceiling artwork by Queensland College of Art (QCA) Master of Visual Art student Michael Phillips.

INTERNATIONAL TERMINAL RETAIL AREA REDEVELOPMENT

Opened in October 2015 the redevelopment of the International Terminal retail area was an intensive 18 month project with 38 stages, working on multiple zones and floors.

Twenty-four new retail tenancies were progressively opened with more than 4,600 square metres of additional retail space created.

As part of the build, 7500 square metres of new tiles were laid, equivalent to one and a half football fields in size. All building materials, including tiles, steel, sand and concrete were individually security scanned before being taken into the secure zone.

Works took place during the quiet times of day, with major construction scheduled late at night and in the early morning to minimise disruption to travellers and airport operations.

The team managed these constraints by delivering the project in carefully sequenced stages, with a strong focus on ongoing communication with stakeholders and terminal users.

In addition to creating the new tenancies, it was critical to minimise or eliminate the period between closure of an existing tenancy and a new one opening.

To ensure seamless transitions, the project was actively managed between the 24 tenancy contractors and the airport’s head contractor.

As a results, new tenancies were able to open for trading on the target date, a critical element of the feasibility of the project.

The project was delivered in conjunction with more than 100 key stakeholders, including Government agencies, Duty Free operators and a total of 25 new retail and food and beverage tenants.

INTERNATIONAL TERMINAL CHECK-IN AND BAG DROP UPGRADE

The $12.5 million Self-Service Check-In and automatic Bag Drop Upgrade delivered ground-breaking technology and smart infrastructure, radically reducing passenger waiting times and queue lengths in the busy International Terminal.

A rolling, three year, seven-stage schedule delivered the installation of 96 kiosks and 24 bag drops with minimal impact to terminal operations, providing a smart, user-friendly and flexible system for passengers and airlines.

The purpose of the project was to meet airline and passenger demand by more than doubling the number of check-in facilities at the terminal, without the need for an intrusive, disruptive and costly expansion of the terminal footprint.

The construction team delivered leading technology and smart infrastructure that not only reduced peak passenger wait times and queue lengths at check-in, but did it in existing space, negating the need for a major expansion of that area of the terminal.

To achieve this, Brisbane Airport worked closely with one of the world’s leading specialists in air transport communications and information technology, and partnered with selected major international airlines and their software vendors, to develop new and improved check-in systems that would operate on a “common user” software platform.

Selected airlines are now able to access any self-service check-in kiosk and automatic bag drop on any row within the terminal, allowing Brisbane Airport greater flexibility and movement on check-in row choices, generating additional capacity within the terminal and providing airlines with greater flexibility to process passengers.

DOMESTIC TERMINAL CAPACITY AND EFFICIENCY UPGRADES

Snce 2014, projects undertaken at the Domestic Terminal and aircraft movement areas to further improve capacity, customer services and operational efficiencies include:

- Expansion of the southern apron expansion to provide dual apron taxiways allowing the efficient simultaneous arrival and departure of aircraft with more efficiency.
- Seven additional aircraft parking bays, extra space for aircraft layover parking and an extra 50,000 square metres of aircraft pavement.
- Conversion of a number of older style check-in areas to automatic bag drop.
- Upgrade of aerobridges to gates 40, 44, 47 and 48, increasing passenger and aircraft processing speed adding and flexibility with the creation of two MARS positions.
- Redevelopment and expansion of the floor plate in the southern satellite, creating an additional 850 square metres of office, retail and seating space.
- New business lounges in both the Northern and Southern ends of the building incorporating upgraded valet services.
- Expanded and upgraded baggage handling infrastructure including new baggage sorting and processing capacity.
- Retail upgrades leading to 16 new tenancies including reconfigured and upgraded food halls, a premium bar and restaurant and speciality retailers. The benefits include more retail choice, additional seating and space for passengers and expanded range of food and beverage choices.

INTERNATIONAL TERMINAL

The International Terminal, originally opened in September 1995 and presents an iconic, spacious and aesthetically pleasing building.

The International Terminal operates as a common user facility, administered by Brisbane Airport and featuring a four-level structure:

- Level 1 – baggage handling, delivery dock, stores and airline offices
- Level 2 – arrivals processing and airline offices
- Level 3 – departure lounges, airline lounges, airside retail and departures processing
- Level4 – check-in and landside retail.

The use of natural light within the terminal, as well as the external and internal landscaping and finishes reflect Brisbane and Queensland's enviable outdoor lifestyle and create an environment encapsulating South East Queensland's sense of place.

Twelve aerobridges (eight apron-drive, two fixed links, one dual headed and one triple headed) connect to either the terminal face or the three level concourses servicing the apron.

Departure gates on the ground level allow walk-out boarding access to five non aero-bridged aircraft stands.

INTERNATIONAL TERMINAL APRON

The International Terminal aircraft parking apron consists of high strength pavement in a linear arrangement with an in-ground fuel hydrant system connected to the Joint User Hydrant Installation (JUHI) facility located half-way between the two terminal precincts.

The apron has 14 primary aircraft contact positions capable of accommodating four Code F aircraft (e.g. Airbus A380) and 10 Code E aircraft (e.g. Boeing B777, Airbus A330 and A350).

There are a further three stands in Multiple Apron Ramp System (MARS) configurations and two Code E positions not currently directly linked to the terminal face or concourses.

The non aerobridge stands have the capacity to serve up to seven Code C aircraft. These are used for both remote parking and walk-out boarding of passenger services.

Ground Service Equipment (GSE) storage areas are located adjacent to both ends of the apron.

INTERNATIONAL TERMINAL LANDSIDE ZONE

The International Terminal landside zone consists of traffic circulation, car parking and ground transport interchange zones. The road system includes two separate elevated ramps servicing the public drop off departures on Level 4 and the taxi and ride share areas on Level 2. A taxi feeder system connected to the arrivals ramp is in the northern corner of the car park zone.

The Airtrain station is located adjacent to the public car park, with an elevated link to the terminal, connected at Level 3. Coach parking is provided at the southern end of the terminal.

The public arrival pick-up area is on ground level with a five level, multi-storey car park located directly opposite the terminal.

DOMESTIC TERMINAL

First opened in 1988, Brisbane Airport's Domestic Terminal is a two storey common-use terminal. The airside presentation of the Domestic Terminal is a convex curvilinear façade with three concourse and satellite structures located in the centre and at either end of the terminal.

The operations of Qantas and Virgin Australia are concentrated at the northern and southern ends of the terminal respectively, with low-cost carriers and smaller regional airlines operating from the centre.

Operated by Brisbane Airport, the Domestic Terminal consists of;

- Level 1 – check-in and bag-drop, northern and southern security screening points, baggage handling system and northern, central and southern baggage reclaim areas. Also located on this level are airline offices, regional boarding gates, ground transport kiosks, retail outlets and entry to premium lounges.
- Level 2 – airline lounges, airline and airport staff offices, central security screening point, boarding gates, retail outlets.

Four primary terminal face aerobridge-serviced gates are located on each side of the central concourse. The northern, central and southern satellites provide access to aerobridge serviced gates and walk-out boarding gates.

Boarding and arrival facilities for regional services are located at both ends of the terminal.

DOMESTIC TERMINAL APRON

The terminal connected apron consists of high strength and tug strength concrete pavement servicing all aerobridge and satellite gates.

An in-ground fuel hydrant system is connected to the JUHI facility.

The apron adjacent to the terminal consists of areas that are a mixture of high-strength and medium-strength rigid and medium-strength flexible aircraft pavement areas suitable for domestic aircraft parking.

Freight, regional operations, and ground service equipment storage areas are located to the south and north of the primary terminal connected stands.

DOMESTIC TERMINAL LANDSIDE ZONE

The landside zone consists of traffic circulation, car parking, transport facilities and surface transport interchange zones. The elevated Airtrain station is linked by a high-capacity elevated walkway to the terminal, known as Skywalk. Skywalk also connects the short-term car park and sits above the circulating roads delivering passengers to the terminal kerb. Travelators, stairs and lifts provide access for passengers from the kerbs to the elevated walkway.

A long-term multi-level car park links by an elevated covered walkway to the short-term car park and from there, to the terminal. Taxi, ride share, rental car, bus and limousine meeting areas are provided on sections of the parallel terminal face roads. Taxi and ride sharing, and bus feeder areas are located at the northern end of the public car parks. Staff car parking is located in the areas to the north of the Domestic Terminal.

GENERAL AVIATION

At Brisbane Airport, general aviation refers to a diverse community operating across the airport site. These operators provide a vast array of services, including charter operations, training and education, aircraft maintenance, and critical emergency services.

General aviation operators are located within the Airport East and Airport North neighbourhoods. Within the Airport East neighbourhood, there are operators who provide various services including the emergency services, training and education and fixed base operations. These operations have access to the logistics apron area and use of the existing runway.

Within the Airport North neighbourhood, there are general aviation operators, charter operations and emergency services for Brisbane Airport. Operators within this neighbourhood use a dedicated apron with a GSE storage area. There is also a small common-use terminal to process charter passenger services which is owned and operated by Brisbane Airport Corporation. In line with one of the 2014 Master Plan initiatives, this terminal was developed in 2016 and has additional capacity for the provision of security screening and further expansion in the future.

Fixed Base Operation (FBO) facilities are established at both the Airport North neighbourhood and adjoining the logistics apron adjacent to the Da Vinci precinct. These two facilities handle VIP operations and closed charter operations, meeting Brisbane Airport's strategy for FBO facilities. Brisbane Airport is not supportive of a proliferation of FBO facilities given the relatively low demand and the need to promote business sustainability outcomes.

The general aviation community plays an integral role in facilitating the relationship Brisbane Airport has with regional Queensland. Communities in regional Queensland are serviced by the general aviation community through RPT operations, small freight operations, and charter flight services which service the resource regions integral to Queensland's economy.

HELICOPTER OPERATIONS

Helicopter operations at Brisbane Airport consist predominantly of emergency services, with very occasional aerial work or charter operations. Helicopter operations are limited to the northern end of the general aviation (Airport North) logistics apron (adjoining Da Vinci). Airport facilities and air traffic control requirements do not accommodate regular public transport helicopter operations.

COMMON GUIDING PRINCIPLES FOR TERMINAL DEVELOPMENT

In the development of the 2020 Master Plan, Brisbane Airport undertook a comprehensive review of the existing development strategy for the terminal areas.

The review considered the factors influencing future planning, including consideration of emerging trends and technology in airport design and passenger processing, passenger demand and other constraints potentially affecting future terminal development.

Following that review, and to ensure consistency of the approach to development, six guiding principles were identified as being important considerations for future development of terminals and associated areas.

SIX GUIDING PRINCIPLES

- FLEXIBLE TERMINAL DEVELOPMENT STRATEGIES
- EFFECTIVE TERMINAL AND LANDSIDE INTERFACE
- MEETING CUSTOMER EXPECTATIONS
- COMPLIANCE WITH AVIATION SECURITY REQUIREMENTS
- EFFICIENT AND FLEXIBLE AREAS FOR AIRCRAFT MOVEMENT
- EFFICIENT AIRSIDE LOGISTICS

PRINCIPLE ONE
FLEXIBLE TERMINAL DEVELOPMENT STRATEGIES

The terminal development strategy is designed to deliver the highest quality of service within an affordable investment framework that delivers benefits to all stakeholders.

Development strategies will incorporate the following considerations:

- Maintain capacity to meet forecast demand while delivering expected service levels.
- Retaining the flexibility to introduce new technologies and to add, remove, expand or relocate processing areas as needed.
- Leveraging innovation in baggage handling to improve efficiencies and offer an increased range of services (including bag tracking, off-site bag-drop and baggage collection and delivery services).
- Consideration of new aircraft types, including larger narrow body and future middle of the market wide body aircraft
- Potential future requirements for international to domestic swing capable facilities.
- The potential consolidation of distributed passenger processing points and integration of domestic and international operations.
- Requirements for effective airline placement and migration strategies.

PROPOSED ACTIONS TO ALLOW FOR FLEXIBLE DEVELOPMENT

CHANGES TO MEET NEW SCREENING REQUIREMENTS

At Brisbane Airport, the upgrade of passenger and baggage screening facilities required to meet the Australian Government's revised aviation security standards represents a significant investment in both the International and Domestic Terminals. In order to avoid creating an unaffordable cost burden on the industry, Brisbane Airport considers it important that the timing of such significant investment in the existing terminals does not coincide with major investment in the future Northern and Western Terminals. For this reason, Brisbane Airport Corporation's policy is that aeronautical investments over the 5 year period of the 2020 Master Plan will focus on extending the capacity of the International and Domestic Terminals to a design horizon of 2030 with new terminals to be planned for the period post 2030.

CONTINUING TO MEET INCREASING DEMAND

Extending the capacity of the existing terminals to 2030 will be achieved through optimising and extending the life of existing processing areas including check-in, security, international outbound and arrivals processing and baggage handling. Strategies to be adopted include further roll out of current technologies including self-service check-in and bag drop, automated border processing, bag tracking and early bag store as well as implementing emerging biometrics technology where appropriate.

Investment across both terminals will also deliver new departure lounge and boarding gate areas and both terminal contact and remote aircraft parking. Brisbane Airport will design flexible future terminal facilities though adopting principles including regular and modular building templates and rectilinear concourses that facilitate incremental expansion.

It is not envisaged that further processing capacity will be added to the Domestic Terminal after 2030. Whilst the Domestic Terminal will continue to operate well into the future, beyond 2030 further domestic processing capacity will be provided within the future Northern and Western Terminals.

In order to continue to service international demand post 2030, the International Terminal would require a major expansion of the core terminal processing areas as well as the development of the southern concourse and supporting apron areas.

MEETING CHANGING INDUSTRY DEMANDS

The terminal strategies presented in earlier master plans have been based on the notion of separate terminals focussed on either domestic or international operations. It is possible however that the introduction of new larger narrow body and new middle of the market wide body aircraft may see airlines seeking to drive optimum fleet utilisation through the cycling of aircraft between international and domestic routes.

Should this demand arise, an opportunity exists in the medium terms to integrate international and domestic operations within the same terminal through the use of swing capable facilities. These facilities have the potential to generate operational and cost efficiencies through the consolidation of separated processing areas and through enabling airlines to operate international and domestic operations within a single terminal.

Therefore, as an alternative to further development of the International Terminal to provide capacity beyond 2030, Brisbane Airport Corporation may instead deliver this international capacity via the development of the future Northern and Western Terminals. Both the future Northern and Western Terminals present a significant opportunity for common use terminals providing integrated domestic and international operations through the use of swing gates, with associated terminal retail and airline lounge facilities.

Prior to 2030, interim opportunities also exist to implement smaller scale swing gate operations at either the International or Domestic Terminals.

In all instances, any proposed changes to terminal design and operations would be subject to consultation and collaboration between Brisbane Airport, the airline parties and the Australian Government.

Prior to the development of a new terminal at Brisbane Airport, the Central Area between the International and Domestic Terminals represents an opportunity to manage overflow during peak periods through the development of a large remote aircraft parking apron.

With excellent connectivity to terminal precincts, the strategic importance of the Central Area as a hub for aviation support facilities such as refuelling, catering, freight and engineering is fully understood. As a result, the 2020 Master Plan contemplates these support functions co-existing with aircraft and passenger processing within this area.

COMMON GUIDING PRINCIPLES FOR TERMINAL DEVELOPMENT

PRINCIPLE TWO
EFFECTIVE TERMINAL AND LANDSIDE INTERFACE

The creation of efficent and integrated terminal and landside interfaces is a priority for Brisbane Airport.

Achieving maximum efficiency in operations is critical to the safe running of a busy airport. A key contributor to the quality of operational efficiency is the existence of effective terminal and landside interfaces. Key considerations in their development include:

- Balancing the efficiency of consolidated and inter-connected terminal precincts with concentrated demand on ground transport infrastructure.
- Planning for easy, efficient and intuitive passenger journeys between the landside ground transport areas and the terminals.
- Maintaining an open corridor and station locations for a future mass transit system linking terminal precincts with round transport service hubs.

PROPOSED ACTIONS TO ENSURE EFFECTIVE TERMINAL AND LANDSIDE INTERFACES

- Provision of adequate car parking facilities offering a range of parking options
- Managing conflict between pedestrian and car movements appropriately
- Providing a diverse range of ground transport products within the proximity of the terminals

PRINCIPLE THREE
MEETING CUSTOMER EXPECTATIONS

In all developments at Brisbane Airport, emphasis is put on ensuring that changing customer needs and expectations continue to be understood and met in full.

Brisbane Airport undertakes regular community and industry consultation to review and understand changing customer needs. important considerations in the review of all future terminal developments include the following:

- Ensuring safe and simple access for all, taking into account lighting, time of day, weather and all mobility and related issues.
- Maxmising the effectiveness of connections between all terminals to minimise waiting times and provide simple way fnding.
- Providing a secure environment for passengers and their belongings, including provision of food and beverage outlets, toilet facilties and associated services.
- Anticipating the needs of customers of all ages including those with disabilities, the provision of information about arrivals and departures, as well as gate locations and other key information.

PROPOSED ACTIONS TO MEET CUSTOMER NEEDS

- Ongoing improvements to café and restaurants facilities and comfortable waiting areas.
- Providing clear signage to allow easy navigation of airport terminals.
- Delivering a range of ground transport options designed to meet the changing needs of the customer, ensuring that journeys into and out of the terminals are simple and intuitive.
- Continue to provide and enhance facilities for passengers using drop-off and pick-up services including free parking for up to 30 minutes in dedicated waiting areas and improved facilities for ride-share and other new transport modes.

COMMON GUIDING PRINCIPLES FOR TERMINAL DEVELOPMENT

PRINCIPLE FOUR
COMPLIANCE WITH AVIATION SECURITY REQUIREMENTS

Aviation security is of paramount importance in the planning of terminal facilities and services at Brisbane Airport.

Future development will respond to existing and future aviation security requirements by:

- Implementing changes to infrastructure and operations to achieve compliance with Australian Government security requirements.
- Improved and efficient screening of public, staff and goods entering the terminal.

PROPOSED ACTIONS FOR SECURITY COMPLIANCE

- In this strategy, plans for upgrades to passenger and baggage screening in the International and Domestic Terminals have been planned to meet requirements for a period of up to 10 years.
- Beyond this timeframe, potential exists for further enhancements to screening and associated services to be accommodated as part of a possible future expansion of the International Terminal and the development of the future Northern and Western Terminals.
- Brisbane Airport will continue to improve operational efficiency through the development of consolidated common-use passenger screening areas and by linking the separated baggage handling systems in the Domestic Terminal.
- Wherever practicable and to maximise efficiencies, screening areas will be located close to the centres of operational and commercial activities.

PRINCIPLE FIVE
PROVIDING EFFICIENT AND FLEXIBLE AREAS FOR AIRCRAFT MOVEMENT

As the airport continues to grow, operational efficiency depends on the provision of efficient and flexible areas for the movement of aircraft.

In line with forecast growth in aircraft movements and changes in aviation, aircraft movement areas will be developed with the following considerations:

- Providing available parking for a mix of aircraft types with proximity to each runway and a balanced and efficient use of the taxiway system.
- Optimise apron infrastructure to achieve the best aircraft parking layouts, anticipating and catering for future demand, including new aircraft fleet design.
- Maintain storage and staging areas for GSE, including support of an electrified ground servicing fleet.
- Ensure sufficient capacity exists for baggage and freight processing.

PROPOSED ACTIONS FOR EFFICIENT AND FLEXIBLE AIRCRAFT MOVEMENT AREAS

- Development of new linear aircraft parking arrangements, where possible, to facilitate the incremental expansion of aprons and concourses.
- Planning of parking areas to accommodate current and future aircraft types.
- Optimise the use of pavement areas using MARS configured bays.
- Maintain flexibility in future apron developments to allow the targeted addition of capacity and ensure balanced load on the taxiway system.
- Maintain the future flexibility to convert remote parking areas to terminal connected gates.

COMMON GUIDING PRINCIPLES FOR TERMINAL DEVELOPMENT

PRINCIPLE SIX
EFFICIENT AIRSIDE LOGISTICS

Thanks to its location and large land area, Brisbane Airport benefits from efficient connectivity to and from the airport and good landside accessibility to aviation support and logistics systems.

Effective landside to airside interfaces and the ability to efficiently move staff, passengers, equipment, goods and freight in the airside environment is critical to the continuation of successful operations. Key future planning considerations include:

- Maintaining the optimal positioning of aviation support and logistics facilities (including aviation fuel, catering, freight handling, engineering and ground service equipment) in proximity to terminal precincts.
- Ensuring sufficient capacity within the airside road network and unobstructed connectivity between the terminal areas.
- Providing suitably located goods and waste management facilities with sufficient capacity to support the flow of goods in and waste out of the terminals.

PROPOSED ACTIONS FOR EFFICIENT AIRSIDE LOGISTICS

- Continue to provide aviation support and logistics facilities in the Central Terminal Area.
- Provide fit-for-purpose and accessible loading dock, waste management and goods storage infrastructure able to accommodate incremental expansion at the extremities of the terminal complex.
- Consider the requirements for forward staging areas for GSE, goods and sensitive freight in the planning of future apron areas.
- Engage with JUHI and into-plane companies to agree and preserve locations for new into-plane facilities.
- Consider the creation of an airside road connection between the eastern side of the airport and the Future Western Terminal to reduce growth of traffic and congestion on the airside Terminal face within the Domestic Terminal and future Northern Terminal areas and minimise travel times for aviation support and logistics vehicles.

TERMINAL DEVELOPMENT STRATEGY

The Terminal Development Strategy for the 2020 Master Plan is informed by the contents of previous Brisbane Airport Master Plans, interpretation of economic and socio-demographic trends which drive passenger demand and by forecast changes in process improvement and technology in the aviation industry.

As with previous Master Plans, the unifying purpose of the terminal development strategy is to continue to provide high quality and flexible facilities to meet growth and changes in demand while maintaining the highest levels of security and customer services.

A FLEXIBLE TWENTY-YEAR PLAN FOR BRISBANE AIRPORT TERMINALS

Brisbane Airport aims to develop its aeronautical infrastructure in order to respond to short to medium term challenges and opportunities whilst maintaining the integrity and capability of the longer term plan. The Airport's strategy to achieve this aim is to create sufficient flexibility in the aeronautical development pathways towards the most optimal long term terminal and airside layout.

Given the constraints of the Airport's planning layout and previous developments, it is unlikely that Brisbane Airport could in the future achieve a single terminal processor model of the type frequently created by today's greenfield airport developments. Therefore a key feature of Brisbane Airport's terminal development plan is the creation of a contiguous series of terminal areas. This approach assists the distribution of demand on both airside and landside systems whilst enabling effective connectivity and access for operations, passengers and public to the various centres of activity.

This section of the Master Plan outlines the high level infrastructure responses within the strategy for providing passenger processing facilities, aircraft parking and related landside developments within the following six interconnected terminal areas of the Airport:

- International Terminal
- Central Area
- Domestic Terminal
- Future Northern Terminal
- Future Western Terminal
- General Aviation

LAND USE PLANNING

The sizing of facilities has considered the requirements at both 2040 and ultimate airport capacity to ensure that the land-use planning and area reservation for passenger and aircraft facilitation is preserved. The strategy also includes a range of short-term projects envisaged for the next five years, with illustrative (not to scale) terminal plans provided for indicative purposes. As part of the overall approach to planning, individual elements are generally interchangeable and designed to provide a flexible response to future industry trends and requirements.

Brisbane Airport will ensure that any proposed changes to the terminal areas will be preceded by consultation with key industry partners and stakeholders including affected airlines, AirServices Australia and relevant Australian Government Departments.

AVIATION SECURITY REQUIREMENTS

Brisbane Airport Corporation places the utmost importance on maintaining the highest levels of security and safety across all operations. Aviation security requirements continue to evolve to manage the threat of terrorism or other activities that potentially affect safety and security, while new technological advances including improved screening systems offer greater protection. Brisbane Airport Corporation continues to review emerging systems in this area to further strengthen safety measures and will implement all new regulatory requirements as they arise.

In May 2018, the Australian Government proposed a series of measures to further strengthen Australia's domestic and international aviation security, bringing Australia screening capability more closely align with the United States and European Union. The upgrade requirements for Brisbane Airport include the implementation of Computed Tomography (CT) technology and increased use of body scanners.

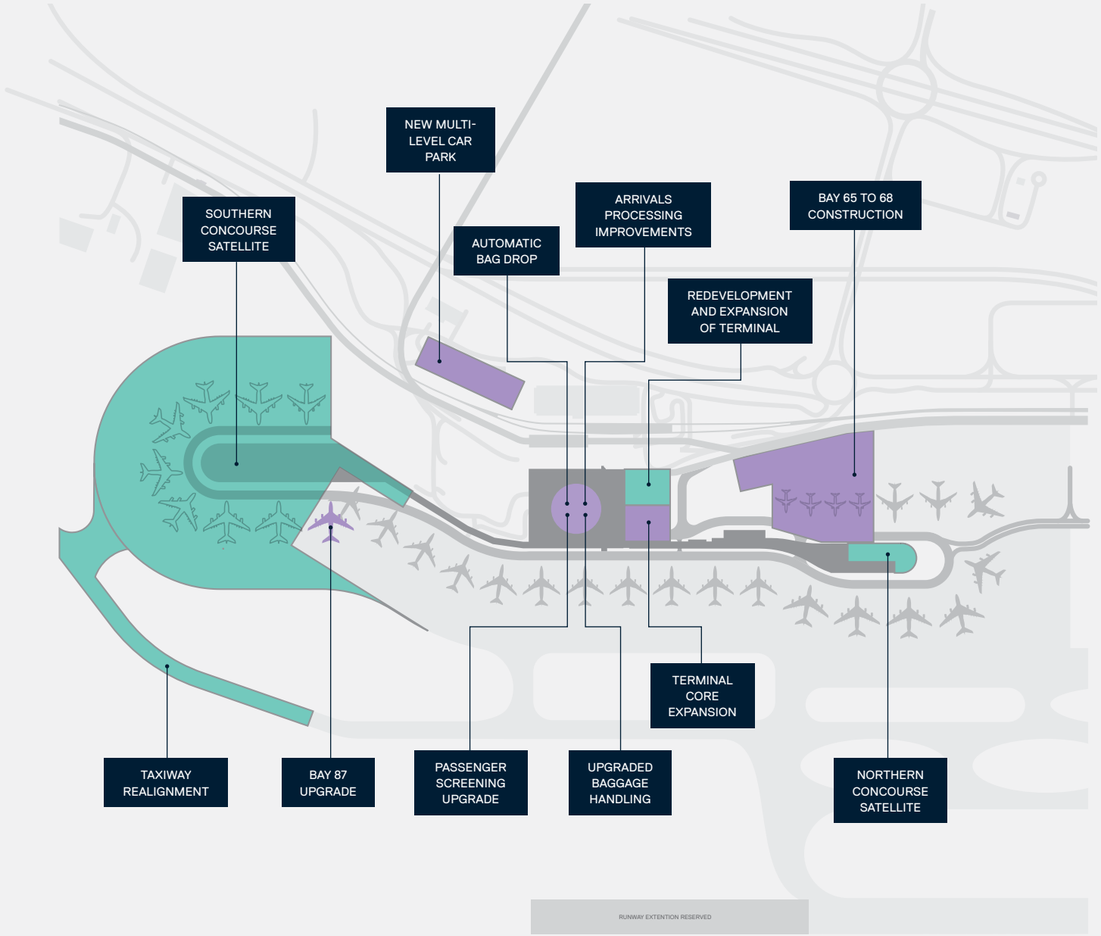
New CT and body scanner technology allows for greater detection capabilities. However compared with the current equipment, the new technology is considerably larger in footprint and will also impose higher loading on the building structure. Therefore significant upgrades are needed at Brisbane Airport in both the Domestic and International Terminals.

The larger floor plate of the International Terminal is able to accommodate the upgrades required to the baggage handling system and all existing passenger security checkpoints. A major redevelopment and expansion of the Domestic Terminal will be required to accommodate the increase in equipment size. The table below presents a summary of the equipment type and terminal upgrade areas required as a result of this legislative change. Brisbane Airport is working with the Department of Home Affairs to implement the updated requirements.

EQUIPMENT TYPE	TERMINAL UPGRADE AREAS
Checked Bag Screening Equipment	• Baggage Make-up areas
Body Scanners	• Passenger screening points • Loading docks • Lounge entries • Transit points
CT Cabin Baggage Screening Equipment	• Passenger screening points • Loading docks • Lounge entries • Transit points

INTERNATIONAL TERMINAL

Within the 20 year planning horizon of this Master Plan, the current International Terminal will continue to be a common use facility for full service and low-cost carrier international airlines. The terminal will be expanded as required to accommodate growth in the international market and to continue to provide the same high level of service.



Planned developments over the next five years

Potential developments over a 20 year horizon

Map not to scale

MASTER PLAN 2020–2025

Projects envisaged at the International Terminal in the next five years include:

- An expansion of the terminal core to provide additional area for terminal retail, airline lounges, departure lounge, arrivals processing, baggage handling, loading docks, and offices.
- Upgrade of Bay 87 to Code E MARS configuration.
- Construction of Bays 65 to 68, fixed links, passenger boarding bridges and departure gates.
- Conversion of conventional check-in counters to automatic bag-drop.
- Upgrade to Australian Border Force arrivals processing areas to accommodate new requirements.
- Expansion of passenger screening area to include installation of body scanners and CT cabin bag x-ray machines.
- Upgrade of baggage handling system to accommodate Standard 3 checked bag screening.
- Construction of a new multi-level car park and enhancement of terminal face roads.

FUTURE PLAN

Over the 20-year horizon of the Master Plan, the following improvements are under consideration:

- Incremental redevelopment of existing facilities, with further expansions of the terminal core, including supporting infrastructure to provide capacity for passenger processing and baggage handling.
- Completion of the northern concourse satellite, creating additional departure gate areas and enabling seven existing aircraft parking positions connected by bridges to the terminal.
- Option to develop a large southern concourse satellite to incorporate up to seven MARS configured wide body parking positions, all of which could be connected with bridges to the concourse expansion.
- Expansion of the baggage handling system including baggage reclaim and early bag store.
- Opportunity for complementary landside commercial development.
- Expansion of taxiway access and other facilities to facilitate wide body aircraft parking.
- Safeguard the corridor and station locations for the MTS connection between the International and Domestic Terminals, as well as connectivity to commercial developments and remote parking areas.

CENTRAL TERMINAL AREA

The 2020 Master Plan recognises the strategic potential of the Central Terminal Area to act as a hub for aviation support and logistics activities, as well as remote aircraft parking servicing both the International and Domestic Terminal areas.

The Central Terminal Area currently has direct airside road linkages to the International and Domestic Terminal areas. In the future, an opportunity exists for a potential road-link between the Central Terminal Area and the Western Terminal effectively creating an airside ring road connecting all terminal.

This Plan envisages the retention of existing aviation support and logistics uses adjacent to a large apron area. In this plan, the option to retain JUHI in its current location is preserved. In the future there is a possibility of expansion into adjacent sites.

The apron would facilitate layover parking and remote passenger boarding operations for both the International and Domestic Terminals and possible freight operations and designed to cater for both narrow body and wide body aircraft including fuelled and non-fuelled positions.

The apron plan potentially allows the connection of a selection of the parking positions to a satellite concourse connected to the southern end of the Domestic Terminal.

Suitable airside road connectivity between the Central Terminal Area and adjoining terminal precincts will be required to facilitate the movement of both passenger buses and GSE vehicles servicing the aircraft.

Consideration has also been given to the relocation of Airport Drive to create an expanded airside precinct in which additional aviation support and logistics facilities could be developed.

MASTER PLAN 2020–2025

Projects envisaged for the next five years include:

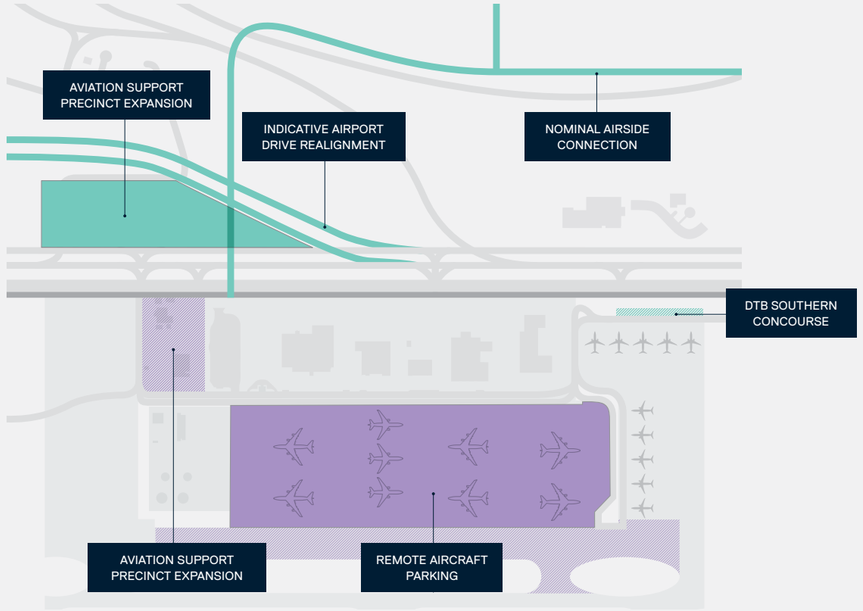
- Construction of remote aircraft parking and enhancement to the airside roads.
- Construction of taxiway connections to existing terminal precincts.
- Further development of existing aviation support and logistics facilities.

FUTURE PLAN

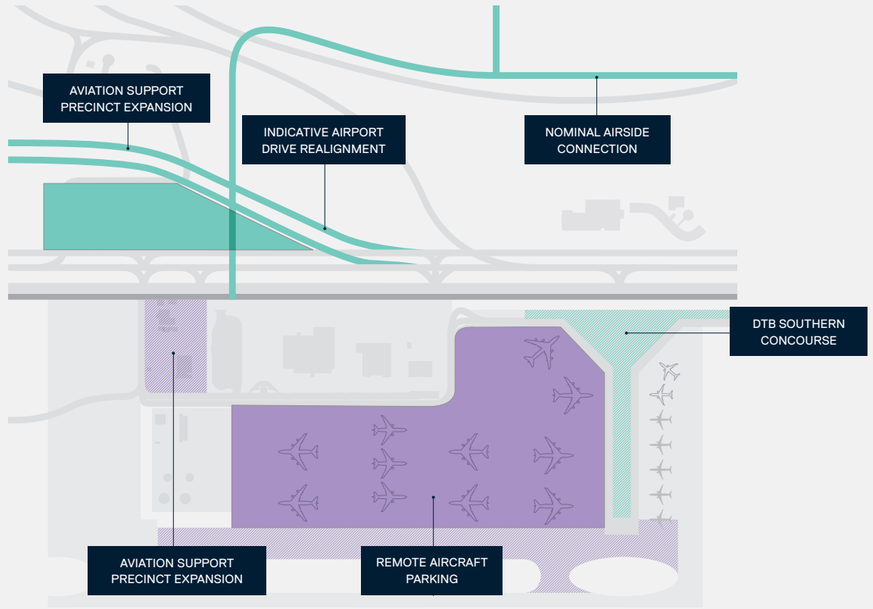
Over the 20-year horizon of the Master Plan, the following improvements are under consideration:

- Construction of a large remote parking apron and taxiway linkages to the International and Domestic Terminal areas.
- Further development of facilities including JUHI, Into-Plane services, catering, engineering support and cargo terminals.
- Potential changes to Airport Drive to create an enlarged aviation support and logistics hub area to the west of Airtrain, providing landside to airside access for new tenancies.
- Potential new airside corridor linking the Central and Western Terminal areas.
- Safeguard the corridor and station locations for the MTS connection between the Central Area and the International and Domestic Terminals.

REMOTE AIRCRAFT PARKING



PIER DEVELOPMENT



Planned developments over the next five years

Potential developments over a 20 year horizon

Maps not to scale

DOMESTIC AND FUTURE NORTHERN TERMINALS

DOMESTIC TERMINAL

During the 20 year planning horizon of this Master Plan, the Domestic Terminal will continue to be used as a domestic common use facility for full service, low cost carriers and smaller regional airlines. The terminal will be expanded to allow it to meet new security arrangements.

With the exception of the planned security upgrades, Brisbane Airport's preferred development strategy for the Domestic Terminal is to limit future modifications to the building core and focus future provision of passenger processing capacity through the development of the future Northern and Western Terminals.

However the plan does include options to add new passenger boarding concourses to the northern and southern ends of the terminal core.

The illustrations on the following pages provide additional detail on the location of potential planning considerations for the short (to 2025) and long-term horizons (2040) for the Domestic Terminal and its connection to the Future Northern Terminal precincts respectively.

Two potential positions are under consideration for the construction of the Domestic Terminal's northern concourse. One presents an optimal arrangement for a domestic operation only and the other an optimal arrangement for a potential shared domestic and international operation. The selection of a final position will follow further infrastructure development planning and feasibility analysis along with consultation with key industry partners including airlines.

MASTER PLAN 2020–2025

Projects envisaged for the next five years include:

- Expansion of the terminal footprint to enable installation of body scanners and CT cabin bag x-ray machines.
- Installation of common use self-service check-in and automatic bag-drops.
- Reconfiguration of baggage handling system and installation of Standard 3 checked bag screening.
- Expansion of baggage make-up and reclaim.
- Upgrades to airline premium lounge entries.
- Expansion and upgrade of retail facilities.
- Reconfiguration and upgrade of facilities within the former airline lease areas to support capacity requirements and the transition to full common use operation.
- Construction of the southern concourse.

FUTURE PLAN

Over the 20-year horizon of the Master Plan, the following improvements are under consideration:

- Incremental expansion of arrivals reclaim facilities into the ground floor spaces vacated by current check-in and security processing.
- Addition of aerobridges to the Central Terminal Area.
- Expansion and upgrade of the food and beverage and specialty retail areas.
- Construction of a southern concourse with additional departure gates, enabling the direct connection of five existing remote bays.
- Potential to connect to central apron area through further extension of the southern concourse.
- Construction of a large northern concourse to provide departure gates and parking for a mix of up to 20 aircraft and connection to the future Northern Terminal.
- A new multi-level short term car park.

FUTURE NORTHERN TERMINAL

The Future Northern Terminal is ideally located with direct connectivity to the cross link taxiway system and both runways and presents a significant opportunity for a common use terminal providing integrated domestic and international operations.

Development within the Northern Terminal precinct is not envisaged during the period from 2020 to 2025, however the interchangeable nature of projects across the various terminal areas makes it strategically important to safeguard this precinct, allowing the option to bring forward development should a suitable project driver materialise.

The development of the Future Northern Terminal could be incrementally staged through connection to the Domestic Terminal, sharing processing capacity and gate infrastructure.

While the final size and position of the terminal is yet to be determined, this plan has created a terminal reserve with sufficient flexibility to accommodate the requirements of the eventual development.

MASTER PLAN 2020–2025

Development within the Northern Terminal precinct is not envisaged within the period from 2020 to 2025.

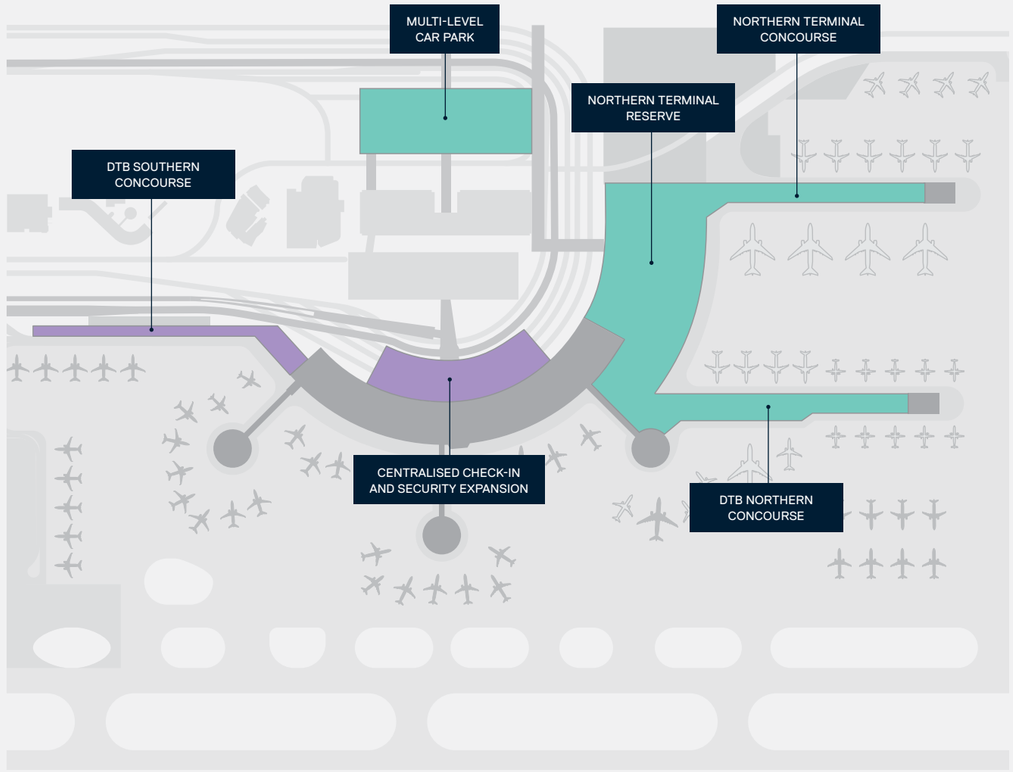
FUTURE PLAN

Over the 20-year horizon of the Master Plan, the following improvements are under consideration;

- Construction of a terminal processor with capability to process domestic and international passengers with associated terminal retail and airline lounge facilities.
- Construction of a concourse serving a combination of dedicated narrow-body gates and MARS configured wide-body gates.
- Connection of the terminal processor to the multilevel car parks and Future Western Terminal via passenger bridges.
- Creation of new terminal-face ground transportation facilities.
- Construction of remote aircraft parking and new GSE storage areas in proximity to the operational apron.
- Planning for compatible landside commercial development.
- Safeguard the corridor and station locations for the MTS connection between the Domestic, International and Future Northern and Western Terminals.

DOMESTIC AND FUTURE NORTHERN TERMINALS

DOMESTIC ONLY OPERATION

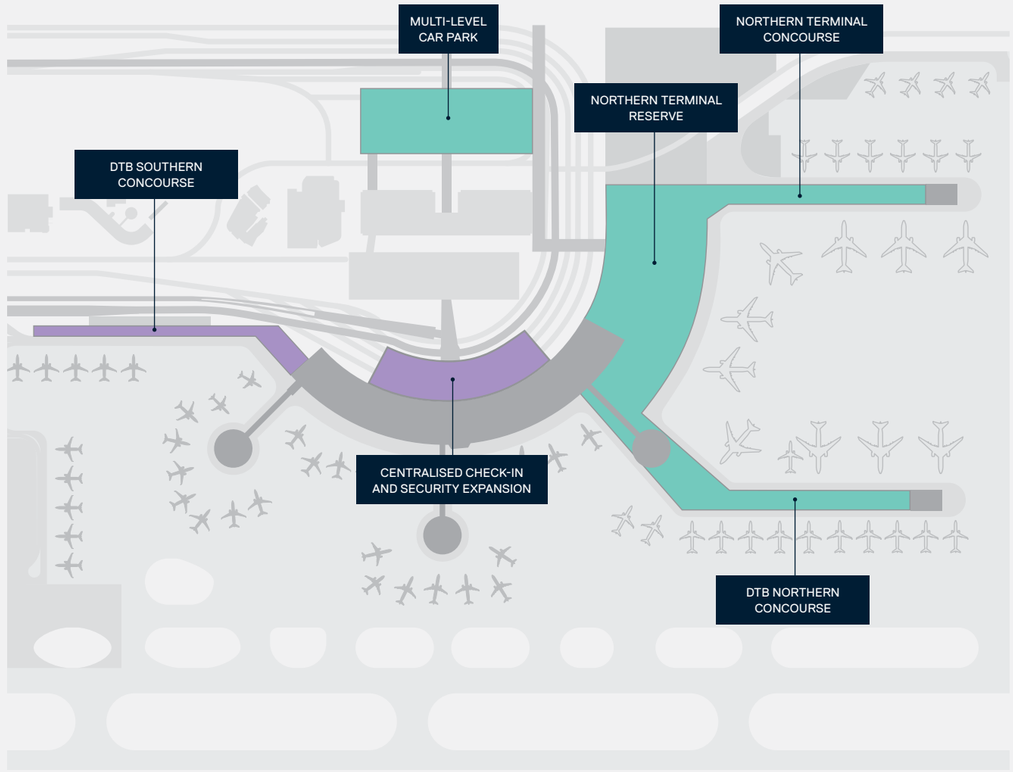


Planned development in the next five years

Potential developments over a 20-year horizon

Map not to scale

COMBINED DOMESTIC AND INTERNATIONAL OPERATION



Planned development in the next five years

Potential developments over a 20-year horizon

Map not to scale

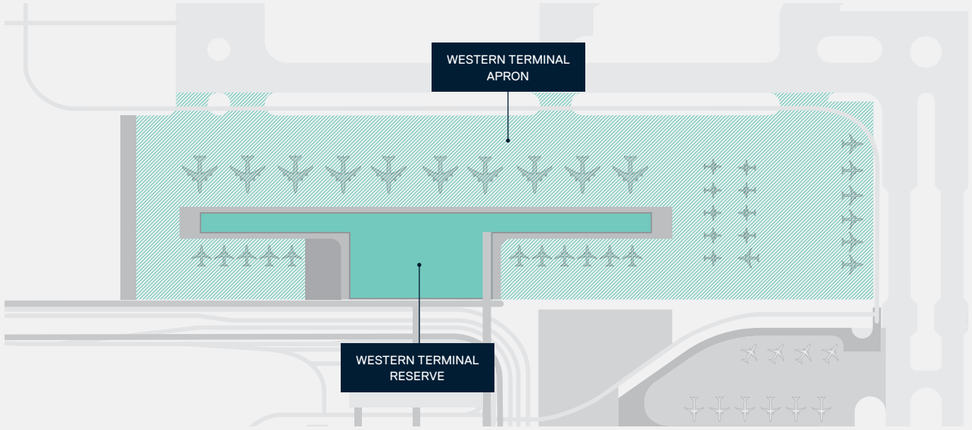
FUTURE WESTERN TERMINAL

The Future Western Terminal is ideally located with frontage to Brisbane's new runway. The planning for the precinct considers the potential for a large terminal reserve of sufficient size to process international and domestic passengers.

In comparison with the Domestic and Future Northern Terminal areas, there is less ability to manage an incremental airline migration plan for the future Western Terminal, due to the separation of the precinct created by Dryandra Road Development of the terminal processor is therefore likely to require a significant step change in infrastructure development, with a single migration step for a single carrier into the new facility.

Nonetheless, opportunities exist to develop the northern extent of the precinct first to provide remote aircraft parking, catering for potential overflow from other terminal areas, potentially assisting staging on the Northern Terminal development.

It is possible that there will be limited development in the Western Terminal Area within a 20-year time frame. This Master Plan however preserves the ability to bring forward development within the Western Terminal Area should a suitable project driver materialise. Brisbane Airport will continually review planning strategies for this precinct that allow the flexibility to respond to market demand.



OVER THE 20-YEAR TO ULTIMATE HORIZON OF THE MASTER PLAN, THE FOLLOWING IMPROVEMENTS ARE UNDER CONSIDERATION

- Construction of a large apron area providing parking positions for a mixture of narrow-body and wide-body aircraft.
- Construction of northern and southern concourses servicing the apron areas on either side of the terminal processor.
- Connection of the terminal processor to the multi level car parks and the Future Northern Terminal via passenger bridges.
- Creation of new terminal face ground transportation facilities.
- Construction of remote aircraft parking and new GSE storage areas in proximity to the operational apron.
- Safeguard the corridor and station locations for the MTS connection to the future Northern Terminal areas, commercial developments and remote parking areas.

Planned developments over the next five years

Potential developments over a 20 year horizon

Map not to scale

GENERAL AVIATION

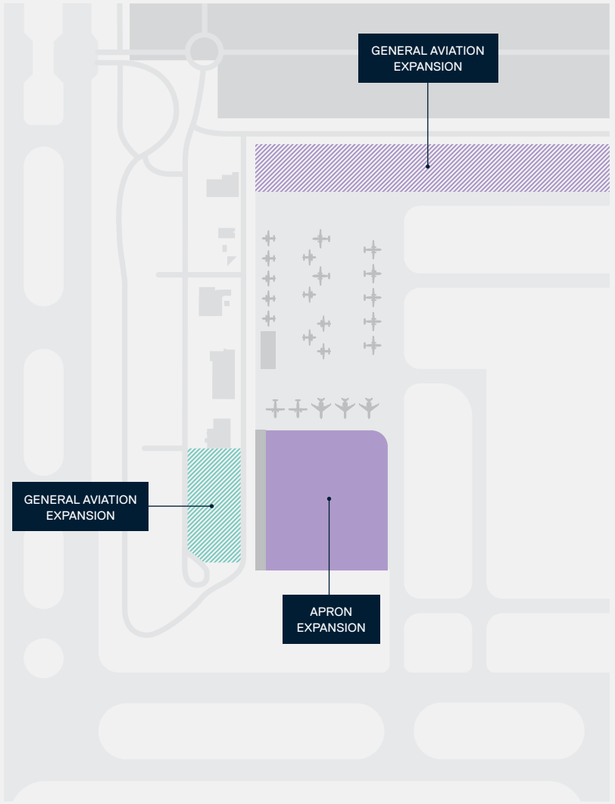
During the 20 year time frame of this Master Plan, General Aviation activities will remain an integral part of the airport supporting domestic and international passenger, freight and medical operations.

Brisbane Airport will continue to operate the dedicated General Aviation Terminal facility positioned against the General Aviation apron in Airport North.

All non-RPT passenger services involving aircraft up to 20 tonnes (excluding FBO and VIP processing) will operate from this facility.

Brisbane Airport has a dedicated FBO located at the Logistics Apron in the Da Vinci precinct. Assessments of the further demand for fixed-base facilities reveal limited airside development opportunities, restricting the further development of facilities of this type.

A future airside access point will be allowed for in Airport North.



OVER THE 20-YEAR HORIZON OF THE MASTER PLAN, THE FOLLOWING IMPROVEMENTS ARE UNDER CONSIDERATION

- Construction of additional apron parking area. Areas for the expansion of the apron will be reserved to provide additional parking for aircraft types (up to a maximum Code C narrow-body).
- Future general aviation expansion areas have been identified adjoining the general apron. These areas will provide for general aviation users which may include medical operations (both fixed-wing and helicopter), charter operations, or small freight operations.

Planned developments over the next five years

Potential developments over a 20 year horizon

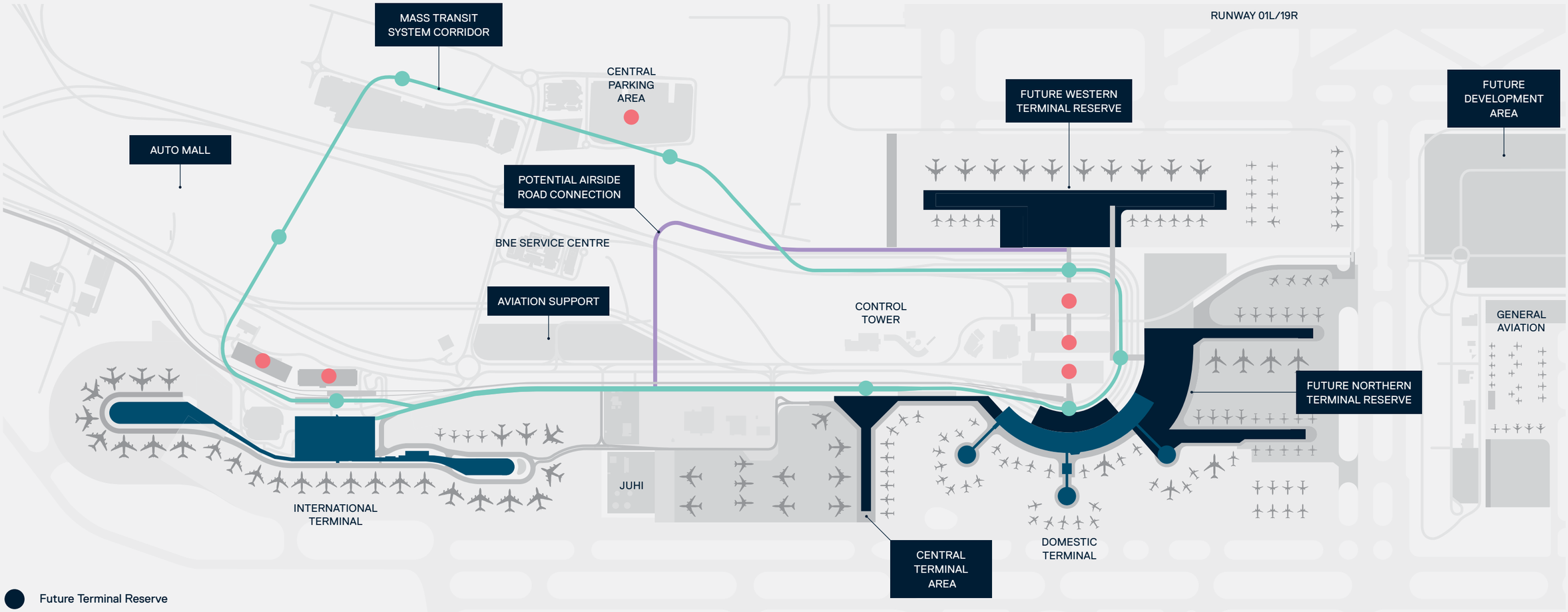
Maps not to scale

FUTURE TERMINAL CONCEPT

The map below is a combination of the precinct options outlined in the previous pages, illustrating a potential configuration of future terminal development at Brisbane Airport.

This configuration can be augmented to provide the Airport with the ability to respond to the influencing factors outlined in the terminal guiding principles, from future emerging trends and technology to capacity or legislation drivers.

A challenge to be faced in the future will be managing growing demands on access to and between the terminal precincts, however, combined with a flexible approach to aviation support and a number of future mass transit solutions, the airport is well placed to respond to the forecast capacity and operational changes that will eventuate over the period of the Master Plan.



BRISBANE AIRPORT'S AIRFIELD AT A GLANCE

Often referred to as the most aeronautical part of any airport, this graphic illustrates the key components of Brisbane Airport's airfield, which are discussed in this chapter.

LOGISTICS APRON

JOINT USER HYDRANT INSTALLATION
The term JUHI is used to describe fuel storage, transfer and underground.

INTERNATIONAL TERMINAL

DOMESTIC TERMINAL

AIR TRAFFIC CONTROL
Air traffic control tower operated by Airservices Australia 24/7.

RUNWAY 01R/19L (EXISTING)
Runway designations refer to the compass bearing of the runway.

FUTURE WESTERN TERMINAL

INSTRUMENT LANDING SYSTEM
Lighting system supporting instrument approach procedures at Brisbane Airport.

RPT (REGULAR PUBLIC TRANSPORT) APRON
Fixed Schedule aircraft on specific routes available to general public.

FUTURE NORTHERN TERMINAL

RUNWAY 01L/19R
New runway (opening 2020).

CROSS-LINK TAXIWAY
Taxiway being constructed to link existing and new runways.

GENERAL AVIATION TERMINAL AND APRON

SURFACE MOVEMENT RADAR
Airservices Australia has an established SMR existing and an additional will be installed for the new runway.

AIRCRAFT MAINTENANCE APRON

AVIATION RESCUE FIRE FIGHTING SERVICE
Service provided by Airservices Australia.

TAXIWAYS
Carriageways connecting the runway, apron, terminals, and other facilities.

RUNWAY 14/32
The existing cross runway will be closed when the new runway is operational.

GROUND BASED AUGMENTATION SYSTEM
GBAS provides digital guidance for approach procedures.

STOP BARS
Row of lights that, when illuminated, designate a runway hold position for an aircraft.

HIGH INTENSITY APPROACH LIGHTING
HIAL to support low visibility operations.

THE AIRFIELD SYSTEM

An integral part of long term aviation capacity planning at Brisbane Aiport, the new runway is essential to ensure the continued provision of the capacity required to meet increasing demand.

Brisbane Airport has experienced significant growth, both in the number of partner airlines using the services of the airport and in passenger demand.

The large scale investment in building a new runway at Brisbane Airport that doubles current capacity is essential in terms of realising the economic benefits to the national and regional economies from air travel through Brisbane Airport.

Increased runway capacity will enable:

- Continued growth in the aviailability of direct airline routes to an increasing number of international, interstate and intrastate destinations.
- Improved connectivity and accessibility for business and leisure travellers.
- A reduction in aircraft delays and improved on-time performance, minimising disruption for travellers.
- Reduced, unnecessary fuel consumption and associated emissions from improved system reliability, for example where aircraft are held on the ground while awaiting a take-off clearance.

The new runway is scheduled to open in 2020 and will be designated as Runway 01L/19R. The current runway is designated Runway 01R/19L. The shorter Cross runway has a designation of Runway 14/32.

This section of the strategy includes details of airfield initiatives undertaken since 2014 as well as detailed assessments of aviation capacity, runway system design criteria and considerations of capacity and demand management included in the formation of the 2020 Master Plan.

DETERMINING CAPACITY

The capacity of the existing runway system is dependent on:

- Aircraft demand and mix during peak periods
- Proportion of arrival and departure movements
- Operating mode and the capacity of that mode
- Meteorological conditions (cloud base, visibility, wind direction and speed, etc.)
- Duration of the busy periods.

In determining when additional airfield infrastructure, such as a new runway, additional taxiways and apron stands for aircraft are required, aircraft movements is a more relevant planning parameter than passenger movements.

VARIATIONS IN USAGE

The volume and frequncy of air travel is not uniform over a year, with the number of daily flights fluctuating according to demand and busy periods. With 75 per cent of all flights at Brisbane Airport being on domestic routes, school holidays and major sports events have a major effect on the volumes of passengers using the airport on any given day.

Equally, with many pasengers using the airport for business travel, the busy times at the airport each day coincide with normal working hours, with especially high demand between 7am and 10am in the morning and 5pm and 8pm in the evening.

BRISBANE AIRPORT CAPACITY

Airfield modelling shows that historically, the capacity of the existing main and cross runway system at Brisbane Airport was in the order of 59 to 63 hourly movements. The cross runway contributes to overall system capacity, however it is dependent on runway operating direction and cannot be relied on. It currently accommodates less than 5 per cent of operations.

The peak hour capacity on the main runway is between 50 and 54 movements depending on the mix of jet aircraft. Larger jet aircraft require longer separation distances and if more of these aircraft arrive during the peak hour, then the capacity may be seen to reduce to approximately 50 movements per hour.

PAVEMENT CLASSIFICATION

When determining appropriate aircraft operations for an airport runway, taxiway, and apron, the Aircraft Classification Number – Pavement Classification Number (ACN-PCN) is used. This is a standardised method to report airport runway, taxiway, and apron pavement strength and used to assess the operational acceptability of an aircraft depending on its weight and on the strength of the pavements.

The ACN is a single unique number that expresses the relative effect of an aircraft of a given weight on a pavement structure for a specified standard subgrade strength.

The PCN is a five-part code associated to any section of the airport pavements (runway, taxiways, aprons or ramps) and indicates its mechanical resistance with respect to excessive wear and tear.

The calculated ACN is compared to the PCN of the foreseen airport pavements to assess the feasibility of the aircraft manoeuvring and operations. As a general rule, if ACN is smaller than the PCN the aircraft can manoeuvre without restrictions. If ACN is great than PCN, the aircraft can be accepted under specific limitations, for example concerning the maximum weight or the operation frequency.

The parallel runway system at Brisbane Airport is of sufficient length and width to enable operations by all types of large jet aircraft, including the Airbus A380, which is a code F aircraft.

RUNWAY SYSTEM DESIGN CRITERIA

Runway systems are designed based on an assumed 'design aircraft'. The design aircraft determines the characteristics of the airfield. Characteristics of Brisbane Airport runways are outlined in the table below.

	RWY 01R/19L	RWY 01L/19R	RWY 14/32
DESIGN AIRCRAFT CHARACTERISTICS			
Code	G*	4F	3C
Wing span	95m	65m but < 80m**	24m but < 36m
Length	113m	-	-
Outer main gear wheel span	-	14m but < 16m	6m but < 9m
AIRFIELD DESIGN CHARACTERISTICS			
Runway width	45m	60m	30m
Runway length	3,600m (extension reserved to 4,080m)	3,300m (extension reserved to 3,600m)	1,760m
Runway strip width	300m	300m	150m

** Code G aircraft are no longer recognised as a category by ICAO. Code F is the largest Code aircraft now recognised by ICAO.*

*** Based on review of historical evolution of aircraft type, Brisbane Airport has adopted a larger allowance for Code F aircraft ("Code F+") for future proofing purposes.*

FUTURE DEVELOPMENT CONSIDERATIONS

ADAPTING TO CHANGE

With technological advances being a catalyst for changes in aviation, ranging from legislative changes to changes in the types, size and weight of future aircraft, Brisbane Airport is in constant communication with aviation partners and key industry bodies to prepare for changing needs in the services it provides.

This strategy has been designed to retain the safety and security of all operational activities while also retaining flexibility where possible to adapt to change.

ANTICIPATING FORTHCOMING REGULATORY CHANGES

At the time of writing, the regulation which defines the design characteristics for an airfield (MOS Part 139) is under review. Brisbane Airport has been fully engaged with CASA throughout the MOS Part 139 update.

The new runway has been designed to meet current requirements. Brisbane Airport will continue to monitor the progress of the Part 139 review and respond accordingly once changes come into force.

New aircraft designs also have a potential impact on Brisbane Airport and it is anticipated that within the planning period of this Master Plan, new passenger aircraft will be introduced into the market.

Brisbane Aiport continues to work closely with aviation partners to ensure that future changes in requirements can be accommodated wherever possible.

CONSIDERING THE IMPACT OF FUTURE PASSENGER AIRCRAFT

Brisbane Airport recognises that the designs of aircraft will continue to evolve.

As an example, Boeing's B777X aircraft, currently under manufacture, will have folding wing-tips allowing it to taxi and park on Code E infrastructure, however when the wing-tips are extended it will be a Code F design. Due to other aircraft characteristics, the B777X will have an ACN impacting the life span of the airfield.

In preparation, Brisbane Airport has taken steps to upgrade parts of the airfield, increasing the thickness of the rigid pavement of the new Runway 01L/19R, and reviewing the capability of existing Runway 01R/19L and supporting taxiway systems.

New 'Middle of the Market' (MoM) or New Midsize Aircraft (NMA) which are larger than a large narrow body, and smaller than small wide body have the potential to relieve congestion on routes between Brisbane, Melbourne, and Sydney airports, potentially able to service short-medium haul ASEAN services as a Code D size aircraft accommodated by Brisbane Airport's parallel runway system.

The biggest impact of this aircraft would be that the taxiway and apron system as a Code D size aircraft (and respective ACN) would not be able to be accommodated on the existing Code C taxiways (and respective PCN).

It is also anticipated that larger aircraft might be introduced into the market. Although the parallel runway system will remain sufficient for aircraft up to Code 4F, the future passenger aircraft characteristics may have other impacts on airfield infrastructure due to the relative ACN and PCN.

The impacts will be a result of the aircraft weight and other at dimensional characteristics for which the current airfield taxiways and aprons may not be designed.

REGULAR MAINTENANCE ACTIVITY ON RUNWAY 01R/19L

Brisbane Airport will continue to conduct a twice-yearly heavy maintenance program for Runway 01R/19L. This entails three-night closures twice a year.

An Integrated Airfield Lighting Control Monitoring System was implemented on Runway 01R/19L in November 2018. Notably, the System does not add any functionality until the Stop Bars on Runway 01R/19L and the new Runway 01L/19R are commissioned in 2020.

The next overlay of Runway 01R/19L is expected to be required sometime between FY2026-FY2029.

Due to the pavement life and increasing demands of large aircraft on pavements, it is expected that major maintenance activities will be required on rigid pavements on Taxiway Alpha, Taxiway Bravo, and Runway 01R/19L thresholds within the planning horizon of the Master Plan.

Brisbane Airport is committed to the implementation of runway LED system lighting on Runway 01L/19R. In the future, progressive replacements of incandescent LED's used in the existing airfield will be considered, potentially aligned with runway overlay works.

Brisbane Airport has also invested in equipment which will allow increased low visibility operations. Since 2014, this has included the installation and implementation of Runway Visual Range infrastructure, and Stop Bars.

Comprehensive inspection and testing regimes are developed by Brisbane Airport to continue to refine the maintenance response to ongoing airfield requirements.

FUTURE CLOSURE PLAN FOR CROSS RUNWAY 14/32

An assessment of Runway 01R/19L has confirmed the high usability outcomes of the runway. The same assessment identified that retaining Runway 14/32 would have a negative impact on system capacity if it was to continue to be used.

The 2014 Master Plan outlined a strategy for the closure of Runway 14/32 and the decision was subsequently made by Brisbane Airport to close it.

The date of closure will align with the Aeronautical Information Regulation and Control (AIRAC) date of 21 May 2020. On this date, the airspace will transition into the new airspace system, despite the new runway not yet being operational.

Following the closure of Runway 14/32, Brisbane Airport has the option to convert the current cross runway into a taxiway. Simulation modelling has confirmed that this will not be required immediately, and is unlikely to occur until 2025, pending numerous industry growth variables.

At this stage, Brisbane Airport envisages this taxiway will be have capacity for aircraft up to Code C size. A potential trigger for this conversion might be development in the Northern Development Area and/or general aviation activity.

Brisbane Airport will undertake a simulation validation exercise to confirm benefits in airfield flows and efficiency prior to converting the current cross Runway 14/32 into a live taxiway.

PARALLEL RUNWAY SYSTEM OPERATION

Unconstrained by artificial caps, with optimum mid-field terminal locations, balanced runway lengths and strength capacities, and positioning against Moreton Bay providing positive noise mitigation opportunities, Brisbane's runway, taxiway and terminal placement will be comparable to the world's best parallel runway airports.

PROGRESS OF BRISBANE'S NEW RUNWAY

Brisbane's new Runway 01L/19R is on track for construction to be complete in early 2020, followed by commissioning and endorsement of operational readiness by Airservices Australia around mid 2020.

It is anticipated that the physical works associated with the taxiway connections to the new runway will be completed in late 2019.

The new Runway 01L/19R will provide critical additional capacity. In addition, having two runways allows for more efficient shut down of operations when runway overlays and /or major maintenance works are being conducted.

ASSESSMENT OF ULTIMATE SYSTEM CAPACITY

The construction of the new runway will make Brisbane operationally Australia's most efficient airport.

The advantage of operating a set of widely spaced parallel runways is that the hourly capacity rate can be delivered consistently in either runway direction. Given its projected traffic mix, it is anticipated that Brisbane Airport with parallel runways will be able to sustain an hourly rate of 100 to 110 movements per hour over the morning and evening three to four-hour peak demand periods.

The capacity of the parallel runway system depends on the types of aircraft and mix of arriving and departing movements.

The Current and Future Flight Path and Noise Information booklet identifies the runways as being used in mixed mode (i.e. departures and arrivals operating from each of the runways) and given the destination/origin mix of the projected traffic, this will effectively see each runway operate almost as an independent airport.

There will be some interaction of flights paths and hence some small loss of capacity when specific long-haul departing flight requires to use the 300m longer existing runway 01R/19L because of an operational length requirement.

Brisbane Airport has undertaken an assessment of future demand and airline fleet trends and has concluded that in also considering current airspace management practices and standards, Brisbane Airport with the parallel runway system, has capacity to meet expected demands until the mid 2050's.

DEMAND AND OPERATIONAL DELAY MITIGATION STRATEGIES

The 2014 Master Plan included details of a number of demand management and operational delay and mitigation strategies. These programs have largely been a success, with Brisbane Airport experiencing a notable decrease in delays since 2014.

AIRPORT CAPACITY ENHANCEMENT PROJECT

The Airport Capacity Enhancement Project (ACE) is a national program that was commissioned by Airservices Australia in collaboration with airports and industry stakeholders to address the growing demand at Australia's major airports.

The goal of the ACE program was to identify opportunities to improve efficiency and to increase the utilisation of existing airfield, airspace and infrastructure in order to increase runway capacity.

ACE is based on the principal of broad collaboration with the airport community to address the common challenge of airport congestion and delay. Led by Airservices Australia, the collaboration has matured and been accorded a high priority by all participants with around 25 capacity enhancement initiatives identified, prioritised, and undergoing progressive implementation.

Brisbane Airport has achieved all initiatives and desired outcomes outlined in the initial period of the ACE.

AIR TRAFFIC FLOW MANAGEMENT

In response to the significant growth and increasing operation delay experience, Airservices Australia implemented an advanced Air Traffic Flow Management application known as Harmony. Capable of simultaneously managing traffic flows at multiple airports, Harmony is used to run arrival Ground Delay Programs (GDP) for Sydney, Brisbane, Melbourne and Perth airports.

Harmony accepts real-time updates to schedule data, either via flight plan submission, airline day of operations changes to scheduled departure times, or Air Traffic Control (ATC) live data.

Harmony can display the most up-to-date demand/capacity information for any monitored airport, in turn providing airlines, airports and air traffic control with an enhanced capability to predict traffic management issues.

From a traffic management perspective, where demand exceeds capacity, Harmony will regulate traffic into a designated airport through the allocation of ground delay. Harmony will issue ground delays through the allocation of Calculated Off Block Times.

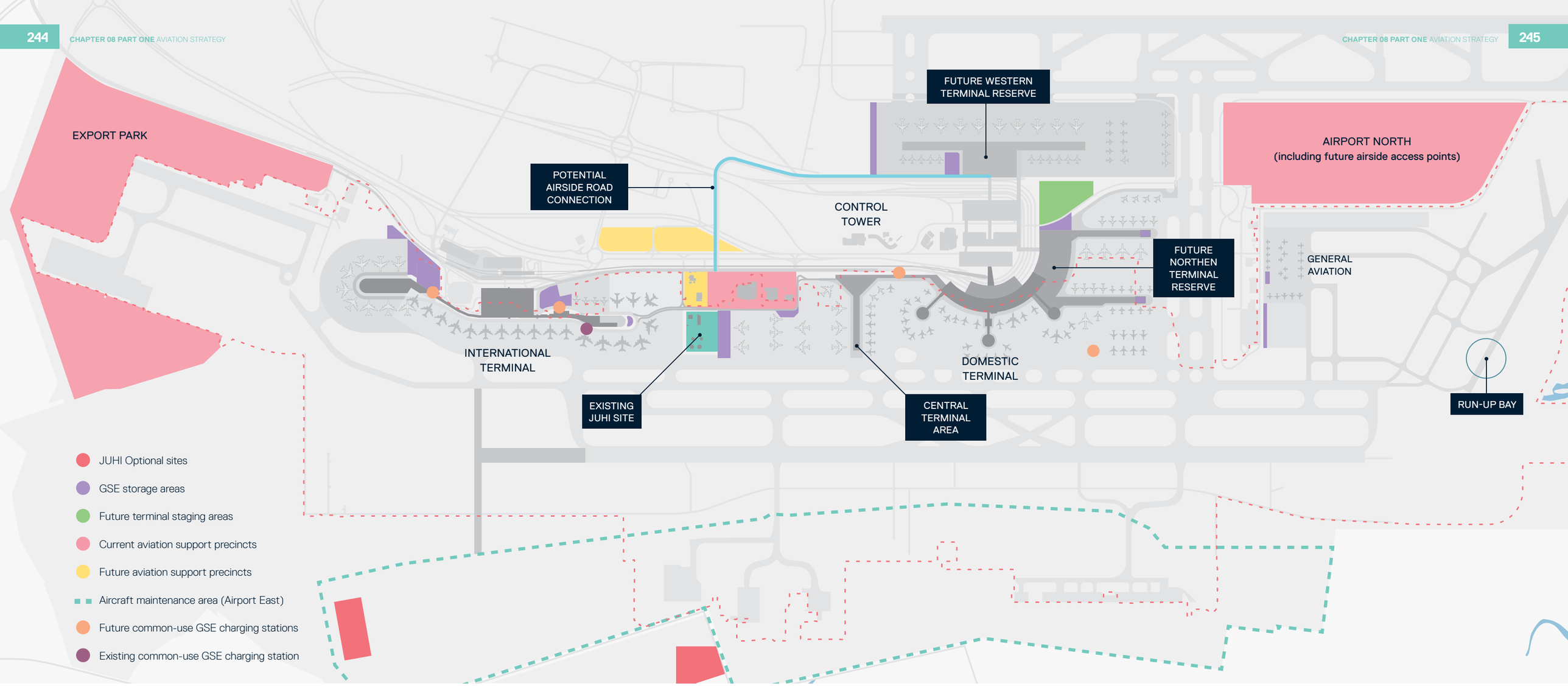
RUNWAY DEMAND MANAGEMENT SCHEME

Brisbane Airport introduced a Runway Demand Management Scheme (RDMS) in 2012. The RDMS was introduced through the Brisbane Airport Corporation Aviation Services and Charges Agreement for the runway system, with airlines/operators contractually bound to comply with its terms.

All operations to Brisbane Airport are required to apply for, and be allocated, a runway slot prior to operation. The RDMS defines the maximum number of slot allocations per hour as well as the process for 48 hours forward planning (weather look-ahead) to control ad hoc slot allocations. Under the RDMS, Brisbane Airport conducts a Local Coordination Committee each scheduling season to review the performance of the previous season, preview the upcoming season, and discuss potential enhancements to the RDMS.

The RDMS has mitigated delays at Brisbane Airport and is a strategic planning tool that generally establishes a compliant, workable schedule on a seasonal basis based on good visual operating conditions.

Brisbane Airport intends to retain the RDMS when the new runway commences operation and it will be updated accordingly for a parallel runway operation.



PLANNING FOR AVIATION SUPPORT

The reliable and ongoing provision of aviation support facilities and services is critical to ensure safe, secure and efficient operations for airlines, passengers and businesses using Brisbane Airport.

Essential support services currently provided by Brisbane Airport include:

- Emergency Service Operations
- Ground Service Equipment storage and maintenance
- The supply and storage of aviation fuel
- Airport and aircraft maintenance
- Freight and logistics facilities
- Flight catering
- Air Traffic Control and other services provide by Airservices Australia

In each of these areas, Brisbane Airport operates reliable and sustainable services directly meeting the needs of users.

Brisbane Airport Corporation is committed to ensuring that the airport continues to operate successfully by facilitating the safe and secure movement of people, freight and aircraft.

In the foreseeable future, the majority of the support services will continue to operate from the sites at Brisbane Airport where they currently occur. Wherever possible, growth will be managed by incremental expansion of existing facilities.

Over time, as the airport continues to grow, Brisbane Airport Corporation will consider options to review the optimal arrangements for the provision of these support activities as terminal and apron areas expand with increased demand.

AVIATION SUPPORT
EMERGENCY SERVICES

Brisbane Airport is home to several emergency service operations including RACQ LifeFlight, the Royal Flying Doctors Service, Queensland Government Air and Aviation Rescue and Fire Fighting Services operated by Airservices Australia.

ROYAL FLYING DOCTORS SERVICE (RFDS)

RFDS is an essential and iconic service for Queensland's regional and remote communities. In recognition of this, Brisbane Airport supports operations to enable medical emergency support and patient transport throughout the state.

Brisbane Airport has contributed towards fitting out aircraft for medical use and purchasing aeromedical equipment for the Brisbane base of the RFDS team.

With more than 3,500 landings a year on average, these aeromedical flights are often the highest priority, carrying the most precious of cargo – premature babies to the Mater Hospital, children to Queensland Children's Hospital and critical patients to tertiary hospitals across Brisbane.

Brisbane Airport is also home to the RFDS Queensland Head Office and a dedicated hangar and administration facility in Airport North, close to landside vehicle access for emergency vehicles and the Brisbane Airport helipad.

RACQ LIFEFLIGHT

RACQ Lifeflight operates from an aeromedical base facility in Airport East. LifeFlight's helicopters take to Queensland skies an average of five times every day.

Queensland's rural and remote communities rely on the RACQ LifeFlight Rescue helicopters to bring the hospital to them. In medical emergencies, these flights are given priority.

Non-urgent RFDS flights are scheduled in non-peak periods to minimise any unforeseen delays wherever possible.

RESCUE AND FIREFIGHTING SERVICES

In addition to the emergency operations provided for Queensland bases at Brisbane Airport, the airport facilitates the Aviation Rescue and Fire Fighting Services operated by Airservices Australia.

More information about the services can be found in the Airservices section of this chapter.

QUEENSLAND GOVERNMENT AIR (QGA)

QGA delivers life-saving, community safety and state support aviation services to the people and government of Queensland. It operates five rotary wing and seven fixed wing aircraft from a variety of location across the state, with a base located in Airport East.

AERODROME EMERGENCY PLAN

The Brisbane Airport Aerodrome Emergency Plan (AEP) details the arrangements and agencies responsible for command, control and coordination of the notification, response to, management and initial recovery process for an emergency within the boundary or adjacent to Brisbane Airport. It also outlines procedures for the activation of operational centres and supporting facilities for emergencies.

The AEP includes planning and coordination requirements for full scale emergency deployment exercises every two years, with emergency exercises and table-top exercises based on credible risk based scenarios for Brisbane Airport conducted annually.

The Aerodrome Emergency Committee coordinates emergency planning at the airport including reviewing the AEP. It includes representatives from Australian Border Force, Air Traffic Control, Australian Federal Police, ARFFS, Australian Transport Safety Bureau, BCC, Commonwealth Departments (Agriculture and Water Resources and Department of Defence), Queensland Departments (Ambulance Service, Fire and Emergency Services, Health and Police) and Airlines.

AVIATION SUPPORT
GROUND SERVICE EQUIPMENT

Ground Service Equipment (GSE) supports the operations of aircraft on the ground. Areas are designed for contact and non-contact layouts and allow vehicles and equipment to be parked indefinitely. They can be either on or off-apron, including areas where vehicles and equipment may be held while waiting to service aircraft.

GSE CATEGORIES

The three main categories of GSE are:

- Equipment used by ground handlers for services including loading/unloading baggage and cargo, aircraft cleaning, lavatory service and potable water supply.
- Equipment used by ramp engineers for aircraft line maintenance, including ground power, pre-conditioned air and aircraft push-back.
- Aircraft containers and unit load devices (ULD).

GSE SERVICES

Ground handling is currently undertaken by four main providers, with some airlines handled by smaller ground service providers. The four major ground handling providers and airlines handled by each are:

- Qantas (Qantas).
- Toll (Virgin Australia).
- Aerocare (Tigerair).
- EGH (Jetstar).

FUTURE CAPACITY

CAPACITY REQUIREMENTS TO 2040

GSE storage areas are dedicated areas where vehicles plant or equipment may be stored. Equipment clearance areas are time limited areas adjacent to the apron for servicing aircraft equipment. Equipment storage areas are dedicated areas where vehicles plant or equipment may be stored.

Brisbane Airport currently has approximately 46,300 square meters of dedicated equipment storage area. It is anticipated that the areas dedicated for GSE use by the year 2040 will be approximately 85,000 square metres.

Brisbane Airport has equipment clearance areas identified adjacent to the stands at the both the international and domestic aprons. Equipment clearance areas are time limited areas adjacent to the apron for servicing aircraft equipment. The size and availability of these areas are dependent on stand configuration and aircraft type and these will be provided in the future to supplement GSE storage areas and the individual airline operational requirements.

ULTIMATE CAPACITY

At ultimate capacity, Brisbane Airport is anticipated to require more than 140,000 square metres of GSE area across the terminal precincts. The following GSE considerations will allow a more efficient use of both the GSE storage areas and equipment clearance areas.

GSE CONSIDERATIONS

EQUIPMENT POOLING

The potential future pooling of GSE may represent an opportunity for airlines to reduce costs to improve operational efficiencies. Greater cross utilisation of major equipment is also likely to drive increased efficiency, while less movement of equipment also reduces safety risks.

In addition, GSE pooling has the potential to reduce the volume of GSE required and reduce airside traffic. Consideration of future GSE pooling will be reviewed in consultation with airlines and aviation support partners.

ELECTRIFICATION OF GSE

Most GSE equipment currently used at Brisbane Airport runs by diesel refuelling. Electricity is more cost effective and more sustainable than diesel.

In considering a potential increase in the use of electric GSE, full consideration will be given to proposed changes to supporting infrastructure as well as any impacts on day to day operations. Currently, plans are in place for trials of two electric charging stations.

GSE SERVICING

On airport maintenance of GSE is currently provided for minor maintenance needs, with facilities distributed between apron areas. A future opportunity exists to locate a dedicated GSE servicing area within the central terminal precinct.

AVIATION SUPPORT
SUPPLY OF FUEL

Aircraft fuelling facilities at Brisbane Airport are owned and operated by an unincorporated joint venture comprising four major fuel companies, Viva Energy Australia, BP Australia Limited, Mobil Oil Australia Pty Ltd, and Caltex Australia Petroleum Pty Limited. This joint-venture is referred to as the joint user hydrant installation (JUHI).

The joint venture was created to maximise capital efficiency in the provision of aircraft fuelling infrastructure.

All facilities and assets are owned by the oil industry participants, under operating lease and licence arrangements with Brisbane Airport Corporation and their own joint working protocols.

Control is delegated to an operating committee comprised of representatives of each participant.

JUHI operators are responsible for the storage, management, and delivery of jet-A1 fuel at Brisbane Airport, in accordance with the standards identified by the Joint Inspection Group (JIG), the world-leading organisation for the development of aviation fuel supply standards.

These standards cover the entire aviation fuels supply chain from refinery to wing-tip.

AVIATION FUELLING FACILITIES

The term JUHI is used to describe the fuel storage, transfer and underground reticulation facilities to aircraft bays.

The Brisbane JUHI includes a complex system of storage tanks, fuel pipes, filters and other quality control equipment, and pipeline and hydrant systems for the distribution of jet fuel to aircraft at a number of locations throughout Brisbane Airport.

At Brisbane Airport JUHI is supplied via two pipelines

- BAPFII – Pinkenba Terminal to JUHI
- BP – Bulwer Island Terminal to JUHI

The installation servicing Brisbane Airport is located at Hakea Street between the International Terminal and Domestic Terminal aprons.

At Brisbane Airport, JUHI consists of four above ground Jet A1 storage tanks. With a total usable volume across these tanks of 12.8 Megalitres. Shell manages and operates the Brisbane JUHI on behalf of the JUHI JV.

This consists of:

- Tank 5 - 1.2 Megalitres
- Tank 6 - 1.2 Megalitres
- Tank 7 - 6.4 Megalitres
- Tank 8 - 4.0 Megalitres

The International Terminal apron is serviced by a system of in-ground fuel hydrants supplied by a high capacity 600 mm fuel pipeline from the Hakea Street depot.

The Domestic Terminal apron primary gates are also serviced by a system of in-ground fuel hydrants supplied by a medium capacity 450 mm fuel pipeline from the Hakea Street Depot.

Regional aircraft and remote stands on the domestic apron are serviced by tanker fuelling, as is the general aviation apron, and those aircraft requiring refuelling in Airport East.

GSE and airside vehicle refuelling requirements are currently addressed by several secondary facilities located within airline leased and licensed areas.

INTO-PLANE OPERATIONS

There are three into plane operators at Brisbane Airport. Each provide the vehicles and staff to service contracts and each are responsible for management of their airline contracts.

FUEL RESERVES

Currently there is approximately 2.9 days reserve held in the large tanks at the JUHI site, a surplus achieved by the successful commissioning of Tank 8 in mid 2019.

Forecasts indicate that the level of the reserve may reduce to two days by 2027, at which point Tank 9 is planned to be commissioned to ensure ongoing supply and suitable fuel reserve status.

Compared to other Category 1 airports in Australia, Brisbane Airport fuel supply is considered as moderately robust.

Reasons for this include:

- Proximity of four major fuel suppliers utilising two underground pipelines.
- Ability to move/share product between pipelines improving supply chain flexibility and reliability.
- Operating refinery in local area that has direct pipeline to Airport Suppliers Fuel Storage yard.

DEMAND MANAGEMENT

Within the period of this Master Plan, it is envisaged that the current JUHI facilities and storage tanks will be sufficient to continue to meet demand for fuel storage and delivery, however forecasts suggest that by 2023 there may not be enough available parking for the into plane carts and tankers servicing the system. Brisbane Airport will work closely with the JUHI operators and into plane partners to review and identify additional areas to stage from after 2023.

AVIATION SUPPORT
SUPPLY OF FUEL

FUTURE STRATEGY FOR AVIATION FUELLING FACILITIES

In planning for the future expansion of the JUHI depot and storage facility, two key factors have been considered – the amount of storage reserve on site and, the distribution system to the aircraft.

While newer aircraft are more fuel-efficient, demand for fuel at both the International Terminal and Domestic Terminal aprons is predicted to increase in-line with the growth in aircraft movements.

Additionally, planning for more storage reflects international benchmarking for fuel reserve criteria.

During the timeframe of the 2020 Master Plan, fuelling requirements will be planned and aligned with the projected future demand for fuel.

SHORT TO MEDIUM TERM

For the short to medium-term, to continue to provide the same level of services, considerations include:

- Installation of additional fuel storage at the Hakea Street Depot.
- Additional primary apron hydrant feeder route to the apron expansion areas to the north of the domestic apron.
- Establishment of common-user GSE and airside vehicle fuelling facilities within a functional operating distance of the major apron areas. A landside interface would minimise the requirements for airside supply access by tankers.

LONGER TERM

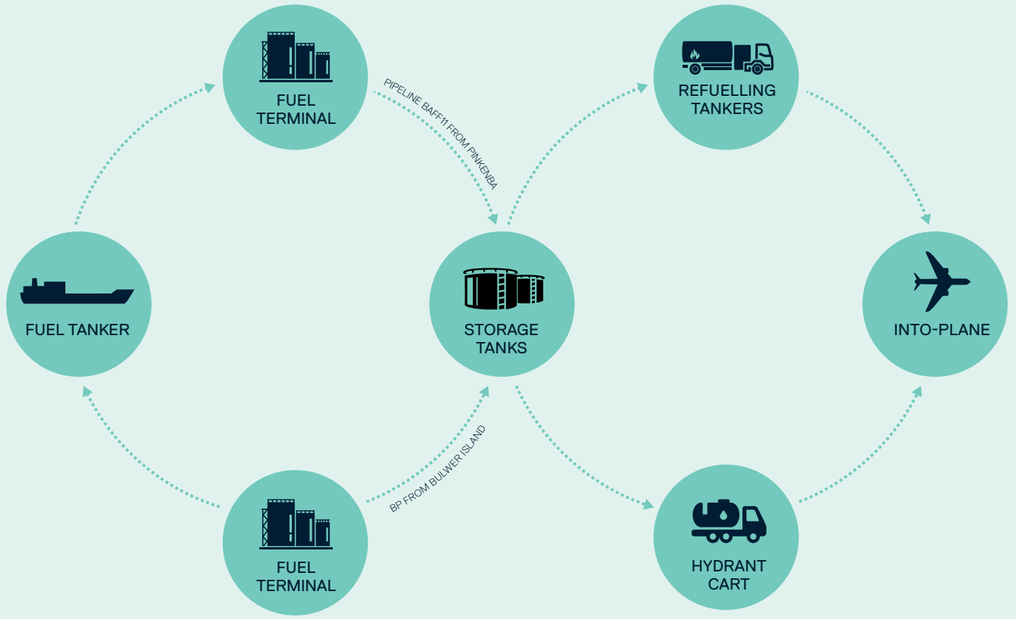
In the long-term, it is anticipated that to ensure connectivity between the apron and current and future satellite terminals, by 2032, the existing JUHI depot at Hakea Street may require relocation.

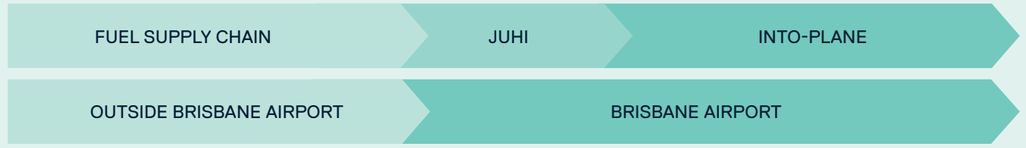
The 2020 Masterplan provides for three alternate futute sites for a JUHI facility. One option may be to operate a primary and secondary 'booster', with the booster site located in Airport North or Airport Central.

Alternatively the current site at Hakea Street has the ability to expand if the ancillary services are staged elsewhere to provide sufficient capacity to 2050.

Brisbane Airport Corporation will continue to work with JUHI and airline partners to develop and expand the use of biofuels for aviation.

FUEL SUPPLY
AT BRISBANE AIRPORT





The JUHI facilities consist of a large on airport storage facility supplied by underground pipe connections to off airport regional bulk fuel terminals. JUHI manages the storage and hydrant facilities. The into-plane operators refuel aircraft from the hydrant system via hydrant carts or directly via tender.

AVIATION SUPPORT
AIRCRAFT MAINTENANCE

At Brisbane Airport, two types of aircraft maintenance activities are carried out on-airport, line maintenance and heavy maintenance. Line maintenance is carried out at the aircraft gate and within dedicated hangar facilities, while heavy maintenance requires a hangar conforming to relevant aviation standards.

GROUND RUNNING AND ENGINE TESTING

Aircraft engine tests are currently undertaken in Airport East. Following the closure of Runway 14/32 an option exists in future to relocate testing to Airport North, potentially to legacy pavement areas of the former runway system.

Regulations require that procedures are in place for reducing environmental impacts including the generation of noise.

Brisbane Airport is aware of the impact noise has on the community surrounding the airport and is continually reviewing measures to minimise this impact wherever possible.

Noise generated from aircraft ground running activities is managed in accordance with a Brisbane Airport Policy which outlines that all operators are required to request approval prior to commencement of any engine ground running.

Depending on the type of aircraft, varying ground running limitations apply with regard to time of day, allowable power settings, maximum allowable ground run duration, and locations available.

RELOCATION OF MYRTLETOWN ROAD

Increases in the demand for maintenance creates follow on needs for services including paint shops and upholstery repair and component supply and maintenance.

The Airport East precinct has been configured to provide connected airside front-line and supporting second-line sites to provide these services, however planning of this precinct is currently constrained by the alignment of main Myrtletown Road.

A planned relocation of the road to a 30 metre corridor reserve along the far eastern boundary of the precinct will remove two sharp corners, significantly improving access for aircraft maintenance and providing better public ground transport access to the Myrtletown industrial zones.

Airport East precinct has historically poor in-situ ground conditions, requiring improvement works to support foundations for buildings and aircraft aprons. To resolve this issue, aeronautical grade sand has been laid across approximately 30 hectares of the southern sections of the precinct in preparation for future development.

FUTURE STRATEGY

Additional space is available at Brisbane Airport to cater for the expansion of maintenance hangars, whether for new airlines requiring maintenance facilities or existing airlines choosing to relocate their maintenance programs to Brisbane Airport.

AVIATION SUPPORT
FREIGHT AND CARGO

Air freight is the most effective means to transport time-critical or high-value freight domestically and internationally.

As part of the development of the 2020 Master Plan, Brisbane Airport engaged with the air freight community in a series of consultations including a dedicated workshop for freight and cargo stakeholders.

As a result, a range of initiatives and strategies to nurture the growth of freight business will be established including the creation of the Brisbane Airport Freight and Cargo Working Group as part of a commitment to further ongoing engagement with the industry.

GUIDING PRINCIPLES

Brisbane Airport provides facilities for a number of freight forwarding companies, primarily located within Airport Central and Airport East. Freight operations service domestic and international destinations.

Guiding principles in the future planning of freight management at Brisbane Airport are:

- Proximity: Ensuring easy access to aircraft gates.
- On Airport Routes: Consideration of airside travel between terminals and the freight forwarding facility.
- Off Airport Routes: Consideration of maintaining optimal transport corridors to arterial connections.

GROWTH IN FREIGHT VOLUMES

Since 2014, there has been a 21.6 per cent growth in international wide body passenger aircraft movements at Brisbane Airport which contributed to an increase of 20.3 per cent in the volume of international air freight processed at Brisbane Airport.

Over the same period, the numbers of domestic freight flights increased by 37.8 per cent.

The combined volume of freight tonnage across domestic and international freight in 2018 was an estimated 190,500 tonnes.

REGULATORY CHANGES

Brisbane Airport Corporation is cognisant of security regulatory changes requiring all exports to be examined at piece-level or to originate from a known consigner.

Brisbane Airport will continue to engage with freight stakeholders to consider the impacts on their businesses and to understand how the airport may address or potentially assist in mitigating challenges.

FUTURE FREIGHT STRATEGY

By 2040, the combined volume of domestic and overseas freight tonnage is forecast to grow to approximately 526,700 tonnes. An estimated 80 per cent of that total is international freight.

The map in this chapter shows existing and future areas required to support the continued growth in freight.

Planning for freight will continue to locate facilities near passenger aprons wherever possible. In the longer term, future expansion of freight facilities will also be considered at Airport North.

Brisbane Airport recognises the future challenges faced by air freight stakeholders at Brisbane Airport, and within the industry. Brisbane Airport will continue to implement measures to alleviate 'pinch points' of the supply chain on-airport, potentially by including dedicated corridors for some airside movements, forward staging areas, and alternative routes for freight operators both airside and landside.

Direct airside access from Airport North to the Domestic Terminal precinct would be facilitated by the Dryandra Road underpass and an expanded airside road system.

FUTURE RELOCATION OF FACILITIES

In the longer term, freight facilities located between the International Terminal and Domestic Terminal precincts can be located in either the Airport North or Airport Central.

The relocation of catering and cargo facilities will allow for the expansion of aviation facilities including the satellite terminal, southern extension of the Domestic Terminal, additional apron area and a southern remote pier of the Domestic Terminal.

Brisbane Airport Corporation anticipates the majority of air freight will continue to be transported in the belly of passenger aircraft in the immediate future. Dedicated freighter services to and from Brisbane Airport may eventuate over the longer timeframe of this Master Plan.

In addition, to the logistics apron, the former international apron is capable of accommodating up to six Code E size aircraft. This provides opportunities for specialised freight and event operations and/or future dedicated freighter services.

AVIATION SUPPORT
CATERING

The provision of flight catering facilities is an important support facility for airline operations. With both premium and low cost carriers operating from Brisbane Airport, catering facilities to suit both short and long-haul flights are an essential service.

CATERING SERVICES PROVIDED

Key services provided by Brisbane Airport include:

- Storage and replenishment of supplies, toiletries and equipment.
- Food preparation and storage.
- Management of food waste generated in flight.

Flight catering support services are currently located in the Central Terminal Area.

FUTURE CONSIDERATIONS

In the short-term and following the opening of the new runway, Brisbane Airport is planning a realignment of Airport Drive.

Once complete, it is envisaged that future needs for flight catering facilities could be met by the future development of a proposed airside zone between the current terminal zones.

As the location of these facilities has a potential impact on the on-time performance of airlines, Brisbane Airport will liaise with stakeholders in providing the most appropriate location and facilities.

It is understood that catering requirements may evolve and change. As an example, airlines offering catering to passengers for collection could reduce waste and reduce the need for aircraft to carry a full galley of food.

New innovations of this nature will be considered as they arise and are subject to discussion and agreement with all stakeholders before any changes are made to operations.

AUTOMATIC
WEATHER STATION

An automatic weather station (AWS) operated by the Bureau of Meteorology (BOM) provides meteorological information for Brisbane Airport. The AWS is located near the existing ARFFS mains station on the eastern side of the airport.

In addition to this automatic weather station, the primary automatic weather station for the parallel runway system will be positioned between the two parallel runways adjacent to the airside road at the northern end of the airport.

The combined weather station facilities provide essential airport meteorological information required for aircraft operations including wind speed and direction, barometric pressure, temperature and humidity, rain intensity, cloud height and visibility measurement with contingency to ensure continuous 24/7 capability.

The weather information from the AWS is communicated via NextG wireless technology and may also be supported by physical connection to the air traffic control tower.

The information is presented to air traffic controllers to inform decisions about runway and flight path nomination and to ensure accurate and immediate weather information is provided to pilots.

Pilots can also access the information independently if required through the aerodrome weather information service.

AIRSERVICES AUSTRALIA FACILITIES

Airservices Australia owns and operates a range of support facilities at Brisbane Airport, providing integral services for airport users in addition to their regulatory responsibility.

AIR TRAFFIC CONTROL

Brisbane Airport's air traffic control tower was completed in 1985 and, along with its related facilities, remains well suited to provide air traffic control services for all aircraft and vehicle movements on taxiways and runways at Brisbane Airport.

Refurbished by Airservices Australia as part of a mid-life upgrade, including installation of the latest digital tower technology and consoles for additional air traffic control positions for Brisbane's New Runway, Brisbane Airport has been advised that the operating life of the tower will be at least another 20 years.

Advances in technology may impact the future need for an air traffic control tower in its current format however it is envisaged that the footprint of the current site will remain sufficient.

The protection of existing aviation infrastructure remains a key consideration in any future development

RESCUE AND FIREFIGHTING FACILITIES

Airservices Australia provides Aviation Rescue Fire Fighting Services (ARFFS) at Brisbane Airport in accordance with the standards and requirements prescribed in Civil Aviation Safety Regulation (CASR) 139H. ARFFS Brisbane provides the capability to deal with aircraft emergencies at Brisbane Airport, as well as a structural response capability to deal with fire or the threat of fire at the aerodrome. As part of this service, ARFFS Brisbane also provides a dedicated water rescue service and difficult terrain capability that is tailored to suit the local conditions at the airport.

ARFFS is required to respond to aircraft incidents at either end of the runways within three minutes from the initial call and must be able to apply fire-fighting agent at 50 per cent of the maximum discharge rate. All other vehicles required to deliver the appropriate discharge rate must also respond in time to ensure there is a continuous application of fire-fighting agent at the required rate.

In addition to Airservices regulated responsibilities, ARFFS Brisbane currently provides an emergency first aid response capability at the airport. This service allows ARFFS staff to respond quickly to medical emergencies on the aerodrome, to assess and treat patients until ambulance staff arrive. The ARFFS Brisbane Station also includes dedicated training infrastructure and facilities that support ARFFS ongoing training needs and contemporary training practices.

The extent of firefighting and rescue facilities is determined by the protection level recommended by ICAO for an airport of the size of Brisbane Airport. There are 10 categories of service that can be provided by ARFF stations at Australian airports. Categories dictate the required amount of water and foam carried, response times, water discharge rates and the number of personnel.

ARFFS Brisbane provides up to a Category 10 service in accordance with its Civil Aviation Safety Authority-approved certificate for existing A380 operations. Future B777X operations will also require provision of Category 10 services. ARFFS Brisbane service will continue to evolve to accommodate the potential introduction of new and different aircraft types and future changes to Brisbane Airport infrastructure and facilities.

In addition to the satellite and main existing ARRFS stations on the airport, a new station will open prior to the commencement of operation on the new runway, located in Airport North. The Fire Control Centre will continue to operate from the main existing station due to greater visibility of the airfield from this location. The satellite station was located to meet the response requirements for aircraft operating on Runway 14/32 and will no longer be required when this runway is closed on 21 May 2020.

Brisbane Airport, as part of the construction of the new runway, has built access ramps to facilitate emergency response for ARFFS into Moreton Bay, north of the airport.

AIRSERVICES AUSTRALIA FACILITIES

FIRST RESPONSE FIRST AID

The ARFFS also provides first response first aid to incidents in terminals/buildings at the airport. Where an incident is deemed serious enough to call a fire emergency vehicle, a paramedic should also be called. ARFFS personnel are firefighters with Advanced First Aid and assist or provide a first response until Queensland Ambulance Service (QAS) arrival who assume control immediately upon arrival. The exception to this would be at a major incident where Australasian Inter-Service Incident Management System Incident management principles have been engaged and authority to operate within a scene would be sought through incident control.

TRAINING FOR REGIONAL AIRPORTS

ARFFS facilities at Brisbane Airport are also used for training for Regional Airports. This is an ongoing strategy of ARFFS and Brisbane Airport and provides a contribution to the region to support ARFFS operations at other airports.

ARFFS has an MOU with the Queensland Fire and Emergency Service (QFES), drawn up in 2006, to provide assistance in the event of an emergency on or within the vicinity of the airport. This document ensures that in the event of an emergency, assistance will be rendered if requested if either service has the resources to assist. The MOU is current until 2021.

INCREASE IN RADAR FACILITIES

Airservices Australia has an established surface movement radar (SMR) installation at Brisbane Airport.

A Surveillance Radar facility is established at Mt. Hardgrave on North Stradbroke Island.

An on-airport Terminal Area Radar is located at Brisbane Airport. Since the 2014 Master Plan, the Terminal Area Radar has been upgraded to have a ‘dome’ added to provide greater protection from adverse weather conditions.

NEW SURFACE MOVEMENT RADAR (SMR)

A new SMR and a number of remote units (RU) will be installed for the new runway.

The system involves a SMR installation in the Airport East precinct supplemented with a system of distributed RUs that have the capability to, as a minimum, triangulate all areas of the movement area. The transponder-based system provides a comprehensive real-time surveillance screen image of the airport’s airfield, operational area and terminal area airspace. It will assist Air Traffic Control (ATC) in managing flight operations at Brisbane Airport and further reducing the risk of runway incursions.

NAVIGATIONAL AIDS AND SYSTEMS

INSTRUMENT LANDING SYSTEM

The key navigational aid at Brisbane Airport on Runway 01R/19L is an Instrument Landing System (ILS) consistent with the ICAO Category 1 standard set.

Additional instrumentation continues to be implemented to improve the safety and efficiency of operations in low visibility conditions.

A Category 1 ILS is being installed for the new runway. In construction, hardware and conduits will be installed in order to allow for an easy future upgrade to Category 2.

It is anticipated that the ILS will remain a relevant navigational aid in the foreseeable future. Advances in technology may impact the future use of the system, however it is likely to remain in use as a back-up network.

RADIO NAVIGATION SYSTEMS

Brisbane Airport uses Very High Frequency (VHF) Omni-Directional Range (VOR) and distance measuring equipment (DME) combined radio navigation stations for aircraft.

VOR produces an angle between the station and the receiver in the aircraft, while DME does the same for range. Together, they provide the two measurements needed to produce a navigational “fix” using a chart.

Airservices Australia have indicated that within the planning period of this Master Plan, the VOR will become redundant however the DME will remain and be used in conjunction with the ILS.

FUTURE NAVIGATIONAL AIDS AND SYSTEMS

The Ground Based Augmentation System (GBAS), known in Australia as Honeywell SmartPath, is a satellite-based precision landing system. It uses GPS signals to provide aircraft with precise positioning guidance during the final stages of an approach, both horizontal and vertical allowing for a safer, more efficient descent and landing.

A single installation has the capacity to guide up to 26 highly precise approach flight paths simultaneously within a 42-kilometre radius. As it is not fixed by function (e.g., proximity to runway centreline), there are a greater variety of siting location options, potentially reducing the need for extensive site preparation effort typically associated with ground-based precision approach and landing systems.

Brisbane Airport will continue to safeguard a site for this infrastructure. If newer technology replaces the need for GBAS, the current sites nominated for GBAS will be utilised where possible.

Upgrades to navigation aids and systems will be dependent on the equipment and capability or aircraft and would be affected the cycles of aircraft production and manufacturing.

AIRSERVICES AUSTRALIA FACILITIES

SURFACE MOVEMENT CONTROL

The separation of aircraft taxiing on the apron manoeuvring area is a joint pilot and air traffic controller responsibility. Brisbane Airport will support digital solutions to provide additional information to the surface movement controller in the central tower where required.

DIGITAL TOWER SERVICES

Brisbane Airport recognises the proposed strategy of Airservices Australia to adopt a remote (virtual) tower concept of operations.

Brisbane Airport understands Airservices Australia is currently reviewing the potential for this technology and looking to trial across three scenarios in Australia. At this stage, it is understood that Brisbane Airport is not being used as a trial location.

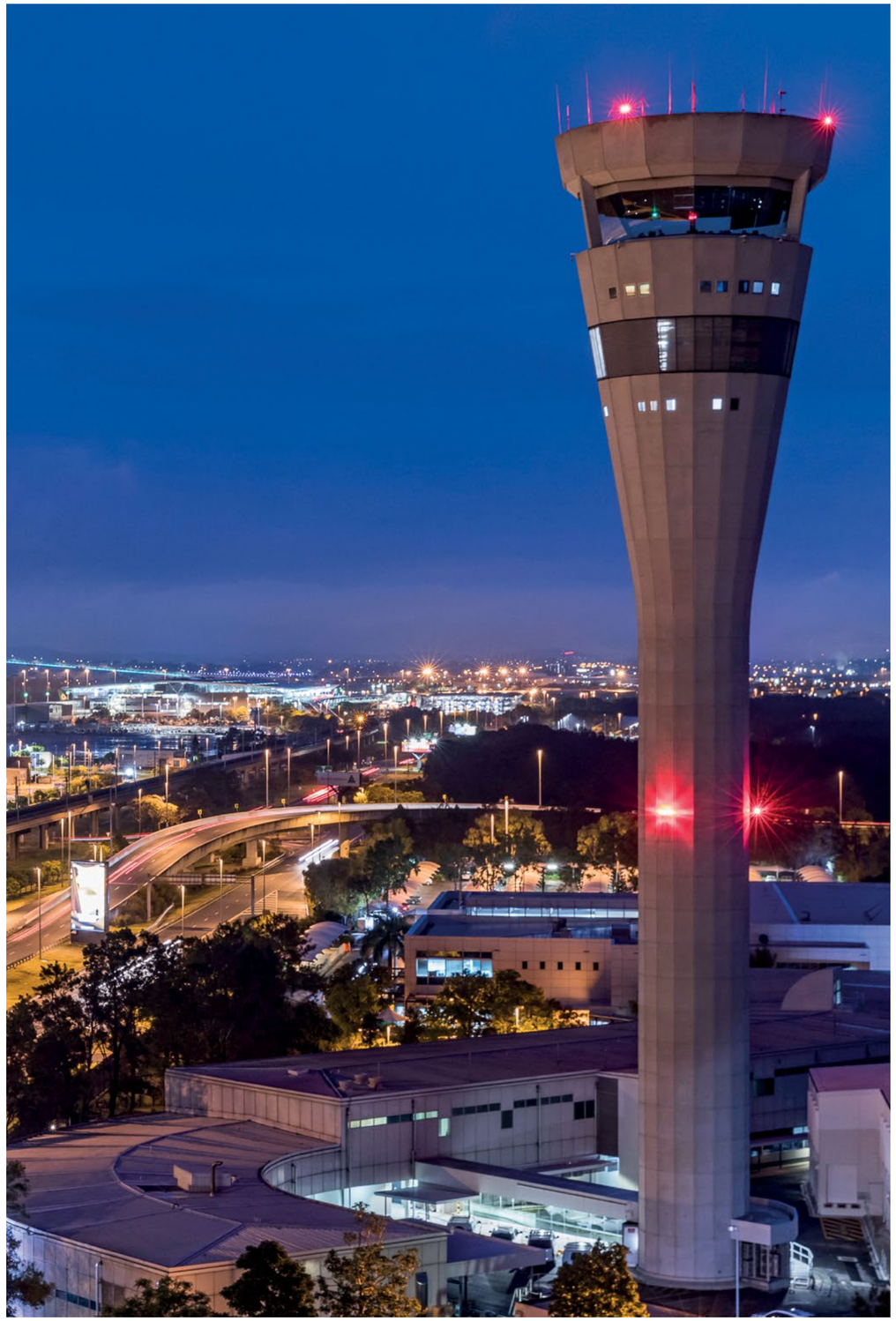
TECHNOLOGY STRATEGY

Line of sight of the airfield is vital for safe airport operations. Subject to CASA compliance approval, it is possible that Airservices Australia may wish to use alternative technology to visually reproduce the display for the controllers, rather than looking out the traffic control tower window.

There may also be an opportunity to use technology to fill any black spots with regard to line of site, if approved by CASA.

This technology may also be utilised to ensure that future developments built do not compromise line of sight and would be subject to a stringent safety case.

Any move towards digital controlling will be required to meet telecommunication and aeronautical requirements.



AVIATION STRATEGY PART TWO AIRSPACE AND SAFEGUARDING

AIRSPACE PROTECTION

Ensuring adequate protection from infringements to the airspace surrounding Brisbane Airport is as important to the safe and efficient use of the airport as the safe design and operation of on-ground infrastructure including runways, taxiways, terminals and navigational aids.

Facilitating the safe and efficient movement of aircraft is a fundamental principle in the development of a Master Plan. Aviation provides an efficient means of long distance transport, particularly in Australia with long distances between major population centres.

Unlike land transport, where long land corridors must be quarantined for road or rail infrastructure and then constructed and maintained, air transport utilises 'highways in the sky' for travel from one city to another.

The physical infrastructure required for air transport is limited in the main to the airports at each end of the journey. Suitable sites for airport infrastructure are increasingly difficult to identify and establish in existing urban areas. Competing land uses and community concerns about noise make the establishment of new airport sites very difficult.

Despite continued growth in demand for air travel across Australia, Brisbane Airport remains the most recently established Australian capital city airport.

THE NEED FOR BRISBANE'S NEW RUNWAY

Originally considered as part of the original construction of the airport in the 1970s, Brisbane Airport is currently nearing the completion of construction of a new runway located two kilometres west of and parallel to the existing main runway. It will be the most important piece of aviation infrastructure to be built in Queensland in the last 30 years.

Forecasts of continued growth in passenger demand reveal that the existing runway system would find it increasingly difficult, and ultimately impossible, to continue to provide the quality and frequency of services required by the people and businesses of Brisbane and the state of Queensland overall.

PLANNING IMPERATIVES FOR SAFE OPERATIONS

Safe aviation operations rely on maintaining an airport environment as free as practical from obstacles that might impede the safety, efficiency or regularity of current and future aircraft operations.

In considering planning imperatives for the 2020 Master Plan, a primary concern is to ensure that the state's largest aviation gateway is able to continue to operate safely and efficiently, and that constraints necessary to maintain aviation operations are understood and recognised in local planning processes, including development around the airport site.

AVIATION REGULATION & LEGISLATION

Aviation operations are carefully regulated to ensure the highest possible level of safety for the travelling public. A regulatory framework provides for the identification and protection of what is known as prescribed airspace within the vicinity of an airport to ensure aircraft flight paths and procedures can be planned and operated safety.

Essentially, the definition of prescribed airspace provides the certainty required to ensure aircraft are separated from each other and from any obstacles which may pose a safety risk.

LEGISLATIVE ENVIRONMENT

As a leased Commonwealth airport, Brisbane Airport is subject to the *Airports Act 1996* (Cth) **(Airports Act)** along with the *Airports (Protection of Airspace) Regulations 1996* (Cth) **(Airports Airspace Regulations)**. Part 12 of the Airports Act and the Airports Airspace Regulations establish a framework for the designation and protection of prescribed airspaces at, and around, airports.

The Airports Act defines prescribed airspace as the airspace specified in, or ascertained in accordance with, the Airports Airspace Regulations, where it is in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of an airport for that airspace to be protected.

Under the Airports Act, any activities which would result in an intrusion into the prescribed airspace for Brisbane Airport (referred to as 'controlled activities') are prohibited unless otherwise approved.

The Airports Airspace Regulations provides a framework for the Secretary of DIRDAC **(Secretary)** to approve applications to carry out controlled activities (with any necessary conditions) if certain criteria are satisfied. Where proposed controlled activities do not comply with the criteria set out in the Airports Airspace Regulations, they cannot be approved.

QUEENSLAND STATE PLANNING POLICY

The Queensland State Government published a revised State Planning Policy (SPP) in 2017, identifying Brisbane as a strategic airport. The policy outlines the key role airports and aviation facilities play in facilitating economic growth in Queensland.

Specifically, it states that "the operation of strategic airports and aviation facilities is protected, and the growth and development of Queensland's aviation industry is supported".

Brisbane Airport supports and integrates the following state policies in its approach to current operations and future planning:

- Strategic airports and aviation facilities are identified, including the associated Australian Noise Exposure Forecast contours, obstacle limitation surfaces or height restriction zones, public safety areas, lighting area buffers, light restriction zones, wildlife hazard buffer zones, and building restricted areas.
- The safety, efficiency and operational integrity of strategic airports are protected. Development and associated activities must not create incompatible intrusions, or compromise aircraft safety, avoid increasing risk to public safety and be compatible with forecast levels of aircraft noise within the 20 ANEF contour or greater.
- Developments must complement the role of a strategic airport as an economic, freight and logistics hub, and enhances the economic opportunities that are available in proximity to a strategic airport.
- Aviation facilities are protected by avoiding development and associated activities within building restricted areas that may affect the functioning of the aviation facilities.
- Key transport corridors (passenger and freight) linking strategic airports to the broader transport network are identified and protected.

NATIONAL AIRPORTS SAFEGUARDING FRAMEWORK

The National Airports Safeguarding Framework (the Safeguarding Framework) is designed to enhance the current and future safety, viability and growth of Australian aviation operations.

The Safeguarding Framework Implementation Plan will identify the processes through which jurisdictions will seek to implement the guidelines taking into account:

- The implementation of best practice in relation to land-use assessment and decision making in the vicinity of airports.
- Assurance of community safety and amenity near airports.
- Better understanding and recognition of aviation safety requirements and aircraft noise impacts in land-use and related planning decisions.
- The provision of greater certainty and clarity for developers and land owners.
- Improvements to regulatory certainty and efficiency.
- The publication and dissemination of information on best practice in land use and related planning that supports the safe and efficient operation of airports.

The Safeguarding Framework provides the opportunity for improvements in consistent planning outcomes across jurisdictions, and to improve the safety and viability of operations at Australian airports. It includes information to guide government depaertments in regulating and managing:

- Measures for managing intrusion by aircraft noise.
- The risk of building-generated windshear and turbulence at airports.
- The risk of wildlife strikes in the vicinity of airports.
- The risk of wind turbine farms as physical obstacles to air navigation.
- The risk of distractions to pilots from lighting in the vicinity of airports.
- The risk of intrusions into the protected operational airspace of airports. It is anticipated that guidelines for public safety areas and the protection of communications, navigation and surveillance infrastructure will also be considered.

The Safeguarding Framework Implementation Plan will identify the processes through which jurisdictions will seek to implement the guidelines taking into account:

- Existing Commonwealth, state and territory legislation and regulatory processes.
- Responsibilities of each level of government.
- Local conditions and circumstances.
- The need for efficiency, effectiveness and appropriate risk management.
- Provision for evaluation and review of regulatory arrangements over time to accommodate changing circumstances and technologies.

Brisbane Airport Corporation advocates the full incorporation of the current Safeguarding Framework guidelines in Queensland planning policy and encourages the continued development of such guidelines as a best practice approach to ensuring sustainable airport operations.

AIRSPACE DEFINITION

Prescribed airspace can be thought of as a series of three-dimensional shapes, radiating from the airport to as far as 30 kilometres from the runway ends.

When aggregated, these shapes determine a series of surfaces, above which any potential obstacle should be assessed to determine whether it has an unacceptable impact on the safety, efficiency or regularity of air transport operations (both existing and future).

DECLARATION OF AIRSPACE

PRESCRIBED AIRSPACE

Aviation operations are carefully regulated to guarantee the highest possible level of safety for the travelling public.

The regulatory framework provides for the identification and protection of controlled airspace within the vicinity of an airport (referred to as the 'prescribed airspace') to ensure that aircraft flight paths and procedures can be planned and operated safely. The prescribed airspace ensures aircraft are separated from each other and from obstacles posing a safety risk.

Prescribed airspace is a series of three-dimensional shapes, radiating from the airport to as far as 30 kilometres from the runway ends.

CONTROL MECHANISMS

The Airports Act and the Airports Airspace Regulations are the primary control mechanisms for airspace protection.

The Airports Airspace Regulations establish a system for the protection of airspace at, and around those privatised airports regulated under the Airports Act, in the interests of the safety, efficiency or regularity of existing or future air transport operations into or out of airports.

AREAS COVERED

Under the Regulations, the 'prescribed airspace' for Brisbane Airport is made up of:

- The OLS and PANS-OPS surfaces, and the airspace above those surfaces, for existing and future air transport operations into and out of Brisbane Airport.

Any additional airspace that has been declared under the Regulations by the Secretary of the Department of Infrastructure and Regional Development and cities. In making that declaration under the Airports Airspace Regulations, the Secretary must have regard to:

- The OLS and PANS-OPS surfaces for the ultimate runway system for the airport proposed in the approved Master Plan.
- Any advice from the CASA.
- Any other matters the Secretary considers relevant.

This declaration process has allowed Brisbane Airport to protect airspace around the New Parallel Runway (NPR) runway system and extensions to the existing main runway. It also takes account of new aircraft navigational procedures that are introduced as a result of technological advances.

BRISBANE AIRPORT'S APPROACH TO DECLARING THE PRESCRIBED AIRSPACE

After commencing as the Airport Lessee Company and Operator of Brisbane Airport on 02 July 1997, Brisbane Airport Corporation first had the prescribed airspace for Brisbane Airport declared on 5 July 2001.

Following further refinement of the positioning of the new runway, combined with the evolution and implementation of satellite-based airspace procedures, a major update exercise for the Brisbane Airport airspace resulted in a revised declaration on 19 April 2013.

In consideration of best-practice precedent (including additional components used by other major Australian airports, incluidng visual segment surfaces and protection of major airfield lighting systems), Brisbane Airport also initiated a minor update process in 2012.

That update included a slight relaxation of Radar Terrain Clearance Chart (RTCC) surfaces to a consistent high-rise building height allowance along the CBD riverfront, with aviation industry stakeholders recognising the value of such development outcomes. The minor change, which will potentially benefit CBD development included an assessment of the implications for safety, efficiency and regularity outcomes.

This third iteration of Brisbane Airport Airspace was declared on 14 July 2017. In each instance, Brisbane Airport's approach involved both an inception and a process finalisation workshop with representation typically from:

- Department of Infrastructure, Regional Development and Cities.
- State Departments of Transport, Planning and Development.
- Brisbane City Council.
- Major Airlines – Qantas Airways and Virgin Australia.
- Board of Airline Representatives of Australia.
- Civil Aviation Safety Authority.
- Airservices Australia.
- Procedure design specialists.

Facilitating each of the three separate airspace definition processes undertaken since airport privatisation, Brisbane Airport has engaged specialist airspace consultants to undertake the analysis necessary to identify the prescribed airspace in accordance with the Airports Airspace Regulations.

Close consultation was required with CASA and Airservices Australia, the procedures designer for Brisbane Airport pursuant to Part 173 of the Civil Aviation Safety Regulations 1998.

It is noted that in each instance Brisbane City Council has challenged the process and the airspace design standards applied, requesting consideration of higher CBD building height outcomes.

While carefully and comprehensively considered, their submissions have not been supported due to negative implications for the long-term sustainability of, and impacts on safety, efficiency and regularity outcomes for aviation operations at Brisbane Airport.

The "Prescribed Airspace" for Brisbane Airport is a combination of the airspace surfaces included in both the 2013 and 2017 Declarations.

An Airspace Declaration is largely focussed on securing future airspace – the airspace associated with current procedures and airspace systems is declared by default.

While Brisbane Airport's processes identify future airspace requirements, the airport produces large-scale detailed charts of all airspace surfaces to allow government and industry to review proposed developments and activities that may constitute a "Controlled Activity".

CHANGES FOLLOWING THE OPENING OF THE NEW RUNWAY

Brisbane Airport is working with Airservices Australia to finalise airspace design, flight paths, arrival and departure procedures and runway allocation principles for Brisbane Airport's new runway.

Once complete and with all necessary regulatory approvals in place, Brisbane Airport will undertake a full review of the required airspace surfaces.

CONTROLLED ACTIVITY

Any activity that involves infringement of an airport's "prescribed airspace" (either because of its height, or because of the efflux generated by it), is termed a "controlled activity", and the Airports Airspace Regulations detail the notification and approval procedures to be followed in that event.

INTRUSIONS INTO AIRSPACE

Under the Airports Regulations, an application to conduct a controlled activity which would result in an intrusion of the PANS-OPS airspace cannot be approved, however a short-term (less than three months) penetration of PANS-OPS surface may be permitted if Brisbane Airport supports the approval.

The most common example is a request to use cranes that penetrate the airspace for short periods to a greater height (above the PANS-OPS surface) than the finished structure.

AIRSPACE PROTECTION
PROTECTION SURFACES

PUBLIC SAFETY AREAS

The term "Public Safety Area" (PSA) is used to describe a defined area at the end of the runways where there is increased risk of an aircraft accident occurring.

In a PSA, development may be restricted to control the number of people on the ground at risk of injury or death in the event of an aircraft accident.

The probability of an accident occurring during any single aviation operation is very low. However, analysis of aircraft accidents suggests that most accidents occur either immediately beyond the ends of a runway, up to 1,000 metres before the runway (during landing) or up to 500 metres beyond the runway end (on take-off).

Consistent with Queensland State Planning Policy and previous Brisbane Airport Master Plans, the PSAs at Brisbane Airport form the shape of an isosceles trapezoid symmetrically positioned on the runway centreline – 1,000 metres long, 350 metres wide at the runway end tapering to a width of 250 metres furthest from the runway.

Brisbane Airport has six PSAs, to reflect the runway system of the three runways. In five of the six instances, they are on airport land or over Moreton Bay. The locations are shown in the map opposite.

The exception is the PSA at the end of runway 14/32, which will no longer be required once the runway is decommissioned. From May 2020, all PSAs will be within Brisbane Airport site.

Brisbane Airport's land-use strategy minimises the risk to public safety by avoiding any significant increases in people living, working or congregating in the PSAs. The use or storage of hazardous, explosive or flammable materials is restricted in the PSAs.

In the event of runways being extended in future, the PSAs will be realigned appropriately.

RUNWAY END SAFETY AREAS

The term "Runway End Safety Area" (RESA) describes an area at the end of a runway to protect the aircraft in the event of under-shooting or over-running the runway. These areas are designed to address the risk to aircraft and passengers.

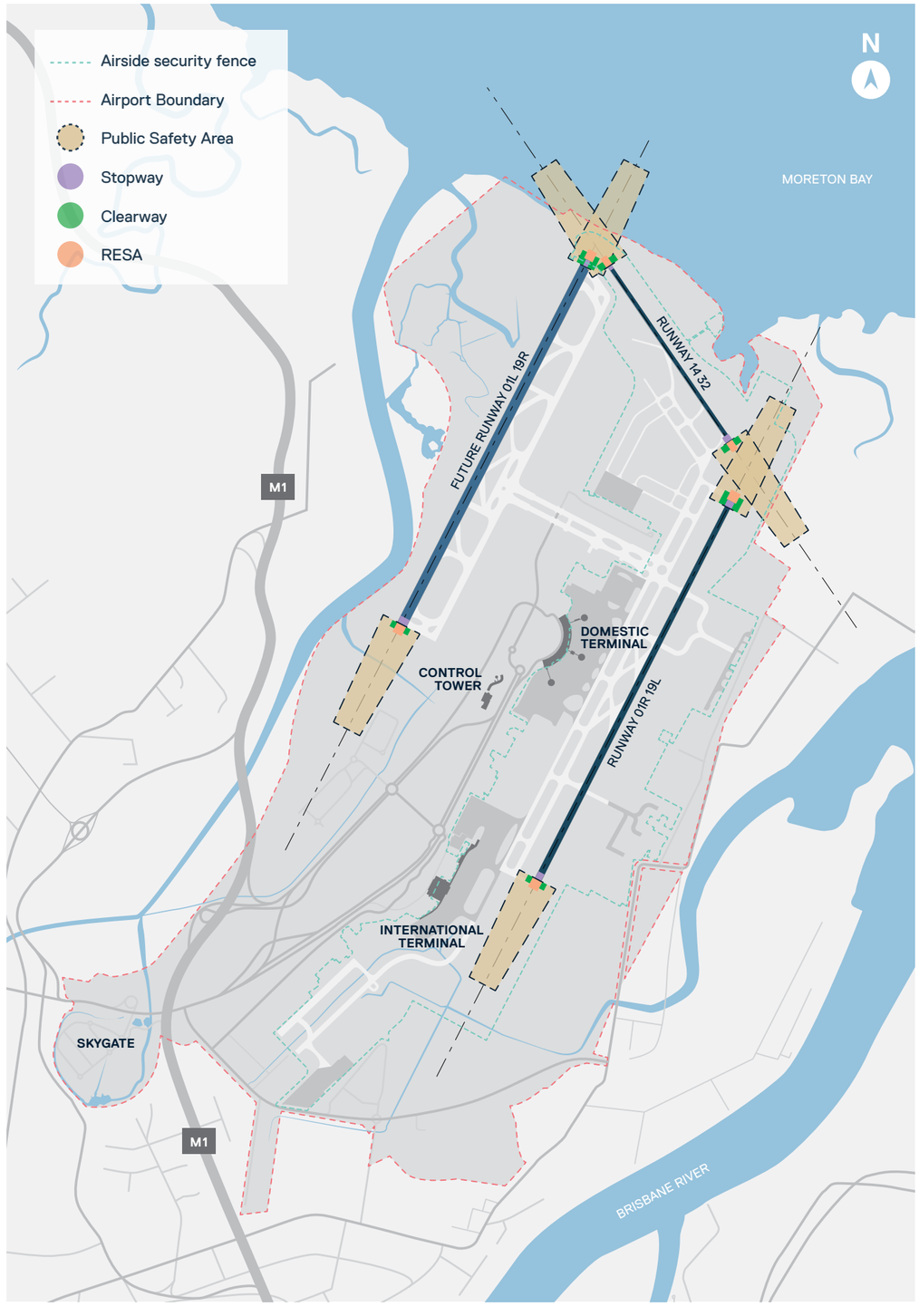
RESAs are required to be free of fixed objects, other than visual or navigational aids for the guidance of aircraft or vehicles. All fixed objects must be of low mass and frangibly mounted. A RESA must also be free of any mobile objects that may endanger aircraft when the runway is being used.

CASA requires that Code 4 runways adopt a 240 metre RESA at all runway ends, in accordance with ICAO recommendations.

Compliant with now superseded standards, Existing Runway 01R/19L and the Cross Runway 14/32 both have a RESA length of 90 metre. Brisbane's new runway will have a 240 metre RESA.

If runways are extended in the future, affected RESAs will be realigned appropriately. Development proposals will be reviewed in consideration of future runway extension and RESA realignment.

SAFETY AREAS AT BRISBANE AIRPORT



AIRSPACE PROTECTION
PROTECTION SURFACES

OBSTACLE LIMITATION SURFACES (OLS)

The OLS for an airport is a surface ascertained in accordance with the procedures in Annex 14 to the Convention on International Civil Aviation (the Chicago Convention), signed on 7 December 1944. In Australia, CASA publishes the criteria in the Manual of Standards for Part 139 of the Civil Aviation Safety Regulations 1998.

The OLS for an airport charts the volume and dimensions of operational airspace that should be kept free of obstacles to aircraft operations being conducted under visual flight rules or during the visual stages of instrument-controlled operations. As such, the OLS protects aircraft operating under visual flight rules.

REQUIREMENTS FOR ENFORCEMENT

The requirements to protect operational airspace need to be enforced most rigorously along the extended centrelines of runways in the approach and take-off areas.

At major airports, this can extend up to 15 kilometres from the ends of the runways. Similarly, other OLS surfaces that protect aircraft circling to land may also extend up to 15 kilometres.

Structures, or other activities such as plumes that intrude into the OLS (i.e penetrate above the OLS surface) could constitute obstacles to aircraft taking off or approaching to land.

The effects of individual obstacles may be relatively minor, but together a number of obstacles may seriously limit runway utilisation, cause airspace congestion or reduce the effective handling capacity of the airport.

ASSESSMENT OF INTRUSIONS

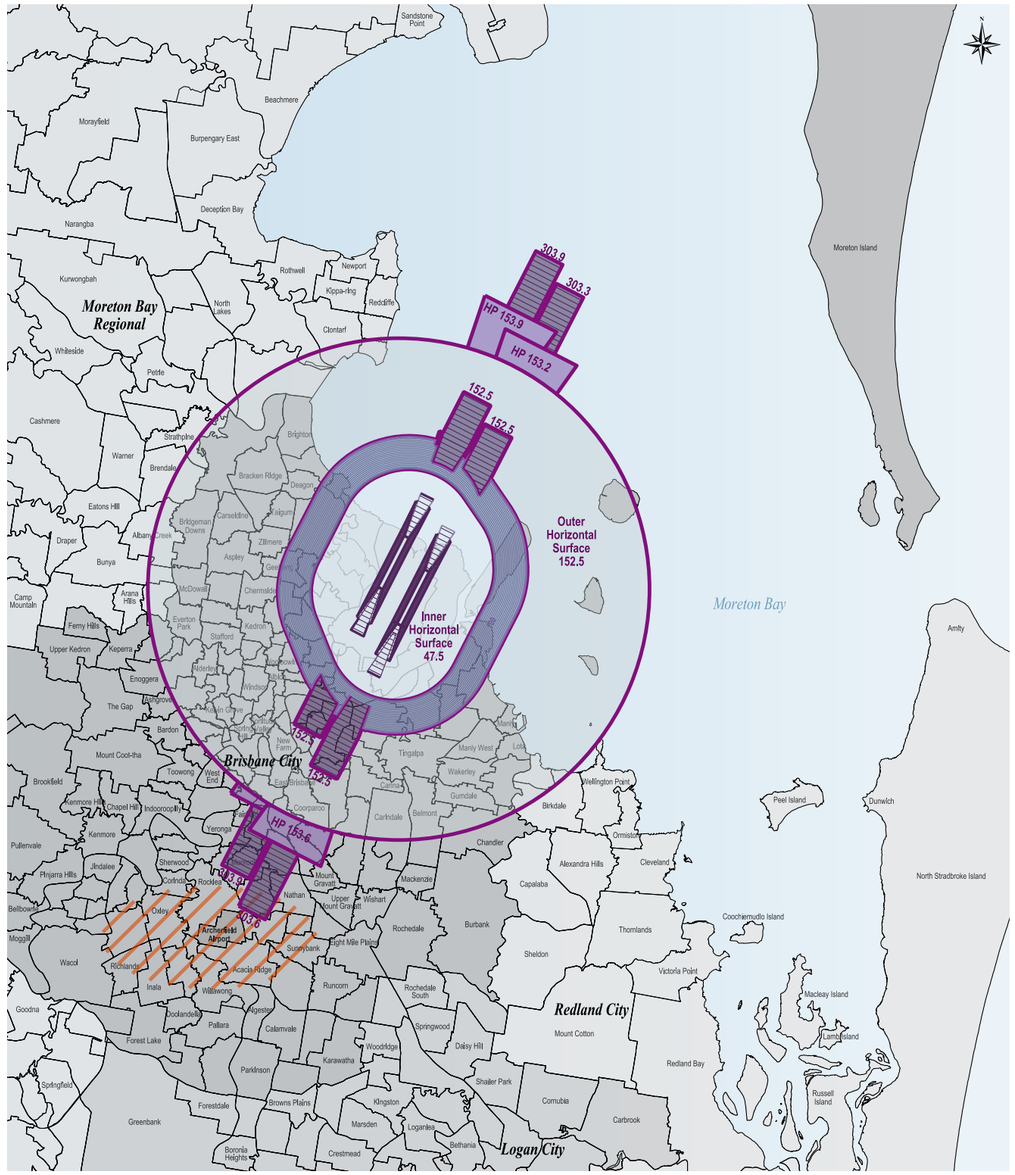
Certain intrusions into the OLS may be approved under the Airports Regulations. Applications for such intrusions are assessed to identify and consider the potential impact on aircraft operations.

The assessment determines whether an intrusion is permissible, and which risk mitigation requirements should be imposed. (Mitigation measures might include lighting or visual marking of obstacles).

Under the Airports Airspace Regulations, the pre-existence of a nearby structure or other intrusion into the OLS does not necessarily mean that a new proposed penetration would be approved.

The diagram on the facing page shows the Obstacle Limitation Surfaces (OLS) for Brisbane Airport, to be effective in 2020 following the opening of new Runway 01L/19R and the decommisioning of Runway 14/32.

ULTIMATE DEVELOPMENT OBSTACLE LIMITATION SURFACES (OLS)



OLS Contours

Airspace surfaces in the vicinity of Archerfield Airport relating to its operations may be more restrictive than Brisbane's Prescribed Airspace

AIRSPACE PROTECTION
PROTECTION SURFACES

PROCEDURES FOR AIR NAVIGATION SERVICES – OPERATIONS

In addition to Obstacle Limitation Surfaces, a second group of criteria is used to determine the volumes and dimensions of airspace required to protect the safety of aircraft operating under instrument flight rules (IFR).

Under IFR operations, pilots are reliant on aircraft instruments for navigation. Airspace protection for IFR operations cannot allow for any long-term penetrations.

The relevant criteria are established by the International Civil Aviation Organization (ICAO) and are published in a document titled 'Procedures for Air Navigation Services – Operations (PANS-OPS)'. The surfaces determined in accordance with the criteria in the PANS-OPS publication are called PANS-OPS surfaces.

The PANS-OPS surfaces are used in the construction of take-off, landing and approach procedures which are based on navigation solely reliant on aircraft instruments. They are complex surfaces designed to protect aircraft from colliding with obstacles when flying on instruments. Minimum safe altitudes are established for each segment of an instrument procedure.

PERMANENT PENETRATION OF PANS-OPS

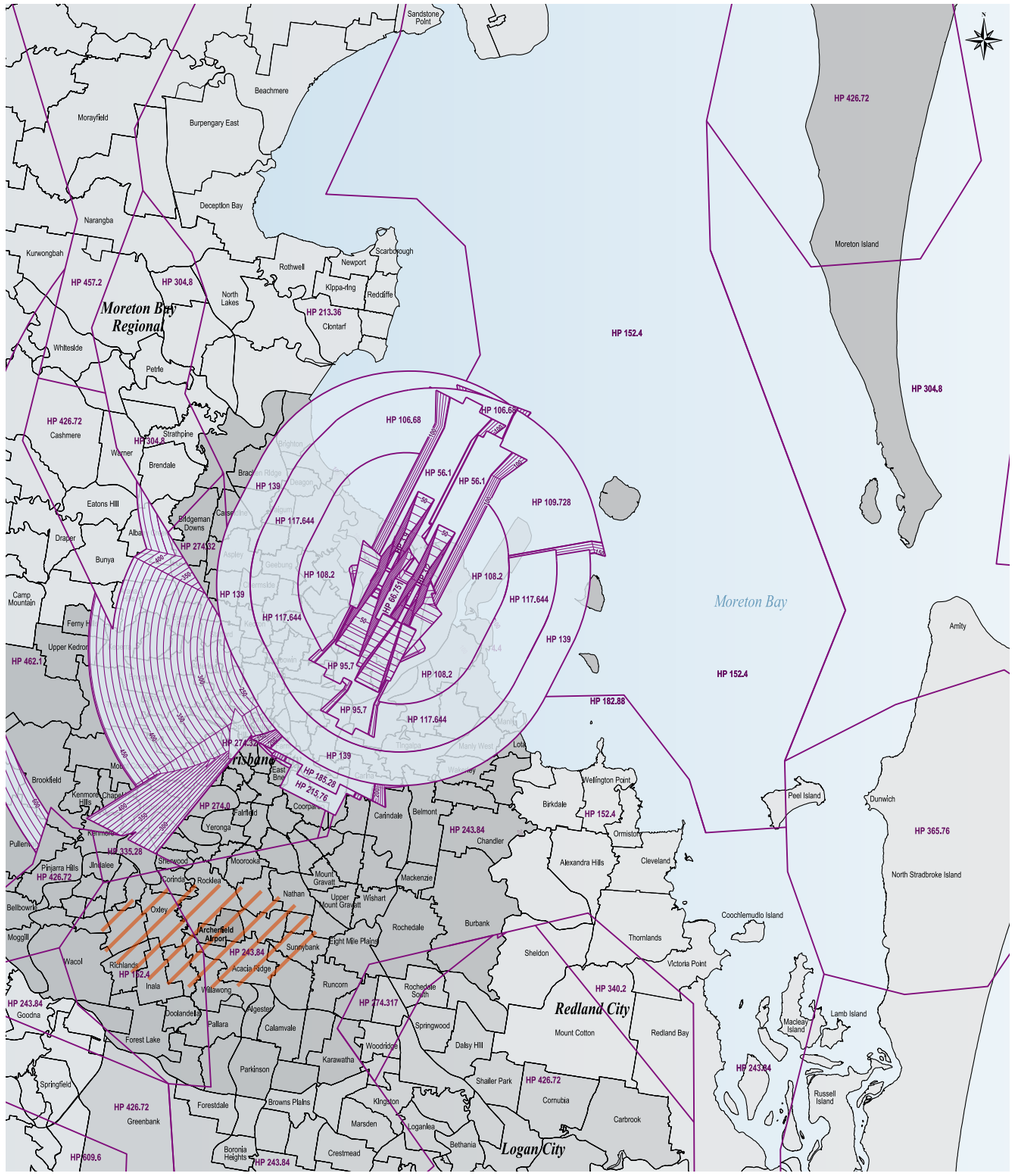
The Airports Airspace Regulations do not permit the permanent penetration of PANS-OPS surfaces. However, short-term (maximum duration of three months) penetrations of the PANS-OPS surfaces may be approved in certain circumstances (if the short-term proposal has the support of the airport operator) under the Airports Airspace Regulations.

In the event that all stakeholders were to agree that a proposal for long-term penetration of the existing PANS-OPS surfaces is desirable, the PANS-OPS surfaces must be raised so they are clear of the development causing the penetration.

Any such decision would be irreversible and would be likely to lead to operational penalties for aircraft operations and possible community impacts, such as re-design of flight paths that increase the population exposed to high levels of aircraft noise.

The diagram opposite presents the Procedures for Air Navigation Services – Operations (PANS-OPS) Surfaces (OLS) for Brisbane Airport from 2020 and following the opening of Runway 01L/19R and the decommisioning of Runway 14/32.

ULTIMATE DEVELOPMENT PROCEDURE FOR AIR NAVIGATION SERVICES AIRCRAFT OPERATIONS (PANS-OPS) AND RADAR TERRAIN CLEARANCE SURFACES



PANS-OPS Surfaces

Airspace surfaces in the vicinity of Archerfield Airport relating to its operations may be more restrictive than Brisbane's Prescribed Airspace

AIRSPACE PROTECTION

AIRSPACE DECLARATION – 2020 MASTER PLAN IMPACT

Under the Airports Act requirements for airport Master Plans, Brisbane Airport must specify any change to the OLS or PANS-OPS surface "that is likely to result if development proceeds in accordance with the Master Plan".

Consistent with the 2014 Master Plan, the prescribed airspace drawings contained in this 2020 Master Plan present the airspace required to protect Ultimate Runway configuration, including the planned extensions to both 01 / 19 runways to the south, and the implementation of Displaced Threshold landing points maintaining touch-down points on both runways in their current position.

Due to the imminent airspace change that will occur on 21 May 2020 and the permanent closure of the 14 / 32 Cross Runway, airspace surfaces associated with the 14/32 Cross Runway are no longer included in the airspace diagrams included in this master plan.

The figures included in this section of the Master Plan are, within the constraints of presenting at a small scale, indicative of the extent of the airspace surfaces associated with the ultimate runway system development as articulated throughout this Master Plan.

The detailed definition drawings and data-sets of the OLS and PANS-OPS surfaces required for the development assessment process will be provided to all appropriate agencies.

CONTROLLED ACTIVITY / DEVELOPMENT ASSESSMENT

An activity that involves infringement of an airport's "prescribed airspace" (either because of its height, or because of the efflux generated by it), is termed a "controlled activity", and the Airports Airspace Regulations detail the notification and approval procedures to be followed in that event. This process applies not only to development at Brisbane Airport but also elsewhere across the city.

The "prescribed airspace" definition details the most critical or restrictive surface of the combined OLS, PANS-OPS and other surfaces.

Proposals are assessed as follows:

- The existing runway system and published procedures are used in assessments of short-term or temporary "controlled activities "(e.g. construction cranes). Brisbane Airport has a delegation from the Department of Infrastructure, Regional Development and Cities (DIRDAC) to assess some of these temporary activities, in consultation with CASA and Airservices Australia.
- The ultimate runway system and intended procedures are used in the assessment of permanent or long-term development and structures. These "controlled activities" must be approved by the DIRDAC.

For these proposals Brisbane Airport makes its own assessment and coordinates consultation with CASA, Airservices Australia and the Brisbane City Council, before lodging with DIRDAC for a decision. DIRDAC may approve the proposal, not approve or approve with conditions.

APPLICATIONS FOR APPROVAL

Brisbane Airport is the first point of contact for a person wishing to apply for approval to conduct a controlled activity. Applications for approval must (as required under regulation 7(2) of the Airports Airspace Regulations) set out:

- the nature of the proposed activity.
- its precise location.
- the proposed maximum height of the controlled activity (be it the proposed building or structure.
- the equipment proposed to be used in its construction/ erection), expressed in metres above the Australian Height Datum (AHD).
- the purpose of the proposed activity.

Upon receipt of an application, Brisbane Airport assesses the proposal and seeks feedback from CASA, Airservices, Brisbane City Council and any relevant airlines or aircraft operators.

The proponent's application and the stakeholder submissions are then sent to DIRDAC for final assessment and approval by their appropriate delegate.

CONSIDERATION OF APPLICATIONS

The Airports Airspace Regulations requires the Secretary of DIRDAC to either approve or refuse an application, or to impose conditions on any approval.

Conditions usually relate to measures to ensure continuing safety of air transport operations, such as lighting or marking of structures penetrating the Obstacle Limitation Surface and giving notice to users of the airspace about the new obstacle.

In considering whether to approve an application, the Secretary must have regard to the effect that the controlled activity may have on the safety, efficiency or regularity of existing or future air transport operations into or out of the airport. In this regard, the opinions of the airport operator company, CASA, Airservices, and the relevant building authority must be taken into account.

Subject to the exceptions set out below, the Secretary must approve an application unless the controlled activity would interfere with the safety, efficiency or regularity of existing or future airport operations out of the airport concerned.

APPLICATIONS FOR INTRUSION OF PANS-OPS SURFACES

Under regulation 14(5) of the Airports Airspace Regulations, an application to conduct a controlled activity (other than a 'short-term' controlled activity) which would result in an intrusion of the PANS-OPS airspace cannot be approved.

Regulation 14(5) of the Airports Airspace Regulations permits a short-term (less than three months) penetration of PANS-OPS surface to be approved if the airport company concerned (Brisbane Airport for approvals concerning Brisbane Airport) supports the approval.

The most common application of this nature is a proposal to use construction cranes that may, for short periods of time, be required to penetrate the airspace to a greater height (above the PANS-OPS surface) than the finished structure (below the PANS-OPS surface).

UNACCEPTABLE EFFECT ON SAFETY

Pursuant to regulation 14(6) of the Airports Airspace Regulations, the Secretary must not approve an application to undertake a controlled activity if CASA has advised the Secretary that carrying out the controlled activity would have an unacceptable effect on the safety of existing or future air transport operations into or out of the airport concerned.

The Secretary has no discretion to grant an approval once such advice is provided by CASA.

AIRSPACE PROTECTION

SHORT-TERM CONTROLLED ACTIVITIES

To ensure continued safety of operations, the regulations regarding the approval of short-term controlled activities state that approval of submissions cannot be given by DIRDAC without support from Brisbane Airport (Reg 14:5). As a result, Brisbane Airport has established a series of qualifying criteria to determine whether support can be given to a short-term controlled activity application.

Factors that need to be assessed include, but are not limited to the following;

- Can safe aircraft operations be assured while the intrusion occurs?
- What changes would need to be made to existing procedures to ensure continued safe operations for the extent of the short-term activity?
- To what extent would the efficiency and regularity of air transport operations be impacted by the proposed penetration? What alternative procedures would need to be used?
- Will temporary changes to procedures impact emergency/ contingency procedures such as aircraft engine-out procedures?
- Would proposed alternative procedures be acceptable to airlines using Brisbane Airport?
- Would any amended procedures result in higher costs for aircraft operators through increased track miles, increased fuel use and associated inefficiencies? Should the applicant for the controlled activity meet these costs?
- Is planning for a short-term (less than three months) penetration a realistic construction timeline?
- Would changes to procedures have any effect on amenity outcomes for communities subjected to increased overflights and/or altered flight patterns. Should the applicant be required to undertake a consultation process to ensure community acceptance?
- What will the cumulative impact of sequential applications be?

RESTRICTIONS ON GRANTING APPROVAL

Where an application for a short-term controlled activity will intrude into the PANS-OPS, Brisbane Airport will generally not support that activity if it will:

- Have any adverse safety or operational implications (as identified through Brisbane Airport's consultation with other stakeholders including CASA, Airservices and airline operators).
- Impose additional cost of operation on airlines, unless the applicant develops and establishes an agreement on an industry compensation response.
- Result in adverse community outcomes unless the applicant negotiates community acceptance of the impacts.
- Appear unlikely to be feasibly completed within the three month short-term criteria accorded such activities under the Airports Airspace Regulations; or
- result in intrusions into the direct approach and departure zones of the OLS and consequently impact runway operational lengths (with the possible exception of activities that can be undertaken in short negotiated periods at night).

Any decision by Brisbane Airport will be made both on the merits of the specific application and in consideration of the overall impact of the controlled activity (and other approved controlled activities) on aircraft operations into and out of Brisbane Airport.

TALL BUILDINGS POLICY

In August 2018, Brisbane Airport developed a Tall Buildings Policy, an advisory document that:

- Outlines legislative requirements, policies and processes used to define, manage and protect the prescribed airspace necessary for the safety, efficiency and regularity of air transport operations into and out of Brisbane Airport.
- Outlines Brisbane Airport's role in responding to applications for short and long-term intrusions into prescribed airspace; and
- Articulates Brisbane Airport's approach to ensuring the prescribed airspace is consistent with the regulatory framework and aviation standards.

The Policy was created to manage challenges arising from the use of construction cranes in the Brisbane CBD. The intention of the Policy is to assist developers and planning authorities alike in understanding necessary airspace protection requirements and the potential implications of comprising airspace.

APPLICATIONS FOR APPROVAL

The Tall Buildings Policy nominates Brisbane Airport as the first point of contact for a person wishing to apply for approval to conduct a controlled activity. As required under regulation 7(2) of the Airports Airspace Regulations, any application must provide:

- Details of the type of proposed activity.
- The precise location of that activity.
- The proposed maximum height of the controlled activity.
- The equipment to be used in its construction/erection), expressed in metres above the Australian Height Datum (AHD); and
- The purpose of the proposed activity.

NOTIFICATION OF DECISIONS

Upon receipt of an application, Brisbane Airport's approach to assessing proposals will include seeking feedback from CASA, Brisbane City Council, Airservices Australia and all relevant airlines or aircraft operators.

The application and all stakeholder submissions are then sent to DIRDAC for assessment. DIRDAC considers Brisbane Airport's opinion on any controlled activities that may impact operations.

DEVELOPMENTS SINCE THE 2014 MASTER PLAN

Since the previous 2014 Master Plan, Brisbane Airport has experienced a significant increase in the volume of Controlled Activity submissions. Additionally, and related to the propensity for developers of CBD high-rise buildings to build to the absolute airspace limits, the facilitation of construction cranes required to complete those buildings has been highly challenging for Brisbane Airport, the construction contractor and the application of the regulatory processes associated with assessing and approving the crane activity.

Brisbane Airport has experienced non-compliance with controlled activity approvals associated with construction cranes operating at unapproved heights, cranes requiring approval iterations due to non-completion within the initial advised timelines and also equipment failures.

All of these experiences have focussed both Brisbane Airport and DIRDAC on the need to ensure that controlled activity assessments for future similar high CBD structures must include careful consideration of construction methodologies and proposed crane operations.

Brisbane Airport has initiated further industry engagement with developers to improve the awareness of airspace constraints and the necessary approval processes and timelines to secure controlled activity approvals, through workshops with the Property Council Queensland Division and major contracting companies.

OBSTACLE AND HAZARD CONSIDERATIONS

OBSTACLE AND HAZARD CONSIDERATIONS

The final approach, take-off and climb phases of flight are the most demanding in terms of pilot workload. Checklists, instruments, radio communications, aircraft configuration and speed changes, weather conditions, other traffic, manipulation of controls, approach monitoring, etc. require intense pilot attention and concentration.

Distractions under the approach and take-off paths may impact on aircraft safety. Issues concerning lighting, navigational aids, visibility and other considerations affect land-use planning beyond the airport boundary.

RESTRICTED LIGHT ZONES

The use of lighting around Brisbane Airport is mainly a concern in close proximity to the airport, where there are two main problems that can arise:

- If bright lights, such as floodlights, emit too much light above the horizontal plane, then there is the possibility that a pilot could be dazzled, and momentarily unable to read cockpit instruments. Those lights could also have an effect on air traffic controllers' ability to clearly see aircraft approaching the airport.
- In addition, lights might create a pattern that looks similar in appearance to approach or runway lighting and this may cause confusion for a pilot. Street lighting, security lighting and illuminated sports fields are examples that require special consideration. The problem will often be able to be corrected by suitable screening or shielding of the light source.

CASA has powers to deal with lights that can be considered hazardous in either of these ways (Regulation 94, Civil Aviation Regulations 1988). It is preferable if the light design can take account of these possibilities in advance rather then look at modification after installation is complete.

Chapter 9.21 of the CASA MOS Part 139 – Aerodromes, entitled 'Lighting in the Vicinity of Aerodromes', will assist in meeting these requirements. The figure opposite shows the restricted lighting zones at Brisbane Airport in accordance with these standards.

INTERFERENCE WITH AIR NAVIGATION AIDS

Aids to aircraft navigation, and to approach and landing manoeuvres, are an essential element of the air transport system. They have to be sited relative to the airport, airspace and aircraft flight paths they serve. Power lines, large buildings, moving vehicles, and the like, can affect the efficiency and reliability of their operation. Therefore, their possible impacts on navigational aids need to be considered.

Facilities in the vicinity of airport navigational systems that have high electromagnetic or radio wave emissions may have the potential to impact on those systems, as well as on aircraft on-board electronic systems. In addition, Brisbane Airport is committed to ensuring developments at the airport will not compromise the efficacy of the existing navigational aids.

Brisbane Airport will continue to work closely with Airservices Australia to ensure relevant equipment and navigational aids remain operational during on-airport construction activities.

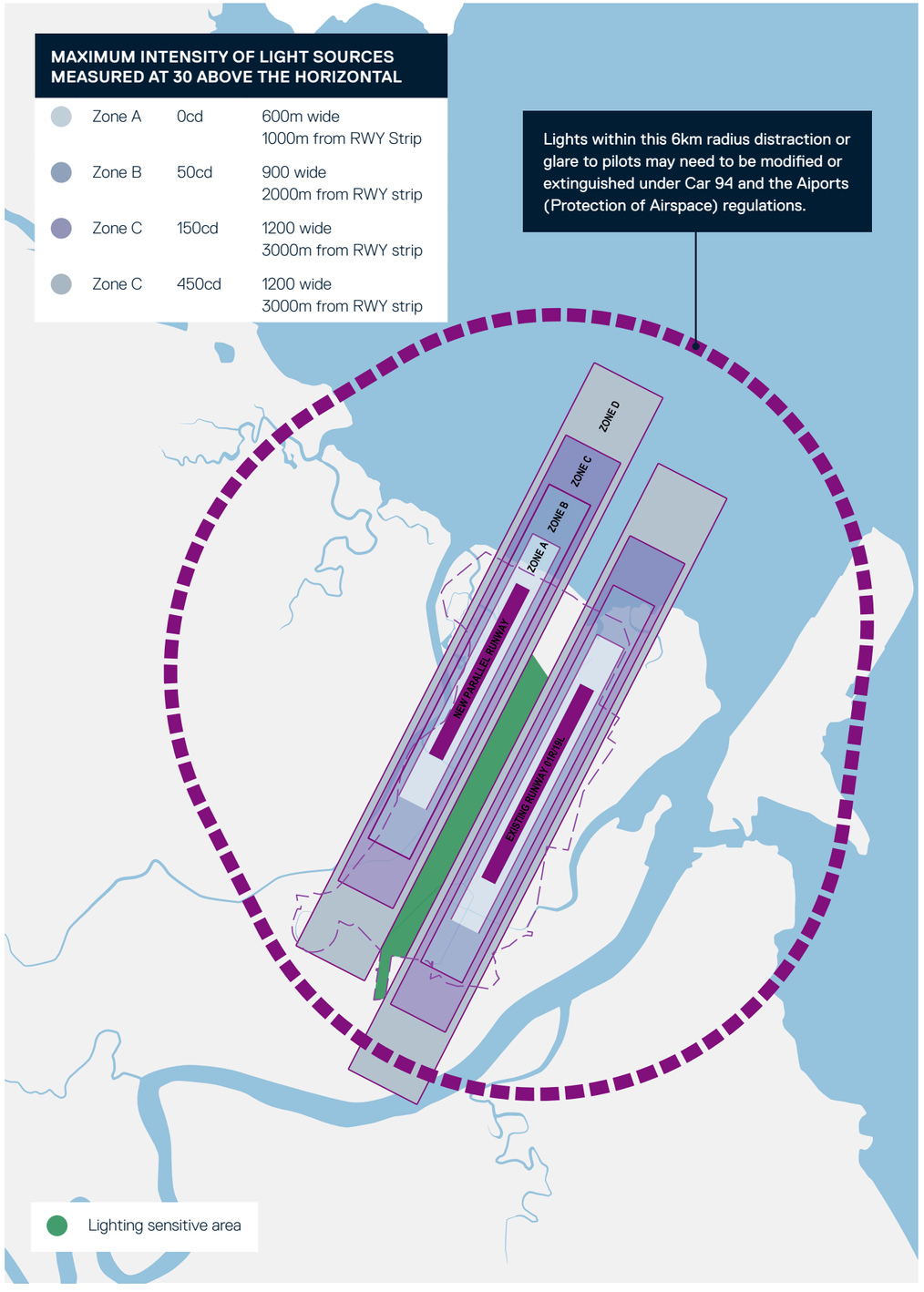
In most cases Brisbane Airport navigational facilities are installed and maintained by Airservices Australia which is a referral organisation on issues of airspace protection requirements.

Brisbane Airport has a direct interest in ensuring the protection of any aids located on or in the vicinity of the airport and works collaboratively with Airservices Australia on the impact assessment of on-airport development proposals, and those off-airport proposals referred to Brisbane Airport.

MAJOR AIRFIELD LIGHTING SYSTEMS

Consistent with best-practice precedent at other Australian major airports, Brisbane Airport has included protection of light plane surfaces associated with major airfield lighting installations such as the High-intensity Approach Lighting arrays at each end of the runways.

ULTIMATE DEVELOPMENT RESTRICTED LIGHT ZONES



AIRSPACE PROTECTION

WILDLIFE HAZARDS

At all airports, wildlife hazards have the potential to cause major damage to aircraft, representing a major risk to safety. Consideration of that risk is critical in land-use planning decisions and in the way that existing land-use is managed in the vicinity of the airport.

Brisbane Airport is surrounded by areas attractive to wildlife, especially birds. The south-west end of the new runway is largely bound by the Kedron Brook. Activities in that area that have the potential to cause hazardous wildlife attraction or activity, including recreational fishing, are discouraged by Brisbane Airport.

The recently installed High Intensity Approach Lights to the north of the new runway have the potential to attract additional wildlife in offering perching options for birds. Brisbane Airport is investigating environmentally friendly options to act as bird deterrents on that installation.

To deter recreational fishing, the installation is elevated above water, reducing opportunities for boats to dock at the structure. CCTV has also been installed, allowing the airport to respond to any issues as they arise.

Other land uses at Brisbane Airport with the potential to attract wildlife will be managed based on proximity, using identified actions for existing and proposed developments within the ICAO guided radius zones.

For example, the development of a new sports facility is identified to have a 'moderate' wildlife attraction risk. Action to minimise that risk will depend on its proximity to the airport, with developments within 3 kilometres mitigated while similar developments within 8 kilometres and/or a 13 kilometres radius will be subject to monitoring.

Brisbane Airport will continue to work with relevant planning authorities to minimise the impact of wildlife hazards at and near Brisbane Airport.

LOW VISIBILITY OPERATIONS

Operations are Brisbane Airport are currently limited during low visibility conditions, such as fog, low cloud or heavy rain. With the forecast increase in passenger demand, minor low visibility events could have a significant impact on operations at Brisbane Airport and across the eastern seaboard of Australia.

To continue to improve safe services to passengers and airlines, Brisbane Airport is investing in infrastructure and aids to improve outcomes of operations during low visibility conditions. The new runway has been designed to accommodate low visibility operations, and existing airfield infrastructure for Runway 01R/19L will be upgraded as required to support low visibility operations.

The investment in new infrastructure and services will increase airfield capacity during low visibility conditions while also improving runway safety and decreasing the risk of runway incursions. Additionally, existing airfield infrastructure will be upgraded to match the facilities of the new runway.

STOP BARS

Runway incursions can take place in all visibility or weather conditions. Several Australian airports have installed stop bar lighting to enhance low visibility operations at the airport. Stop Bars are a row of lights at the entrance to a runway which, when lit, warn pilots that they must not enter the runway.

The installation of stop bars, together with other new facilities, allows landings and take-offs to take place in low visibility conditions where otherwise extensive delays may occur.

Brisbane Airport is currently finalising the Stop Bar design for the existing Runway 01R/19L. The Stop Bars will be in operation when the new runway opens in 2020.

RUNWAY VISUAL RANGE

The term Runway Visual Range (RVR) describes the maximum distance in the direction of take-off or landing at which the runway, or specified lights or markers delineating it, can be seen from a position above a specified point on its centre line at a height corresponding to the average eye level of pilots at touch-down.

RVR equipment provides for electronic calculation of visibility.

New RVR equipment is currently being installed at Brisbane Airport with BOM certification expected by mid-2019. Included in the scope of the RVR project was the installation of pit and duct infrastructure for Stop Bars on the eastern side of the existing runway.

HIGH INTENSITY APPROACH LIGHTING

Brisbane Airport has installed High Intensity Approach Lights (HIAL) to the north and south of Runway 01R/19L and has recently constructed HIAL to the north of the Runway 01L/19R. In conditions of low cloud or reduced visibility, these lights facilitate a smooth transition from instrument to visual flight on a precision instrument approach.

Brisbane Airport plans to install HIAL to the south of Runway 01L/19R in the short-term future. HIAL's will be in operation when the new runway opens.

AIRSPACE PROTECTION

AERONAUTICAL GROUND LIGHTING (AGL) CONTROL AND MONITORING SYSTEM

The new Runway 01L/19R AGL system requires a bespoke control and monitoring system. In order to provide similar controls across the Runway 01R/19L AGL and the existing AGL, a migration to an Integrated Airfield Lighting Control Monitoring System (AGLCMS) will be necessary.

The project has two operational phases:

- Phase One: The migration of the existing airfield AGL.
- Phase 2: Deployment of the AGLCMS in conjunction with the AGL for the new runway.

Upon completion of the new Stop Bar installation, Stop Bars for the existing airfield will be integrated with the AGLCMS. Phase 2 is scheduled for completion at the end of 2019, prior to the opening of the new runway.

TELECOMMUNICATIONS TOWERS

In the digital age, Brisbane Airport is aware that emergent technologies, offering new mobile phone and tablet services, attractive to passengers and stakeholders are likely to continue to emerge in the near future. The airport is committed to providing access to the highest quality of telecommunications infrastructure.

All telecommunications towers and other telecommunications infrastructure, current or planned are required to comply with all airspace protection regulations, including OLS, PANS-OPS and those regulations governing potential interference with navigational aids.

STACK/VENT EFFLUX AND VISIBILITY HAZARDS

Although it is becoming increasingly unlikely with the implementation of strict emission controls, there may still be instances in which industry located in proximity to an airport may create a smoke hazard, which could reduce visibility for visual flight operations. A similar situation may arise in relation to land uses or construction works which generate a severe dust problem.

Of more concern is the potential impact of either high velocity, high volume, high temperature or oxygen depleted discharge from stacks located in aircraft manoeuvring areas. This can interfere in the safe running of the airport.

Development proposals that incorporate these structures therefore require careful assessment on their potential impact on the safety of aircraft operations.

A facility located within the “prescribed airspace” footprint, regardless of its physical height, with an efflux rate of greater than 4.3 metres/second measured at the discharge point will trigger further assessment to determine whether the facility will require approval as a “controlled activity” under the Airports Airspace Regulations.

OTHER CONSIDERATIONS

Other planning considerations with regards to airspace protection include:

- The location on the Boggy Creek and Serpentine Creek wetlands and abutting Moreton Bay, with its associated bird activity increases the potential for aircraft bird strike incidents – a potentially serious safety issue.
- Land-use, developments, and their design and landscaping in the vicinity of the airport should not compound this problem by providing an attraction to bird life (e.g. because of a type of flora planted or new water receptacles created).
- Land-use planning in the vicinity of the airport needs to take account of the risks, however slight, associated with aircraft operations in the siting of:
  - fuel or hazardous material storage facilities.
  - facilities that involve large concentrations of people.
  - major public utility infrastructure.
  - any other activity in the air that may impact on aircraft operations.
  - large structures and building materials utilised in those structures located close to the Brisbane Airport runway systems final approach and take-off areas.
- Wind shear conditions can potentially influence aircraft Ground Proximity Warning Systems, with glare off large reflective surfaces potentially impacting pilot concentration at a critical stage of aircraft manoeuvres.
- Clear line of sight from the Airservices Control Tower cabin to the primary airside manoeuvring areas should be maintained and mitigating technology and procedures need to be developed to address compromised areas.
- Reflectivity can also be an issue for air traffic controllers due to the potential for interference with radar and other navigational aids, with glare potentially affecting air traffic controllers as well as pilots.

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

This section describes the process that was undertaken to finalise the flight path and airspace design to support the safe and efficient operation of the new parallel runway system at Brisbane Airport.

The development of a complex flight path must have safety as its principle objective. Once the regulatory standards, requirements and approval conditions have been met and safely achieved, minimising environmental impact and maximising operational efficiency must also be incorporated while ensuring equitable access remains for operations at all other airports within the airspace design.

The flight path and airspace design process for Brisbane's New Runway started in the early 2000's with the concept design for the FY2005/06 Environmental Impact Statement (EIS) and Major Development Plan (MDP). The EIS/MDP flight path diagrams and noise contours were extensively documented and consulted with the Brisbane community and airport stakeholders and have continued to be communicated consistently across the Brisbane community in the years since 2006.

In 2015, Brisbane Airport and Airservices Australia initiated a detailed airspace and flight path design process to develop a final design that utilised the latest available technology to meet current safety and regulatory standards and requirements, while optimising efficiency and minimising environmental impacts as much as possible for the opening of the parallel runway in 2020.

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

EIS/MDP APPROVAL

In 2007, after extensive consultation and consideration of feedback, both the Federal Transport Minister and the Federal Environment Minister granted approval to Brisbane Airport Corporation to construct a parallel runway at Brisbane Airport (designated Runway 01L/19R). Along with many conditions stated in the approval, the Minister provided guidance about flight path design.

The Federal Transport Minister recognised that those flight-paths which were depicted in the EIS/MDP were based on the existing operations (2004) where possible, and also on an analysis of future developments in the aviation industry. However he recognised that between 2004 and the opening of the new runway, (then projected for 2015, but now to open in 2020), there would be considerable introduction of developing technology and an evolution of airspace management practices and regulatory and safety standards.

As a result the Ministers guidance on flight paths was that they should be developed:

- Using existing flight-paths where possible, including those flight-path changes developed and introduced between 2007 and the commissioning of the new runway
- Aligned where possible with the flight-paths presented in the EIS/MDP
- Taking into account the introduction and expected future introduction of new technologies and standards

FLIGHT-PATH DESIGN

The area of airspace required for the new parallel runway system extends a significant distance from Brisbane Airport and interfaces operations associated with Gold Coast, Sunshine Coast, Defence Base Amberley, and several general aviation airports including Archerfield, Redcliffe, Caboolture, Caloundra, and Southport.

Aircraft operations at Brisbane Airport are significantly influenced by the positioning and orientation of the various airport/aerodrome/airfield locations and the orientation of runways at those sites. Providing equitable access to all airspace users and separation with military airspace operations in Amberley's airspace which extends to within 30km to the west of Brisbane Airport, are critical regulatory requirements and constrains the location of fight paths.

These constraints, in addition to the required crossover of departures and arrivals at Brisbane Airport, results in numerous points where flight paths must cross, requiring the application of vertical separation standards (typically a minimum of 1,000 feet) to ensure safe operations.

Flight-path crossover points must be positioned to meet safety standards and must also allow aircraft to operate as efficiently as possible, optimally at reduced throttle settings to minimise fuel burn, emissions and noise.

At the time of the development of the EIS/MDP, while some use of on-board aircraft navigation systems was used to manage crossover points, a large degree of manual intervention by Air Traffic Control (ATC) was required. Management of crossovers by ATC manual intervention results in aircraft having to level off on climb or descent at low level, with resultant extra noise and fuel usage (CO_2 emissions) and reduces the operational efficiency of the runway.

Since the EIS/MDP there has been a significant increase in the proportion of aircraft operated by major airlines capable of using sophisticated on-board navigation systems to assist ATC in managing crossovers by flight-path design, rather than relying on manual ATC intervention. One such improvement in systems is the current ability of the jet aircraft fleet to fly flight paths that are designed to meet the International Civil Aviation Organisation (ICAO) Required Navigation Performance (RNP) standards utilising satellite based navigation. This type of navigation is now mandated across Australia by the Civil Aviation Safety Authority (CASA).

RNP standards allow for a flight-path design that incorporates "safety by design" rather than relying on ATC manual intervention. Safety by design allows the pilot to use on-board navigation systems to manage the flight-path over the ground, its speed relative to other aircraft, and most importantly the vertical flight path flown, such that the need for a level-off at low altitude is significantly minimised.

REQUIRED NAVIGATION PERFORMANCE

Part of the introduction of satellite navigation into Brisbane Airport was the use of Required Navigation Performance - Authorisation Required (RNP-AR) approaches, also known as Smart Tracking, with initial implementation on 18 January 2007, providing the improved safety, operational and environmental outcomes associated with this technology.

In accordance with the EIS/MDP approval conditions, these RNP-AR flight-paths have been retained to and from the existing runway (now redesignated as Runway 01R/19L) in the new parallel runway flight-path design.

In 2018, the ICAO issued an updated rule set that permits the application of RNP AR to wide spaced parallel runways for simultaneous use of both runways, removing the need to manually fly aircraft on headings at level altitudes onto final approach to the runway as required in the previous rule set. To provide the safety, efficiency and environmental benefits that this technology provides, the arrival flight-paths to both runways in the new Brisbane airspace design make use of the RNP-AR standards as approved by ICAO. This supports constant descent approaches using minimum power settings and reduced engine noise relative to manual flight of aircraft using headings.

Incorporating RNP-AR to join final approach for parallel runways is the type of technological advancement utilising the latest available safety standards envisaged in the governments response to the EIS/MDP.

POSITIONING OF FLIGHT PATHS

The use of RNP technology and ICAO parallel runway standards to allow simultaneous runway use, together with the need to meet aircraft performance requirements for climb, descent and rate of turn, and standards to separate arriving and departing aircraft, is a key determinate for the positioning of the flight-paths for both arriving and departing aircraft.

Positioning of flight paths requires that all approvals, regulatory standards and rule sets have been applied and "safety by design" is achieved.

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

STANDARD INSTRUMENT DEPARTURES (SIDS) AND STANDARD ARRIVAL ROUTES (STARS)

Flight paths for arriving and departing aircraft are designed in such a way that they can be digitally coded and loaded into the aircraft and ATC software systems to provide exactly the same information to pilot and ATC. This provides predictability and consistency and reduces the possibility of human error. The flight-paths within 80km of the Airport linking runway arrivals and departures to high level routes are known as Standard Instrument Arrivals (STARS) and Standard Instrument Departures (SIDS).

- STARS connect arriving aircraft to the type of approach required to ensure a safe landing on the runway. The position at which the STAR connects to the approach is determined by regulatory standards. STARS to each runway end connect to three different types of approach:
  - Instrument landing system (ILS)
  - Visual approach
  - Required Navigation Performance Authorisation Required (RNP AR)
- SIDS provide navigation guidance to enable aircraft to safely depart the runway to intercept the outbound route.

The safety standards for simultaneous parallel runway departures have been met by designing a straight ahead flight path from one runway and a turn of 15 degrees or more from the other runway to ensure there is sufficient divergence when aircraft are departing simultaneously.

FINALISATION OF THE AIRSPACE DESIGN

Given the extent and complexity of the airspace over multiple airports, the technical design standards and regulatory requirements, and requirement to meet the Ministerial approvals and conditions, several specialist areas were considered in parallel to achieve a safe and efficient design and to minimise environmental impacts.

Specialist areas included:

- Air Traffic Control (ATC) - safety management, capacity management, human machine interface (HMI) and flight path design specialists, fast time and real time ATC and airfield simulation.
- Environment and Community Engagement Specialists – noise modelling, environmental assessment and advice, community considerations to minimise noise effects including noise abatement procedures.
- Airlines – system performance engineers, flight crew technical experts, flight simulators.
- Flight Standards - ICAO procedures and standards specialists, aircraft performance specialists
- Civil Aviation Safety Authority (CASA) – regulatory requirements and approvals

As well as designing to the required safety standards and approval requirements, and ensuring efficiency of operations, designers were required to consider how to best minimise noise and ensure equity of access for all airspace users. A small change in design for an improvement in one area may impact on the design in another area so the overall benefit was continually assessed as the design progressed.

A fundamental principle achieved was to maximise the use of continuous descent operations and continuous climb operations which reduces aircraft noise, fuel and emissions as aircraft are managed by the aircraft systems and not flown manually on stepped descent or climb segments.

As a result of the complexity associated with all of the requirements and constraints, the finalised airspace design underwent twenty one iterations before reaching a stage that could be presented to CASA for airspace change approval.

FEATURES OF THE PARALLEL RUNWAY AIRSPACE DESIGN

SIMULTANEOUS OPPOSITE DIRECTION OPERATIONS (SODPROPS)

The positioning of the parallel runways adjacent to Moreton Bay and 2km spacing between the runways allows the use of SODPROPS to minimise the overflight of residential areas.

When SODPROPS are in use, all jet operations are confined to over Moreton Bay, with arrivals over water onto the new Runway 19 Right, and departures over water off the existing Runway 01 Right. A small number of turbo propeller aircraft are permitted to depart from the new runway 19R if departure demand is excessive from 5am to 10pm.

SODPROPS has been introduced as the first priority method of operating between 10pm and 6am.

The SIDS and STARS to support this mode have been designed in such a way that the initial climb and final descent phase of the flight of jet aircraft is all over Moreton Bay. The operational technique of using minimal reverse thrust on landing has also been applied to this mode to minimise impacts on communities adjacent to the airport.

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

FEATURES OF THE PARALLEL RUNWAY AIRSPACE DESIGN

RUNWAY 19 LEFT AND RIGHT OPERATIONS (ARRIVALS AND DEPARTURES IN A SOUTHERLY DIRECTION)

ARRIVALS

Runway 19 Left (19L)

Arriving aircraft from the south and east will generally land on the existing Runway 19L, and will fly STARS that are generally consistent with the existing arrival flight paths.

The later stages of flight have been confined to over water and the principles of constant descent have been employed.

Runway 19 Right (19R)

Arriving aircraft from the north and west will generally land on the new Runway 19R. In the later stages of flight, aircraft from the north and west will continue to use existing over water flight paths but join the final approach for 19R.

To meet the principle objectives of safety by design, facilitate an airspace that allows continuous climb and descent, and meet the geometry required by the design standards, the jet arrival flight paths from the north of Brisbane Airport have been moved further west than the existing flight paths. As a result, the existing flight paths over the north western suburbs around Ferny Grove and Upper Kedron have been moved to less developed areas west of Samford.

While STARS are designed to be flown by the aircraft navigational systems without pilot manual intervention, ATC may require aircraft to be taken off track when separation requirements, excess arrival demand or weather conditions require it.

DEPARTURES

Runway 19 Left (19L)

Departures to southern and eastern destinations will generally depart from the existing Runway 19L. Two jet SIDS currently exist from 19L.

One SID turns left at approximately 2km and 1000' and will continue to be used in the parallel runway system airspace design for southern and eastern departures.

The second SID maintains runway track and turns right once just past the CBD of Brisbane. In the parallel runway operation, this departure track will only be used by aircraft that have a specific operational requirement to depart off 19R or in those periods at night when weather conditions are not suitable for SODPROPS. There have been some minor variations to this departure track as it proceeds west and north after the initial right turn as explained below.

Runway 19 Right (19R)

Departures to northern and western destinations will generally depart from the new Runway 19R.

The jet SIDS for this runway depart straight ahead for the first 10 km. At this distance all of the SIDS commence a right turn and track to a point further west than either the existing SID or that predicated in the EIS. The extension of the SIDS further west is due to separation requirements with both arriving and slower departing aircraft and to maximise the use of overflight of non-populated areas to minimise the impact of noise, such as Enoggera reservoir.

At this further west turning point, the SIDS split to track to northern, north western and western destinations. The extension of the departure flight path further west results in reduced population overflight to the north west by overflying less populated areas around Mt Cootha and Enoggera Reservoir and higher altitudes as aircraft then fly over residential areas further north.

RUNWAY 01 LEFT AND RIGHT OPERATIONS (ARRIVALS AND DEPARTURES IN A NORTHERLY DIRECTION)

ARRIVALS

Runway 01 Right (01R)

An RNP-AR approach was introduced to the existing runway 01R in January 2007 for operations from the south and east and this approach will continue to be used as it meets the applicable international standards.

The current STAR for ILS approaches from the south and east does not meet the international standards for simultaneous operations of parallel runway approaches. The new STAR from the south is further south than both the existing STAR and the flight path predicted in the EIS, and must provide level flight at 3000ft for a short distance to meet the standards.

To join up with both the RNP-AR and ILS approaches and meet the required design geometry and standards, the STAR from the east has been moved further south than both the existing STAR and that predicated in the EIS. In designing this STAR use has been made of less populated areas, such as golf courses, and aircraft will cross the coast line a minimum of 2000' higher than the existing STAR.

Runway 01 Left (01L)

To provide the required design geometry and regulatory standards for simultaneous approaches to both Runway 01L and 01R, all outer arrival paths from the north have been moved further west than the existing paths, to the west of the suburban development spine north of Brisbane CBD.

From the common outer section of the STARS, aircraft flight paths will split and join the final approach, either via a new RNP-AR approach which joins final approach at approximately 7 km from the runway, or via the ILS join at approximately 25 km from the runway.

The STAR for aircraft arriving from the west is positioned to move aircraft south of Amberley's airspace and over the less populated areas to the south west of Brisbane.

DEPARTURES

Runway 01 Right (01R)

There have been minor initial heading changes off the existing runway as required to meet the simultaneous parallel runway departure standards. All jet SIDS to the south continue to track initially over water with aircraft on constant climb, maximising altitudes prior to crossing the coast.

Runway 01 Left (01L)

The SIDS from this runway replicate the existing northern and western SIDS as closely as possible. They are designed for constant climb and the over water path designed for jets allows sufficient room for turbo prop aircraft to remain over water as well generally until above 3000'.

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

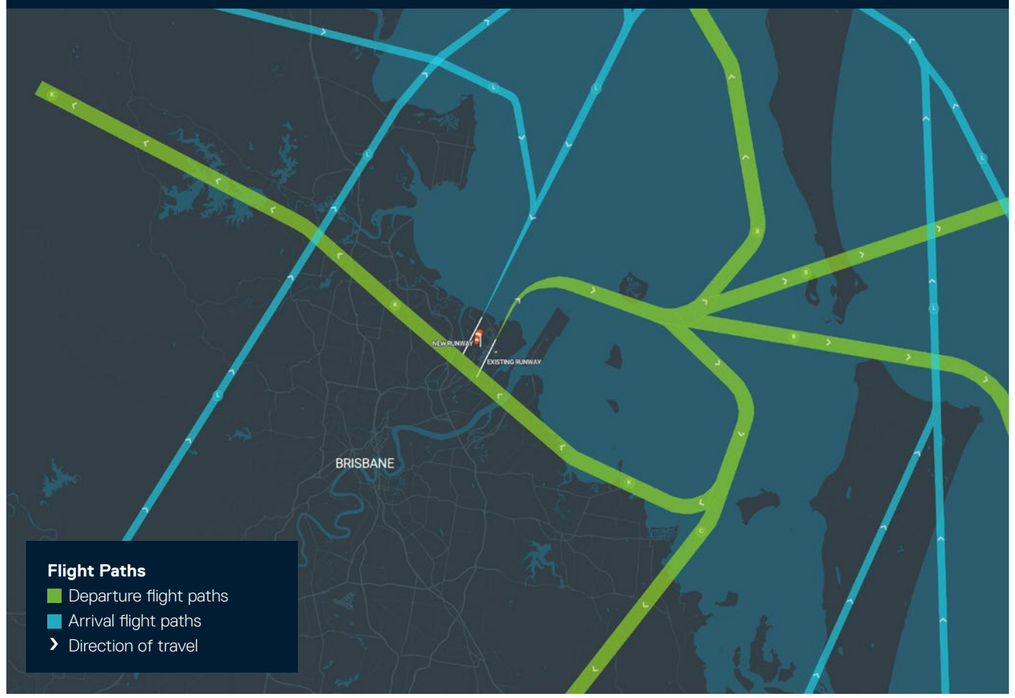
FLIGHT PATHS

The Brisbane Airport flight path tool shows the jet arrival and departure flight paths from Brisbane Airport, both current and when the new runway opens in mid-2020.

It allows a user to search any address in Brisbane in relation to these flight paths, to understand the impacts on the selected address.

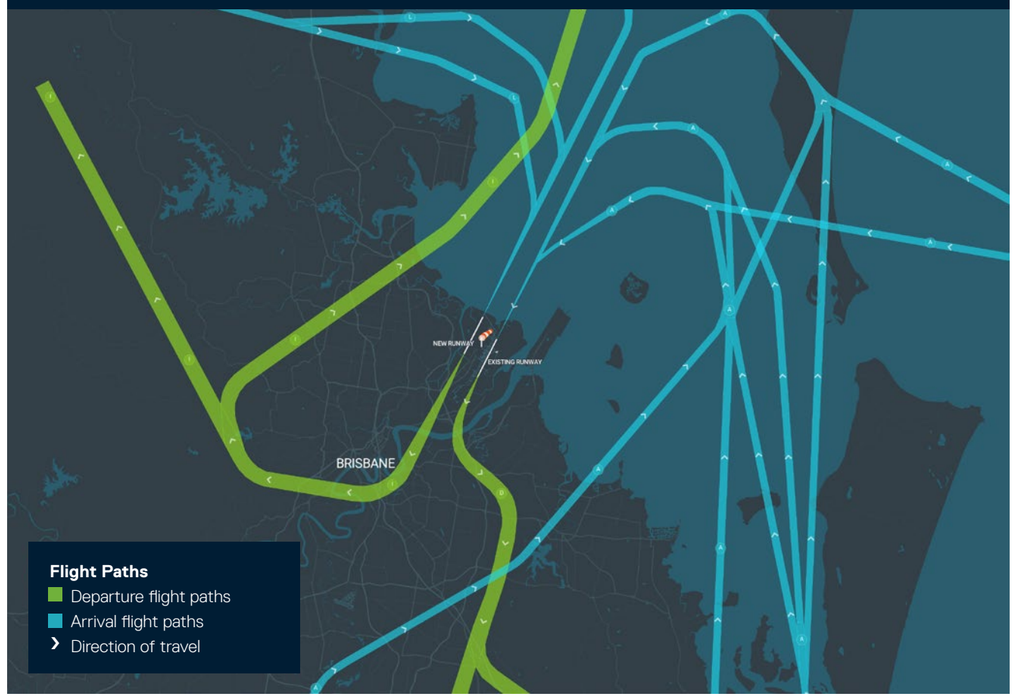
The tool also shows noise mapping, highlighting areas affected by aircraft noise of 70 decibels or more.

FLIGHT PATHS WITH BRISBANE'S NEW RUNWAY PREFERRED NIGHT TIME OPERATIONS (10PM – 6AM)



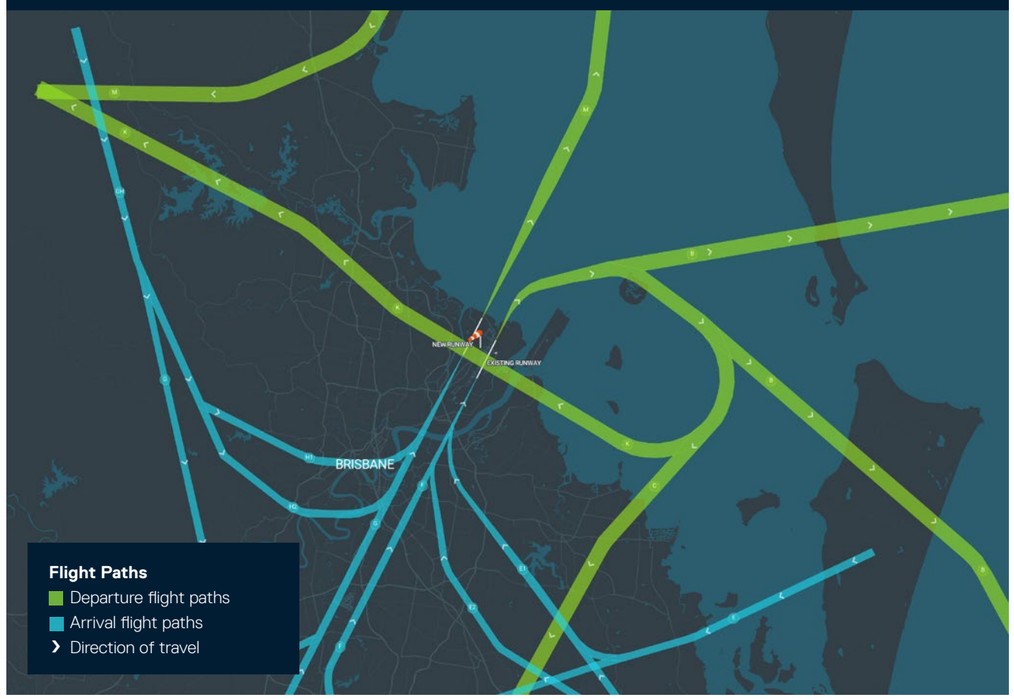
FLIGHT PATHS PRIOR TO BRISBANE'S NEW RUNWAY – SOUTHERLY WINDS

FLIGHT PATHS WITH BRISBANE'S NEW RUNWAY – SOUTHERLY WINDS



FLIGHT PATHS PRIOR TO BRISBANE'S NEW RUNWAY – NORTHERLY WINDS

FLIGHT PATHS WITH BRISBANE'S NEW RUNWAY – NORTHERLY WINDS



HELICOPTER OPERATION FLIGHT PATHS

In order to facilitate helicopter operations (predominantly emergency and medical response), in and out of these areas without disrupting airport runway operations, air traffic controllers use three standard flight path routes:

- Brisbane Airport direct to and from Mount Coot-Tha TV Towers – approximately 1-2 flights a day
- Brisbane Airport direct to and from Manly Boat Harbour – approximately 3 flights a day
- Brisbane Airport direct to and from Bald Hills Radio Mast – approximately 3 flights a day

STANDARD HELICOPTER ROUTES

BRISBANE'S NEW RUNWAY AIRSPACE DESIGN

FLIGHT PATHS AND NOISE ABATEMENT PROCEDURES

Noise abatement procedures are developed during the airspace design process to optimise the use of the noise minimisation built into the design. These procedures are ultimately instructions provided to pilots and ATC.

NOISE ABATEMENT DURING NIGHT TIME

The preferred noise abatement operating mode at night between 10pm and 6am is SODPROPS.

At other times, SODPROPS may be used when aircraft traffic demand levels and weather conditions allow, to minimise overflight of residential areas outside the night hours. This is likely to occur during periods of low demand in the evening during the week, and evening and early morning at the weekend. SODPROPS is only available when visibility is 8km or greater, and the cloud base is 2500' or above. The tailwind must also be 5 knots or less and the runway surface must be dry.

If the cloud and/or visibility conditions are less than those required for SODPROPS, Reciprocal Runway Operations (RRO) will be used, where traffic demand allows, up to 5 knots of tailwind. RRO makes use of both runways for arrivals and departure over the bay with greater spacing required between aircraft, and can only be used during periods of low demand.

At night, when SODPROPS or RRO cannot be used (generally when winds are greater than 5 knots) the preferred operations are Runway 19L/R for landing and Runway 19L for take-off, or Runway 01R for landing and Runway 01L/R for take-off, for noise minimisation.

Runway 01L will not be permitted to be used for landings between 10pm and 6am, except when weather conditions (e.g. thunderstorms, fog, and heavy rain) or temporary infrastructure constraints (e.g. runway or taxiway closure) make it the only runway available for landings.

Runway 19R will not be permitted to be used for take offs between 10pm and 6am, except when weather conditions (e.g. thunderstorms, fog, heavy rain) or infrastructure constraints (e.g. runway or taxiway closure) make it the only runway available for departures. Another exception may be operations between 5am and 6am for a limited number of non-jet aircraft to help reduce the delays to departing jet aircraft on 01R.

In addition to a priority for the use of over water modes during the 10pm and 6am, other operating techniques will be used in this period to limit aircraft noise. These include:

- No intersection departures for jet aircraft will be permitted on the 19L runway between 2200 and 0500 local time.
- Between 10pm and 6am local time when the landing runways are 19R/L, jet aircraft will not be permitted to descend below 5000' and turbo propeller aircraft below 3000' until over water.
- When over bay operations are not available due to weather, and landings are on runway (end) 01R, all aircraft will not be permitted to descend below 3000' until aligned with the runway centreline.
- When aircraft are departing in the 01L/R direction, all aircraft will be contained over water until above 5000'.

It should be noted that in this context the term "all aircraft" applies to all jet aircraft, other aircraft with a maximum take-off weight exceeding 5,700kg, and all other fixed wing aircraft with two or more engines.

Departing aircraft will be issued with a procedural Standard Instrument Departure (SID) all of which have preferred noise abatement procedure flight paths. When compliance with the preferred flight paths is not possible due to prevailing weather conditions, aircraft will be manually flown as closely as possible to the preferred flight paths.

Noise abatement procedures will specify that pilots will be requested to minimise the use of reverse thrust on landing where operational safety allows.

NOISE ABATEMENT DURING DAY TIME

During the day, Runway 19L/R will be preferred to ensure aircraft over residential areas are as high as possible, making maximum use of the buffer between the airport and residential areas. This preferred runway mode during the day will be subject to traffic demand when a runway change is required.

NOISE MANAGEMENT

Brisbane Airport is committed to working closely with the community, Airservices Australia, the airlines, and Commonwealth, State and Local Governments to minimise the effects of noise associated with airport operations on the community as much as possible.

The strategic location of the airport adjacent to Moreton Bay with a 6km buffer zone to the nearest residential areas to the south, as planned in the 1970's, provides the opportunity to further maximise over the bay operations and height of aircraft over residential areas with the introduction of Brisbane's New Runway in 2020.

Brisbane Airport proactively supports management of aircraft noise at the airport through the following activities:

- Works closely with Airservices Australia, who is responsible for the design and use of flight paths, on development and implementation of airspace and flight path design and noise abatement procedures making maximum use of the airport location and the latest available navigation technology to minimise the effect of aircraft noise
- Supports the use of quieter new generation aircraft
- Develops and maintains infrastructure to support efficient and environmentally responsible aircraft operations
- Ensures procedures are in place to control noise generated by engine ground running and reverse thrust and effective responses to ground based noise complaints
- Participates in the Brisbane Airport Community Aviation Consultative Group to properly inform community representatives and respond to community concerns about aircraft operations at the airport
- Works together with federal, state and local government to support the National Airport Safeguarding Framework guidelines, including providing noise metrics and advice to ensure inappropriate development is avoided in areas excessively affected by aircraft noise.

NOISE MANAGEMENT

DESCRIPTION OF AIRCRAFT NOISE

Aircraft noise is created by several different parts of an aircraft, which vary at different stages of flight.

The airframe and engine are a source of noise during arrivals and final approach, the engine creates noise during the flight as well as during departure and climb-out phases of flight.

The airframe of an aircraft refers to the slats, flaps, spoilers, aileron, and elevator components.

The level of noise that can be heard from an aircraft during take-off, landing and during flight can vary depending on a number of different factors, including: the weather, including season, wind and cloud cover, the height of an aircraft, changes in engine thrust, and the type of aircraft.

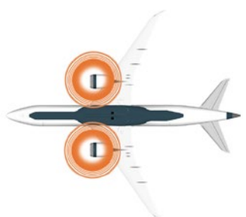
Noise is also subjective person to person and what you hear can be influenced by many different factors including your surroundings and other activities happening in the background.

AIRCRAFT NOISE SOURCES

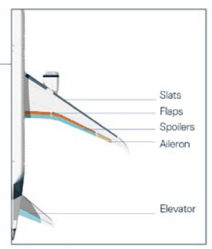
ARRIVALS AND FINAL APPROACH
(Airframe and engine noise)

AIRCRAFT DURING FLIGHT
(Engine noise)

DEPARTURE AND CLIMB OUT
(Engine noise)



ARRIVALS AND FINAL APPROACH
(Airframe noise)



AIRCRAFT NOISE MEASUREMENT

Whilst the experience or impact of noise is dependent on the individual, there are standards used to measure noise. Noise is measured within a scale of decibels (dB) as the unit of measure. The sound level of typical daytime activities can vary between 40 dB and 85 dB. Typical aircraft noise levels are between 65 dB and 95 dB.

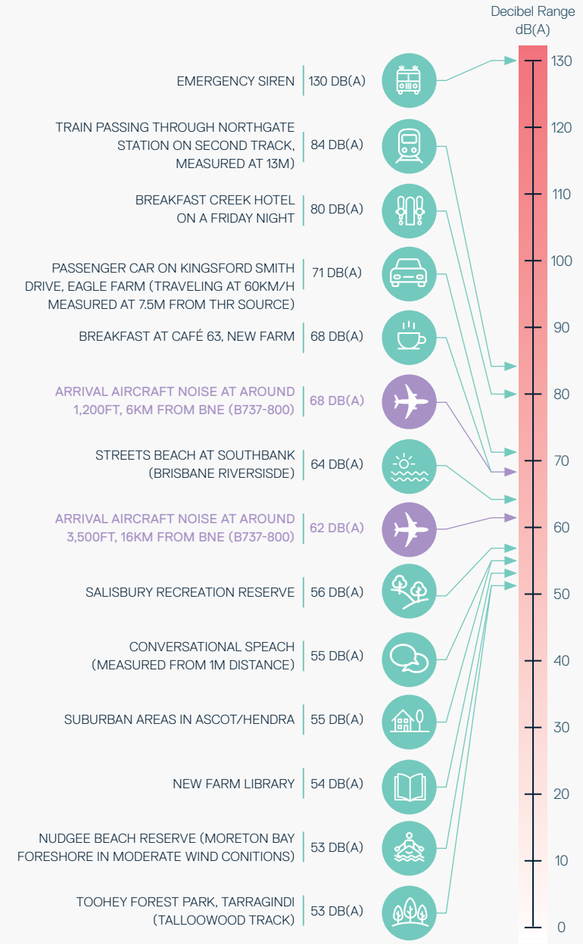
The figure presented here depicts typical sounds experience by residents of Brisbane on a scale of dB, with aircraft activities presented within this for context.

The aviation industry in Australia refers to the "Significance of Change in Environmental Noise Exposure (Department of Transport and Main Roads, 2013)" to determine noticeability in changes to noise levels. The change in subjective loudness and the significance of change is presented in the table below.

INCREASE OVER EXITING NOISE LEVEL DB(A)	CHANGE IN SUBJECTIVE LOUDNESS	SIGNIFICANCE OF CHANGE
3	Nil	Insignificant
3 – 5	Noticeable	Marginal
10	About double	Significant
15 or more	At least triple	Very significant

Source: Queensland Department of Transport and Main Roads, 2013.

BRISBANE SOUND LEVELS



Source: Local noise measures collected by SoundIn, December 2018

NOISE MANAGEMENT

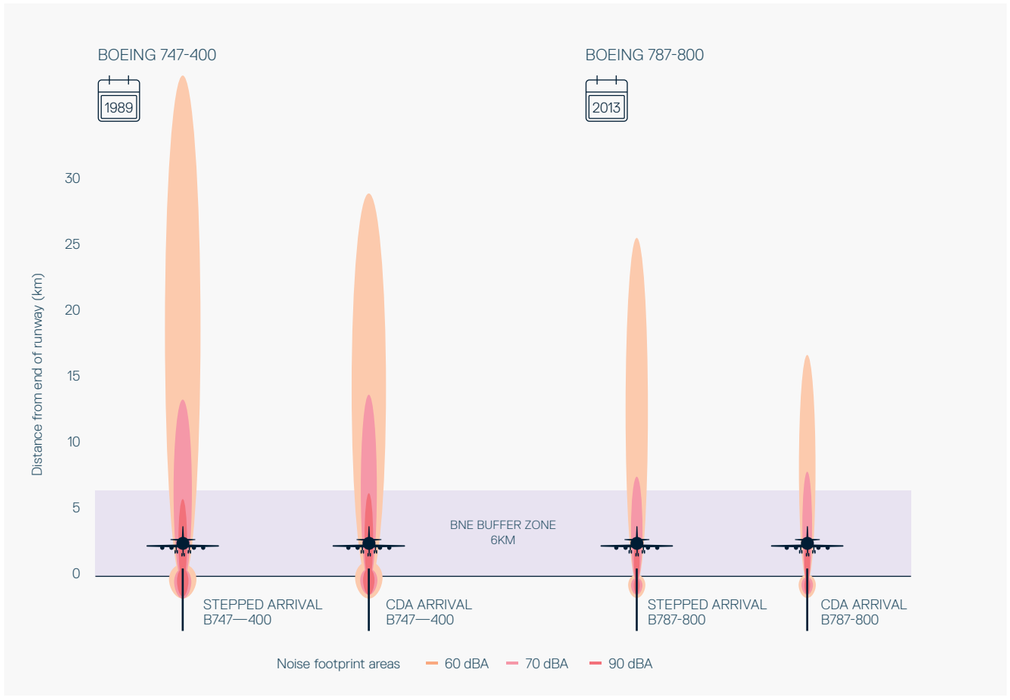
INDUSTRY REGULATORS AND STAKEHOLDERS

Brisbane Airport minimises noise associated with operations at the airport and associated services and facilities. We work closely and proactively with the following industry regulators and stakeholders to minimise noise impacts associated with airport operations and to make sure the community receives accurate and transparent information about aircraft noise.

- International Civil Aviation Organisation (ICAO) – develops global standards, rules and regulations generally implemented by aviation regulators including noise certification standards for new aircraft. Guidance on noise management strategies including the use and application of satellite navigation technology.
- Civil Aviation Safety Authority (CASA) – regulator of civil aviation operations in Australia, responsible for airspace regulation and safety of aviation.
- Department of Infrastructure, Regional Development and Cities (DIRDC) – advises the Commonwealth Government on the policy and regulatory framework for Australian airports and the aviation industry including policy advice to the Minister on the management of aircraft noise. Provides regulatory oversight of the Air Navigation (Aircraft Noise) Regulations 1984 as they apply to aircraft which do not meet Australian aircraft noise standards.
- Airservices Australia – provides Air Traffic Control and Information Services across Australia's airspace and towered airports. Manages and maintains aircraft navigation, surveillance and noise monitoring, responsible for airspace and flight path design, implements noise abatement procedures, noise complaints and information service, provides information on aircraft movements, runway and flight path use and noise impacts, reviews and endorses ANEF's for technical accuracy.
- Aircraft Noise Ombudsmen – conducts independent reviews of Airservices Australia' handling of noise complaints, community consultation and information on aircraft noise and makes recommendations to Airservices Australia for improvement.
- Airlines and aircraft operators– operate and maintain aircraft to meet regulatory noise certification requirements, maximise efficiency and minimise noise through new generation fleet acquisition including use of the latest satellite based navigation technology, comply with noise abatement procedures.
- State and Local Government – develop and implement land use planning frameworks to prevent inappropriate developments in areas excessively effected by aircraft noise

COMBINING AIRCRAFT TECHNOLOGY WITH AIRSPACE DESIGN

The airspace design for Brisbane's New Runway is based on allowing the latest in aircraft systems to manage the flight trajectory of the aircraft which reduces noise levels.



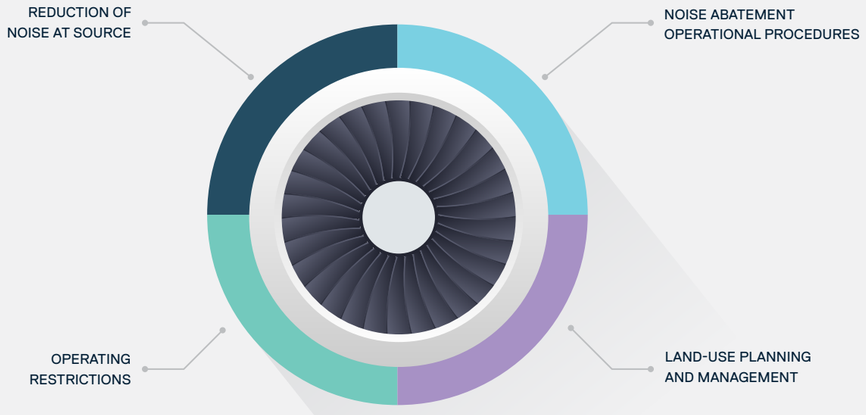
NOISE MANAGEMENT

ICAO'S BALANCED APPROACH

Brisbane Airport supports ICAO's Balanced Approach to Aircraft Noise Management based on:

- Noise reduction at source with quieter aircraft and noise reducing technologies and advancements in airframe design (evident through increased B787 and A350 operations at Brisbane Airport as replacements for noisier legacy fleet such as the B747 and A330 aircraft and implementation of satellite navigation technology at Brisbane Airport).
- Appropriate land use planning and development controls to safeguard and protect local communities from aircraft noise disturbance.
- Noise abatement operational procedures in the air and on the ground.
- Operating restrictions imposed on certain aircraft types and application of noise abatement to specific runway use.

BALANCED APPROACH TO AIRCRAFT NOISE MANAGEMENT



EFFECTIVE ENGAGEMENT

Brisbane Airport uses a range of effective engagement tools applying the following principles to engagement about the new runway to ensure the community clearly understands how they will be affected by aircraft noise after opening of the new runway:

TRUTH

Providing accurate information to the public about the aircraft noise that will result from the new runway.

CLARITY

Providing clear and understandable information to the public about aircraft noise and the changes that will result from the runway.

UNDERSTANDING

Understanding that for some people aircraft noise is a significant annoyance and that they deserve to know that we will do the best we can to minimise that.

Promoting the community benefits of the airport and the runway project.

ADVOCACY

The engagement tools to provide the community with a clear understanding of aircraft operations now and after new runway opening in relation to their address are both in booklet and interactive electronic form.

FLIGHT PATH AND AIRCRAFT NOISE INFORMATION BOOKLET

Brisbane Airport Corporation has prepared a Flight Path and Aircraft Noise Information Booklet to provide the community with useful information on aircraft operations at Brisbane Airport between now and 2035.

The Booklet was created as part of the information included in the EIS/MDP for the new runway project. The booklet includes:

- Flight path maps and data tables
- N70 noise contours overlaid on the flight paths

It provides readers with a greater level of understanding about the creation of aircraft noise, why aircraft take off and land in certain directions, the operating modes of Brisbane Airport now and in the future, Airservices Australia's role in managing aircraft traffic and the factors that will influence runway choice when Brisbane's new runway is in use.

The booklet is provided on the Brisbane Airport website.

FLIGHT PATH TOOL

The interactive flight path tool available on Brisbane Airport's website allows users to input specific address and provides current and future location of flight paths, aircraft altitudes and numbers of flights and noise levels above 70 decibels for a given time of the day and year.

AUSTRALIAN NOISE EXPOSURE FORECAST

The management of aircraft noise has a central place in the day-to-day operation of major airports such as Brisbane Airport.

In line with an ongoing commitment to minimise negative environmental impacts, Brisbane Airport works in close cooperation with aviation partners to minimise aircraft noise over residential areas and to maintain an ongoing dialogue with those communities affected by aircraft noise.

Although Brisbane Airport is not responsible for the operational standards of airlines or how airspace is managed, a proactive approach to monitoring and mitigating noise is consistent with Brisbane Airport's sustainability goals.

As a result, Brisbane Airport liaises and collaborates with the airlines, the Civil Aviation Safety Authority (CASA) who administer the safety of aircraft operations, and with Airservices Australia, who control and manage airspace, in a joint effort to address the issue.

A mandatory legislative requirement in the preparation of an Airport Master Plan is the development of an Australian Noise Exposure Forecast (ANEF) to assist Brisbane City Council (BCC) and state planning agencies to ensure that land-use planning decisions and future land uses, including new residential developments and schools take into account those areas that may be subject to intrusive or nuisance noise levels from current or forecast aircraft operations.

AUSTRALIAN NOISE EXPOSURE FORECAST

BACKGROUND

ANEF charts show contour lines in the vicinity of an airport of forecast daily average noise exposure levels from aircraft landings and take-offs. These contours are displayed as 20, 25, 30, 35 and 40 ANEF levels with higher contour levels representing higher cumulative daily aircraft noise averaged over a year. Each airport Master Plan contains an updated ANEF which is endorsed by Airservices Australia for technical accuracy.

As required for the Brisbane Airport 2020 Master Plan, an updated Ultimate Capacity ANEF has been prepared and endorsed by Airservices Australia.

The Brisbane Airport Ultimate Capacity ANEF that it will replace was similarly endorsed for technical accuracy by Airservices Australia in 2013 as part of the previous Airport Master Plan process, and is currently adopted in relevant State Planning Schemes. For convenience this revised ANEF is referred to as the 2020 ANEF and that which it will replace is called the 2014 ANEF.

The following sections describe an ANEF, and set out the base parameters and assumptions used to prepare the Ultimate Capacity ANEF contours in accordance with the requirements of the current "Manner of Endorsement" for ANEFs approved by the Minister for Infrastructure, Transport and Regional Development.

For Brisbane Airport 'Ultimate Capacity' is nominally expected to be reached in the mid-2050s. This time horizon was calculated through modelling and is regarded as a conservative estimate. In contrast to some major airports applying 20 year horizons, Brisbane Airport has consistently adopted an "Ultimate" horizon for the Brisbane Airport ANEF, as Brisbane Airport considers that residential purchase and land-use decisions involve long-term implications.

The ultimate capacity year may change in future Master Plans depending on variables such as demand, peak spreading, changes in aircraft technology and air traffic management procedures.

THE INTEGRATED NOISE MODEL (INM)

ANEF contours are derived by computer simulation using endorsed Noise Modelling Software. The 2020 ANEF was prepared using the Federal Aviation Administration (FAA) Integrated Noise Model (INM) Software Version 7.0d (including the service update circulated making a correction to the standard departure profiles for Boeing 777-300ER aircraft).

The INM database includes a representative listing of standard aircraft types for use in an INM study, including for example the B737-800 and A320. Where possible these standard INM aircraft are used to model operations. The INM database also contains a number of approved substitutions, which allow these standard INM aircraft to be used to model another aircraft with similar performance and noise characteristics.

Each INM aircraft has a number of standard approach, departure and/or circuit training profiles which define thrust setting, airspeed and altitude related to the distance from the start of take-off or from the runway threshold.

Each INM aircraft has an associated set of noise-power distance (NPD) curves for approach and departure at different thrust settings and defined by 10 noise levels at standard distances from an observer (point).

The INM calculates aircraft noise impacts by applying either standard or user defined aircraft flight profiles, performance data and NPD curves to the runway configuration and flight tracks specific to the study airport. The time of day is also factored in to allow for people being more sensitive to aircraft operations at night. In order to factor this, aircraft movements between 7pm and 7am are weighted by multiplication of four (i.e. 50 additional movements between 7pm and 7am would be the equivalent of 200 additional daytime movements).

The extent and shape of noise contours are influenced by many factors such as airport elevation, runway geometry, aircraft types, movement numbers, runway utilisation, flight track geometry, origins/destinations and subsequent assignment of aircraft to individual flight tracks, and the day/night split in aircraft movements.

Version 7.0d of the INM software (the most recent version) has now been replaced by a similar Aviation Environmental Design Tool (AEDT) model. The AEDT model was only approved by Airservices Australia for use in the preparation of ANEF contours after the update of the Brisbane Airport contours were completed. However, in the future, AEDT will be updated with noise profiles for new aircraft as they are certified and will be used when the ANEF contours are updated for future Master Plans. Brisbane Airport has confirmed a very close consistency between INM and AEDT model outputs through scenario testing and for the same assumptions outlined in this Master Plan, there is not anticipated to be any significant difference in contours prepared by AEDT.

PREVIOUS ANEF STUDIES

Brisbane Airport completed a comprehensive Environmental Impact Statement and Major Development Plan for the new runway at Brisbane Airport (NPR MDP/EIS) in 2005/06. This included extensive noise modelling and a 2035 ANEC as required by the Australian Government's Terms of Reference for the NPR MDP/EIS.

The NPR MDP/EIS was approved on 13 September 2007 by the Australian Government Environment Minister under the Environment Protection and Biodiversity Conservation Act (EPBC), and from the Transport Minister on 18 September 2007 under the Airports Act. In developing an updated ANEF for the 2009 Master Plan, the extensive modelling and noise studies undertaken as part of the NPR MDP/EIS were used as a base and translated into an Ultimate Capacity ANEF using INM Version 7.0a.

The 2014 ANEF built on the assumptions in the ANEF prepared and endorsed in 2009. It included updated forecasts, and confirmation and adjustment, as appropriate, of various other operational assumptions.

The 2014 ANEF used a composite of four ANECs to combine the effects of individual summer and winter scenarios for both Existing Runway System and Parallel Runway scenarios.

This Ultimate Capacity 2014 ANEF was a composite of the following four ANECs:

ANEC 1	Current runway system at capacity (2020)	Summer
ANEC 2	Current runway system at capacity (2020)	Winter
ANEC 3	Future parallel runway system at capacity (nominally 2060)	Summer
ANEC 4	Future parallel runway system at capacity (nominally 2060)	Winter

SEASONAL ANECS

Brisbane Airport experiences different wind patterns between summer and winter months that bias operations in different runway directions. As a result, separate winter and summer ANECs for each runway layout have been prepared to best reflect projected changes in runway and flight path usage at the airport.

This approach also allows the ANEC to account for the difference in the hourly aircraft movement profiles between summer and winter caused by daylight saving in south-eastern states impacting on interstate flight schedules, particularly in early morning operations.

Reviewing both the months when wind patterns start to change, and the dates when domestic schedules change with daylight saving in the southern states, the summer ANECs reflect airport operations in the six-month period October to March, and the winter ANECs are for the six months from April to September.

Due to the imminent commissioning of Brisbane's new runway in mid-2020, and the permanent closure of the 14/32 Cross Runway System, the 2020 ANEF is now a composite of only two ANECs:

ANEC 1	Future Parallel Runway System at capacity	Summer
ANEC 2	Future Parallel Runway System at capacity	Winter

Current aviation growth forecasts for Brisbane Airport suggest that ultimate capacity of the Parallel Runway system will be reached around the mid-2050s.

The chart on the following page entitled "Brisbane Airport 2019 Ultimate Capacity Composite ANEF: Overall Methodology" shows diagrammatically the key assumptions feeding into the various functional models and the subsequent outputs.

BRISBANE AIRPORT 2019 ULTIMATE CAPACITY COMPOSITE ANEF: OVERALL METHODOLOGY

AUSTRALIAN NOISE EXPOSURE FORECAST

KEY ANEF INPUT PARAMETERS: AIRFIELD CONFIGURATION

The airfield layout at Brisbane Airport will change from its current converging Main and Cross Runway System to an independent parallel runway system:

THE PARALLEL RUNWAY SYSTEM

Brisbane Airport is completing construction of a new parallel runway and is committed to its operational commissioning by mid-2020. As part of that process and to enhance safety outcomes, the existing Main Runway was renamed to 01R / 19L in November 2018.

The new runway will be designated 01L / 19R.

ULTIMATE CAPACITY ANEF

The Ultimate Capacity ANEF has retained the following Ultimate Capacity Runway System configuration:

- 01R/ 19L – 4,040 metres x 45 metres (extended to the south from its current length of 3,560 metres, incorporating a Displaced Threshold for 01 approaches at the current 01 landing point).
- 01L / 19R – 3,600 metres x 60 metres (extended to the south from its initial build length of 3,300 metres, incorporating a Displaced Threshold for 01 approaches at the initial build 01 landing point).

PARALLEL RUNWAY SYSTEM CONFIGURATION ADOPTED IN THE ANEF MODELLING

DATA TYPE	DESCRIPTION	COORDINATES (LAT)	COORDINATES (LONG)	RUNWAY LENGTH (M) /WIDTH(M)	ELEVATION (M)	LANDING THRESHOLD FROM RWY END (M)
Airport Coordinates	Airport	-27.384159	153.117530	N/A	2.5 (8 ft)	
Ultimate Capacity	**Rwy End**					
Runway Coordinates	Rwy 19L	-27.374677	153.134301	4040 / 45	3.2 (10 ft)	0
Runway Coordinates	Rwy 01R	-27.407146	153.115751	4040 / 45	3.6 (12ft)	540
Runway Coordinates	Rwy 19R	-27.356557	153.121963	3600 / 60	4.066 (13 ft)	0
Runway Coordinates	Rwy 01L	-27.385491	153.105416	3600 / 60	4.066 (13 ft)	300
Runway Coordinates	Rwy 19L_A3	-27.381058	153.130653	N/A	3.6 (11 ft)	0
Runway Coordinates	Rwy 19R_T3	-27.361782	153.118976	N/A	4.066 (13 ft)	0
Runway Coordinates	Rwy 19R_T5	-27.365398	153.116908	N/A	4.066 (13 ft)	0
Helipad	HE	-27.370688	153.124693	N/A	2.4 (8 ft)	0

AUSTRALIAN NOISE EXPOSURE FORECAST

AIRCRAFT NOISE PROFILES

Both ANECs have been modelled using standard profiles and assumptions as laid out in the INM 7.0d model except for the use of user-defined aircraft noise profiles for next generation narrow body jet aircraft. The Boeing 737 MAX and Airbus A320/A321neo jet aircraft are scheduled to progressively enter the market and will supersede completely existing narrowbody fleet by the horizon of the Ultimate Capacity ANEC parallel runway contours (mid-2050s).

The definition of the noise profiles adjustments (Noise Power Distance (NPD curves) for these new generation aircraft as shown in the table below were based on latest EASA (European Union Aviation Safety Agency) Noise Certification information and advice from Airservices Australia.

USER-DEFINED AIRCRAFT NOISE PROFILES

USER-DEFINED AIRCRAFT TYPE	INM BASELINE MODEL	DEPARTURE ADJUSTMENT	ARRIVAL ADJUSTMENT
A320NEO	A320-211	-3.3 dB	-2.4 dB
A321NEO	A321-232	-3.5 dB	-1.1 dB
B737MAX8	737800	-4.2 dB	-2.3 dB

AUSTRALIAN NOISE EXPOSURE FORECAST

AIRCRAFT TYPES AND SUBSTITUTIONS

Annual aircraft movement forecasts were prepared by Tourism Futures International (TFI) and broken down into the generic aircraft categories listed below These were then assigned to specific representative aircraft types for the two ANECs.
The forecast proportions for the parallel runways at Ultimate Capacity (mid-2050s) are compared with those in the 2016 NFPMS data.

The various splits between types of aircraft operations are shown for:

- → the 2015 base demand used to establish schedules for NPR Compliance Modelling and ANEF.
- → the nominal 2054 parallel runway system at capacity.

ANNUAL AIRCRAFT MOVEMENTS 2015 BASE AND 2054 FORECAST BASED ON TYPE OF OPERATION AND CATEGORY

ANNUAL AIRCRAFT MOVEMENTS (1)(2)	2015	2054
International	29,000	95,000
Domestic	166,000	425,000
GA Itinerant	28,000	35,000
Helicopters (3)	1,600	7,400
Total	**224,600**	**562,400**

Notes:
(1) Source is TFI
(2) Numbers do not match exactly with other tables and breakdowns because of rounding
(3) Helicopter projection by BAC assuming similar annual growth as fixed wing with an additional of new operator

ANNUAL AIRCRAFT MOVEMENTS (RPT) (1)(2)	2015	2054	2015	2054
Widebody Jet	20,100	105,700	10%	20%
Narrowbody Jet	124,500	312,500	64%	60%
Turboprop (non-jet)	50,400	101,800	26%	20%
Total	**195,000**	**520,000**	**100%**	**100%**

(1) Numbers will not necessarily match exactly because of rounding
(2) RPT Aircraft Movements excludes freight and GA and Helicopters (Table above includes freight and GA)

AIRCRAFT CATEGORIES

While there is growth in all aircraft categories, the widebody jets category is growing fastest and there is also up-gauging from turboprop to narrowbody jets over time, as average seats per aircraft increase in line with long-term historic trends.

The forecast proportions of aircraft types used for the runway system at ultimate capacity are compared with NFPMS data from 2015.

FORECAST PROPORTIONS OF AIRCRAFT TYPES COMPARING 2015 WITH ULTIMATE CAPACITY

FLEET MIX RPT - NARROWBODY

AIRCRAFT CLASS	AIRCRAFT TYPE	INM TYPE	2015	UC	COMMENTS
LNB	A321	A321-232	1%	0%	By Ultimate capacity and being 30+ years out and an expected fleet turnover, that all A320/A321/B738 will be replaced by Neo/Max aircraft.
LNB	A321neo	A321-232*	0%	15%	Increase uptake in A321Neos as upgauge to A320neo on domestic routes. The A321neo is represented by A321-232 with adjusted departure and arrival profiles.
LNB	A320	A320-232	24%	0%	By Ultimate capacity and being 30+ years out and an expected fleet turnover, that all A320/A321/B738 will be replaced by Neo/Max aircraft.
LNB	A320neo	A320-232*	0%	5%	Replacement of A320. The A320neo is represented by A320-232 with adjusted departure and arrival profiles.
LNB	B738	737-800	73%	0%	By Ultimate capacity and being 30+ years out and an expected fleet turnover, that all A320/A321/B738 will be replaced by Neo/Max aircraft.
LNB	737 8	737-800*	0%	40%	Replacement of B738. The 737 Max 8 is represented by 737-800 with adjusted departure and arrival profiles.
LNB	737 10	737-800*	0%	40%	Increase uptake in 737 Max 10 as upgauge to 737 8 on domestic routes. The 737 10 is represented by 737-800 with adjusted departure and arrival profiles.
LNB	B733	737-800	2%	0%	

FORECAST PROPORTIONS OF AIRCRAFT TYPES COMPARING 2015 WITH ULTIMATE CAPACITY

FLEET MIX RPT - WIDEBODY

AIRCRAFT CLASS	AIRCRAFT TYPE	INM TYPE	2015	UC	COMMENTS
VLWB	A380	A380-861	63%	100%	Reduced A380s overall and increase in LWB (B777X) by Ultimate Capacity with an expectation that only the Middle Eastern market will be serviced by A380s, and Americas/East Asia/South Asia/India will be replaced by LWB (B777x) and NZ by MWB (B787/A350s).
VLWB	B744	747-400	37%	0%	Both 747s QF and CI are phased out and replaced by B789/A350s.
LWB	B77W	777-3ER	100%	0%	Used by VA, NZ and EK to be phased out and replaced by B777x.
LWB	B777X	777-3ER	0%	100%	777-3ER is the newest in INM 7.0d so best to represent the B777x. Replacing A380s in other markets.
MWB	A359	777-200	0%	25%	Replacement for international A333/2 and B772.
MWB	A339Neo	787-8R	0%	25%	Orders for A339neo includes most from AirAsia X to service short haul international marker into Asia and NZ. Replacement for international A333/2 and B772.
MWB	A333	A330-301	51%	0%	International only in 2020 then replaced by A339neo.
MWB	A332	A330-301	29%	0%	Backbone for QF domestic short-/medium-term replacing B763 then phased out in 2035 to be replaced by A359 and B789.
MWB	B772	777-200	2%	0%	Ultimately replaced by A359 and B789.
MWB	B789	787-8R	6%	50%	Replacement for international A333/2 and B772. Expectation of SWB (MOM) market to increase as replacement of domestic/short international MWB routes. But ultimately the MOM will be represented by B787R for noise modelling purposes, hence no change in the fleet is required.
MWB	B788	787-8R	12%	0%	Ultimately replaced by B789 for upgauge need.
SWB	B763	767-300	100%	0%	B767s are to be phased out and replaced/upgauged to MWB A332/B788 or to the SWB (MOM). But ultimately the MOM will be represented by B787R for noise modelling purposes, hence SWB moved to MWB.

AIRCRAFT CATEGORIES

FORECAST PROPORTIONS OF AIRCRAFT TYPES COMPARING 2015 WITH ULTIMATE CAPACITY

FLEET MIX RPT – REGIONAL JETS AND TURBOPROPS

AIRCRAFT CLASS	AIRCRAFT TYPE	INM TYPE	2015	UC	COMMENTS
RJ	A220	EMB190	0%	50%	A220 as the next gen of Regional Jets (RJ) to be operational by Ultimate Capacity, but to be represented by the EMB190 as the most representative INM type.
RJ	B712	717200	31%	0%	717s are phased out replaced by similar aircraft as E190-E2/A220.
RJ	E190	EMB190	55%	0%	E190 to be replaced by E190-E2 (next gen of EMB190) by Ultimate Capacity.
RJ	E190 – E2	EMB190	0%	50%	E190-E2 (next gen of EMB190) to be operational by Ultimate Capacity, but to be represented by the EMB190 as the most representative INM type.
RJ	E135	EMB190	7%	0%	
RJ	F100	717200	1%	0%	
RJ	F70	717200	1%	0%	
RJ	B463	EMB190	5%	0%	
LTP	AT76	DHC830	4%	80%	Increased uptake in AT76 as opposed to DHC830 but represented by a DHC830 INM type the most representative INM type for the LTP category.
LTP	AT75	DHC830	18%	0%	
LTP	DH8D	DHC830	62%	20%	Backbone LTP for QF.
LTP	DH8C	DHC830	16%	0%	
MTP	DH8B	SF340	45%	45%	Keep same breakdown with SF340 the most representative INM type for the MTP category.
MTP	SF34	SF340	55%	55%	
STP	BE20	DHC6	72%	72%	Keep same breakdown with DHC6 the most representative INM type for the STP category.
STP	SW4	DHC6	28%	28%	

The forecasts were further broken down into generic aircraft categories as shown, from which detailed INM aircraft types were finally derived.

TOTAL EQUIVALENT ANNUAL AIRCRAFT MOVEMENTS BY AIRCRAFT CATEGORY – 2015 BASE AND 2054

AIRCRAFT MOVEMENTS (RPT) [1][2][4]	2015 SUMMER[3]	2015 WINTER[3]	2054 SUMMER[3]	2054 WINTER[3]
VLWB – very large widebody	2,600	2,800	3,000	2,900
LWB – large widebody	2,600	2,100	14,600	15,100
MWB – medium widebody	11,800	11,400	89,100	86,600
SWB – small widebody(5)	3,100	5,400	0	0
LNB – large narrowbody	107,700	105,000	277,000	276,000
RJ – regional jet	17,300	15,800	35,500	36,600
LTP – large turboprop	44,600	46,100	100,100	102,000
MTP – medium turboprop	0	300	0	0
STP – small turboprop	5,300	6,100	700	700
TOTAL	**195,000**	**195,000**	**520,000**	**520,000**

Notes:

(1) Excludes freight, GA and helicopters

(2) Totals are shown for ANEF average daily x 365, although summer and winter seasons are assumed to be six months each

(3) Minor differences in summer and winter due to differences in base from which profiles are grown

(4) Numbers will not necessarily match exactly with other tables and breakdowns because of rounding

(5) Expectation SWB to be represented by the MOM, but for noise modelling purposes those movements allocated to MWB category since the MOM will be represented by the 787-8R.

AUSTRALIAN NOISE EXPOSURE FORECAST

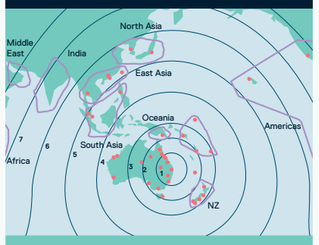
ORIGINS AND DESTINATION

Annual aircraft movement forecasts from TFI were broken down by regions based on markets, distance and direction for international, interstate and intrastate origins and destinations.

This breakdown was then applied on the daily and hourly level, to individual aircraft movements, which are in turn used to define stage length (for departure profile) and direction (for runway and flight allocation).

ORIGIN AND DESTINATION REGIONS – DIRECTION, DISTANCE AND TYPICAL AIRCRAFT

INTERNATIONAL



AC TYPE	EXAMPLE
VLWB	A380, B744
LWB	B773,A340
MWB	A332, A333
SWB	B752, B763
LNB	A321, B738

INTERSTATE (DOMESTIC)

AC TYPE	EXAMPLE
MWB	A332, A333
SWB	B752, B763
LNB	A321, B738
SNB / RJ	F100, E170
LTP	DH4, ATR72
MTP	DH3, F50
STP	DH8A, BEH

INTRASTATE (REGIONAL)

AC TYPE	EXAMPLE
LBN	A321, B738
SNB, RJ	F100, E170
LTP	DH4, ATR72
MTP	DH3, F50
STP	DH8A, BEH

AUSTRALIAN NOISE EXPOSURE FORECAST

CIRCUITS

There are currently no circuit operations at Brisbane Airport, nor are they anticipated in the future and are therefore not included in the ANECs.

RUNWAY ALLOCATION & CONOPS

There is no significant intrinsic difference in the operational capability or capacity of the two parallel runways. A detailed runway allocation rule-set was determined through the airspace finalisation process consistent with the Concept of Operations (CONOPs) presented in the EIS/MDP. This is predominately based on “compass mode” for both arrivals and departures (that is the direction (north, east, south or west) to the destination port or from the last departure port. This eliminates the need for crossing flight paths on arrival or departure.

If during particular busy hours there is a bias of traffic to one runway or the other, some balancing would assumed to be done by Air Traffic Control on a tactical basis.

The fundamental runway allocation principle are:

- Operations to/from south and east destinations/origins will be allocated the existing Main Runway 01R / 19L; and
- Operations to/from north and west destinations/origins will be allocated to Brisbane’s new runway 01L / 19R.

The exception to this allocation principle will be during periods when Noise Abatement Procedures are in operation or in the situation that a pilot in command specifically requests the slightly longer 01R / 19L runway for operational reasons.

There will also be occasions where air traffic control (ATC) must re allocate runways due to weather or for traffic management requirements.

FIXED WING FLIGHT TRACK ALLOCATION AND SPREAD

The flight track allocation and position are based on the finalised airspace design and CONOPS for the parallel runway system provided by Airservices Australia. The table title Arrival Flight Tracks RNP/ILS and Visual Allocations shows the flight tracks RNP/ILS and Visual allocations.

ARRIVAL FLIGHT TRACKS RNP/ILS AND VISUAL ALLOCATIONS

WB JETS	RNP	ILS	VISUAL
2020	15%	85%	0%
2035	70%	30%	0%
Ultimate Capacity	70%	30%	0%
NB JETS	**RNP**	**ILS**	**VISUAL**
2020 (01L/19R Landings)	45%	45%	10%
2020 (01R/19L Landings)	65%	25%	10%
2035	75%	20%	5%
Ultimate Capacity	75%	20%	5%
NON JETS	**RNP**	**ILS**	**VISUAL**
2020	10%	10%	80%
2035	70%	10%	20%
Ultimate Capacity	70%	10%	20%

The track spread was based on 2015 NFPMS data and ANOMS (Aircraft Noise and Operations Management System) track analysis. The table titled Track Spread Assumptions of the Runways shows the spread for both the RWY 19L/01R and the New Runway system.

TRACK SPREAD ASSUMPTIONS OF THE RUNWAYS SYSTEM

	ARR - RNP	ARR – NON RNP	DEP
Jet	0.3nm spread across 3 tracks	0.7nm spread across 5 tracks	0.7nm spread across 5 tracks
Non-Jet	0.3nm spread across 3 tracks	As per NFPMS across 5 tracks (when possible). Otherwise min. 0.7nm spread across 5 tracks	0.7nm at 3nm out 1.7nm at 10nm out across 5 tracks

AUSTRALIAN NOISE EXPOSURE FORECAST

HELICOPTERS

Growth in existing helicopter operations were not specifically forecast for Ultimate Capacity but were conservatively assumed by Brisbane Airport to grow at the same rate as the overall average annual growth rates of fixed wing aircraft movements - around 3 per cent per year.

Based on a review of NFPMS, two helicopters were selected to represent the helicopter operations with 92 per cent of operations to be represented by a twin-engine helicopter, the B430 and 8 per cent by a single-engine helicopter, the EC130, with standard INM profiles adopted.

In addition, Brisbane Airport envisages an increase in helicopter operations associated with a proposed Aeromedical Base, initially with 22 movements/week at 2020, growing at annual growth rate of 5 per cent for 20 years then no growth up to Ultimate Capacity. These operations are represented in the noise modelling by a twin-engine helicopter B430.

Helicopter tracks used in the noise modelling were advised by Airservices Australia and provide for three alternate arrival/departure routes to/from the primary Helipad located in Airport North.

These flight paths are currently used for departures and arrivals and will continue to be applied out to Ultimate Capacity. The noise modelling assumes equal proportional allocation of Helicopter operations across the three routes.

Currently noise from helicopter arrivals and departures makes a negligible contribution to the overall noise footprint outside the airport boundary and to the extent of ANEF contours.

HELIPAD LOCATION	
Data Type	Helipad Coordinates
Description	HE
Coordinates (Lat)	-27.370688
Coordinates (Long)	153.124693
Elevation (m)	2.4 (8 ft)

RUNWAY SYSTEM CAPACITY

The wide-spaced parallel runway system has been designed for independent operations, so that the sustainable peak capacity can be assumed to be at least twice the current single runway capacity.

Three independent methods were used to derive the Ultimate Runway Capacity of between 450,000 and 550,000 scheduled RPT aircraft movements:

- A bespoke analytical model originally developed based on Brisbane Airport runway timing studies.
- A method based on peaking factors and ratios of busy hour to busy day, busy day to annuals from a baseline and adjusted based on assumptions of peak spreading as demand approaches capacity.
- Benchmarking ratios of actual hourly peak runway throughput versus actual annual aircraft movements for several airports currently close to their nominal runway capacity.

The capacity assessments were initially based on a notional parallel runway peak throughput (as per NPR EIS/MDP) of 100+ hourly movements and a scaled-up design day movement profile with some future peak spreading. As noted in the NPR EIS/MDP peak capacities for short periods could be greater than this and up to 108 total movements per hour.

Recent advice from Airservices Australia suggested an expectation of future capacity improvements resulting from new airspace management system implementations and unspecified but expected innovation in coming decades. Brisbane Airport has therefore adopted a nominal increase in maximum peak-hour Runway System Capacity to around 110 movements per hour.

Based on extrapolating a 2040 design day schedule to this peak-hour rate results in annual RPT movements at ultimate capacity of around 520,000 in mid-2050s. General Aviation movements would be in addition to this figure resulting in around 550,000 total annual movements.

AIRCRAFT MOVEMENT AND TYPE FORECASTS

20 year passenger and aircraft movement forecasts to Year 2040 used in this Master Plan were prepared by Tourism Futures International (TFI). The last five years average annual percentage growth for each traffic sector International, Domestic (Interstate and Intrastate) and GA, was used to extrapolate out to Ultimate Capacity year.

The aircraft movement forecasts prepared by TFI are based on econometric modelling for unconstrained growth by various components of traffic – international, interstate (domestic) and intrastate (regional). These forecasts include details at the regional market level (e.g. for the international sector the major markets include Asia, the Middle-East, the Pacific, the Americas and Africa). Passenger demand to/from Europe is assumed to be via Asian or Middle-Eastern hubs. Annual passenger movement projections were converted to aircraft movements based on aggregate fleet mix and load factor assumptions for each individual traffic sector.

The fleet mix was based on consultations with airlines on short to medium-term trends and plans, which were then extrapolated out for the long-term forecast. Based on this and the matching of airplanes (range and capacity) to routes, the long-term aircraft movement forecast provided for use in the preparation of the ANEF included annual projections by region and split by generic aircraft type (for example Very Large Wide-body, Large Wide-body, Medium Wide-body etc).

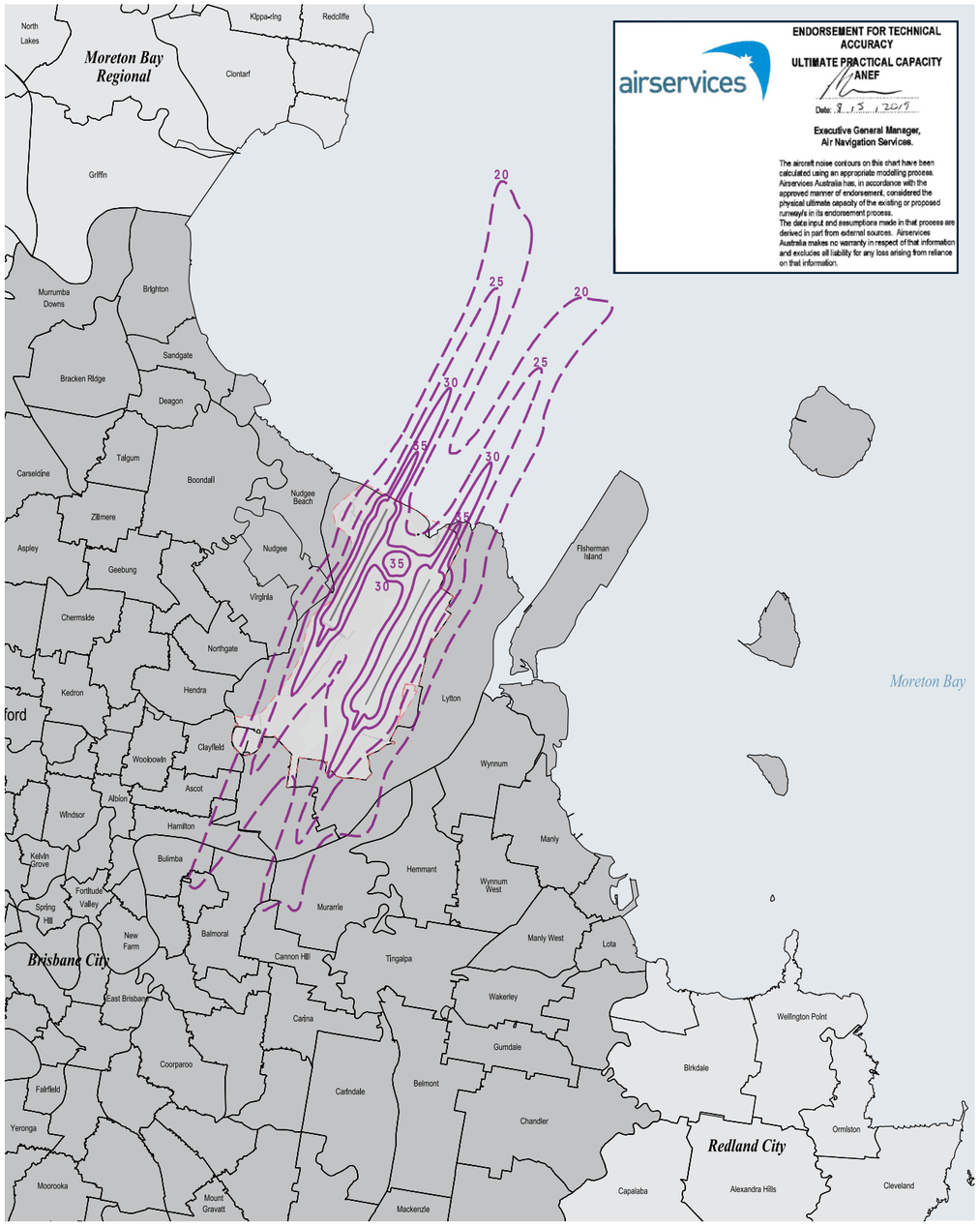
Typical busy day hourly aircraft movement profiles were then created scaling-up and modifying existing schedules. These included details of aircraft type and region based on the annual aircraft forecasts, and where runway capacity calculations were done for the parallel runways, based on hourly overall, arrival and departure capacities for typical busy days as described in the section above - Runway System Capacity.

The nominal long-term forecast year corresponding annual aircraft movement numbers was then used to check the detailed breakdown of the forecast by aircraft fleet and regions.

2020 AUSTRALIAN NOISE EXPOSURE FORECAST

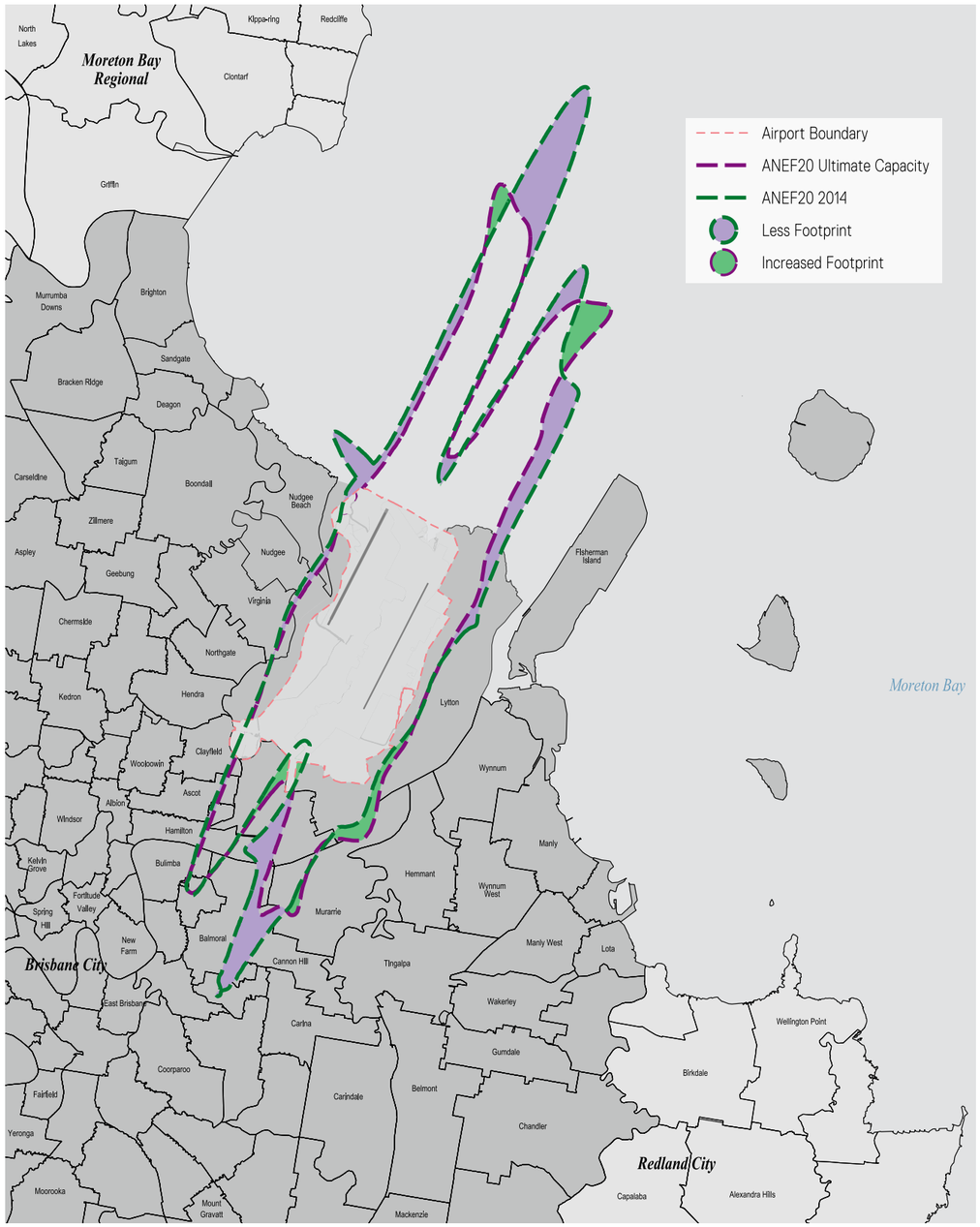
The Ultimate Capacity Australian Noise Exposure Forecast (ANEF) contours for Brisbane Airport are shown on the opposite page. This ANEF and the extensive inputs summarised in the sections of this chapter of the 2020 Master Plan have been endorsed for "technical accuracy" by Airservices in accordance with the "Manner of Endorsement" for ANEFs approved by the Minister for Infrastructure and Transport on 18 April 2017.

The process in developing those inputs included regular engagement with planning agencies at the three levels of government and the major airlines operating at Brisbane Airport. As noted previously, the 2020 ANEF is a series of composite contours (20, 25, 30 and 35 ANEF lines) of the outer extent for two ANECs – Ultimate Capacity Summer and Ultimate Capacity Winter.



This Ultimate Capacity ANEF is a land use planning tool of relevance to state and local planning authorities. The ANEF contours relate to building site acceptability based on ANEF zones table presented following.

ANEF20 CONTOUR COMPARISON BETWEEN 2014 AND 2020



This comparison between the 2014 ANEF20 contour and the Ultimate Capacity ANEF20 contour is a land use planning tool of relevance to state and local planning authorities.

CHANGES TO ANEF CONTOURS

The ANEF20 contour comparison between 2014 and Ultimate Capacity shows changes in the ANEF20 contour footprint between the 2020 and the previous 2014 Brisbane Airport Ultimate Capacity ANEFs. The ANEF contours are an output of the INM. Brisbane Airport Corporation has a responsibility to develop an appropriate suite of input metrics in consultation with industry and agency stakeholders and subjected to close scrutiny through a structured endorsement process. A number of factors have contributed to changes in the extents of the ANEF contours:

- An increase in ultimate capacity total annual aircraft movements from an updated capacity calculation involving a robust methodology in converting mode capacities to annuals A significant decrease in the extent of the 20 ANEF contour to the south of 01R / 19L due to the distribution of aircraft over both runways and ultimate capacity aircraft fleet assumptions not including current day fleet which influenced this contour extent in the 2014 ANEF through the Summer and Winter “Current System at Capacity” ANEC’s included as part of that composite ANEF.
- An increase in the proportion of the airline fleet.
- Being capable and using Performance Based Navigation procedures (such as RNP AR approaches). This has resulted in a slightly increased bulge where 01R Arrivals intersect with the extended 01R / 19L centreline at Murarrie.
- Updated fleet mix assumptions and INM data now available for new aircraft models.
- Updated annual forecasts (movement numbers, proportional split with aircraft types and differential growth trends of regions).
- Increasing jet aircraft operations (including wide body jets) in the INM weighted (x 4) period of 7pm to 7am.
- Increasing stage length operations by large wide-body jet aircraft due to increased Middle East hubbing and emerging ultra longhaul services.

AIRCRAFT FLEET UPDATES

The INM aircraft database includes a representative listing of standard aircraft types and approved substitutions, which are applied to the forecasts in the development of the ANEF. With the exception of the deliberate substitution by Brisbane Airport Corporation of a reduced noise characteristic for LNB jet aircraft in the ultimate capacity ANECs, due to the imminent introduction of A320 NEO and B737MAX aircraft, the accepted ANEF process limits speculative application of long-term airline technology improvements (use of “paper-aeroplanes” theoretical noise profiles constructed to represent anticipated characteristics of aircraft types not yet in production).

It is probable that the aircraft industry will undergo at least two iterations of major fleet improvements over the next 50 years to around Year 2060.

THE ANEF AND STATE AND LOCAL GOVERNMENT PLANNING AGENCIES

The Queensland Government has developed an overarching State Planning Policy (SPP), which sets out the state’s interest concerning development in the vicinity of those airports and aviation facilities considered essential for the state’s transport infrastructure. The SPP applies to land use changes and development occurring off airport that could:

i. Adversely affect the safety and operational efficiency of operational airspace or the functioning of aviation facilities

ii. Increase the number of people that could, amongst other things, work or live within a noise contour of 20 – 25 ANEF

iii. Increase the number of people or the use/storage of hazardous material within public safety areas Under the Sustainable Planning Act 2007 (SPA), the SPP has effect when development applications are assessed, when planning schemes are made or amended, and when land is designated for community infrastructure.

The SPP applies in the vicinity of airports but does not apply to those airports or aviation facilities themselves. The specific areas to which the SPP applies vary with the issue being addressed; for noise purposes it is within areas defined by the ANEF20 contour at and around each airport.

Brisbane Airport Corporation has prepared the ultimate capacity ANEF for Brisbane Airport. The ANEF defines those contour areas to which SPP applies. Brisbane Airport has the largest buffer zone of any major capital city airport in Australia and is the outcome of several decades of determined planning by all levels of government. This buffer is comprised of physical distance, augmented by additional areas of appropriate conservation/green-space and industrial land uses.

Brisbane Airport Corporation will continue to work closely with BCC and the State Government to maintain the substantial buffer zone around Brisbane Airport.

AUSTRALIAN NOISE EXPOSURE FORECAST

MANAGING NOISE BY OFF-AIRPORT LAND USE PLANNING AUTHORITIES

The primary function of an ANEF is as a tool in land-use planning; Brisbane City Council (BCC) and state planning agencies use the ANEF charts to determine the compatibility of different land uses within the ANEF contours – the higher the ANEF contour, the greater the noise exposure. Table 8 details the types of buildings (as established by AS2021-2015) considered acceptable to be located within different ANEF zones.

Brisbane Airport strongly supports the consideration of aircraft noise effects as a relevant factor to consider in land-use planning and residential development assessments, as (future) aircraft noise from increased movements can have a potential impact on residents. Additionally, Brisbane Airport believes that high-rise residential development in the vicinity of Brisbane Airport should be considered carefully. Residents in upper levels of such developments may find aircraft noise more intrusive as there is less other background or ambient noise experienced at higher levels.

Furthermore, Brisbane Airport recommends forms of covenants on title for residents at new developments in the 20 ANEF contours, to ensure awareness and acceptance of the potential amenity impacts from aircraft over-flight.

Brisbane Airport is required to provide, as part of its Master Plan, a strategy to manage the intrusion of inappropriate land uses in areas forecast to have aircraft noise above the "significant" ANEF levels. The Airports Act identifies the 30 ANEF contour as being the “significant" noise level.

The 2020 ANEF developed as part of this master plan, shows that the 30 ANEF contour is generally contained on Brisbane Airport land or over water in Moreton Bay. There is very minor extension beyond the airport boundary to the south of Runway 01L/19R, which is over land-use zoning consistent with its existing general industry use and therefore consistent with the land-use compatibility standards of AS 2021.

BCC's ongoing planning intent within the 30 contour is to maintain industrial land-use zoning. The 30 ANEF contour southern extents associated with Brisbane’s new runway is contained well within the airport boundary.

Finally, Brisbane Airport reiterates its belief that the ANEF system, while being the adopted system for land-use zoning around Australian airports, has proved to not adequately address individual’s reaction to aircraft noise and aircraft over-flight. Brisbane Airport is committed to working with all levels of government and the industry to continue to explore metrics to improve aircraft noise information and planning mechanisms.

BUILDING SITE ACCEPTABILITY BASED ON ANEF ZONES

	ANEF ZONE OF SITE		
BUILDING TYPE	**ACCEPTABLE**	**CONDITIONALLY ACCEPTABLE**	**UNACCEPTABLE**
House, home unit, flat, caravan park	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hotel, motel, hostel	Less than 25 ANEF	25 to 30 ANEF	Greater than 30 ANEF
School, university	Less than 20 ANEF (Note 1)	20 to 25 ANEF (Note 2)	Greater than 25 ANEF
Hospital, nursing home	Less than 20 ANEF (Note 1)	20 to 25 ANEF	Greater than 25 ANEF
Public building	Less than 20 ANEF (Note 1)	20 to 30 ANEF	Greater than 30 ANEF
Commercial building	Less than 25 ANEF	25 to 35 ANEF	Greater than 35 ANEF
Light industrial	Less than 30 ANEF	30 to 40 ANEF	Greater than 40 ANEF
Other industrial	Acceptable in all ANEF zones		

NOTES:

01. The actual location of the 20 ANEF contour is difficult to define accurately, mainly because of variation in aircraft flight paths. Because of this, the procedure of Clause 2.3.2 (AS2021-2015) may be followed for building sites outside but near to the 20 ANEF contour.

02. Within 20 ANEF to 25 ANEF, some people may find that the land is not compatible with residential or educational uses. Land use authorities may consider that the incorporation of noise control features in the construction of residences or schools is appropriate (see also Figure AI of Appendix A, AS2021-2015).

03. There will be cases where a building of a particular type will contain spaces used for activities which would generally be found in a different type of building (e.g. an office in an industrial building). In these cases Table 8 should be used to determine site acceptability, but internal design noise levels within the specific spaces should be determined by Table 3.3 in the AS2021-2015.

04. This Standard does not recommend development in unacceptable areas. However, where the relevant planning authority determines that any development may be necessary within existing built-up areas designated as unacceptable, it is recommended that such development should achieve the required ANR determined according to Clause 3.2, AS2021-2015. For residences, schools, etc., the effect of aircraft noise on outdoor areas associated with the buildings should be considered.

05. In no case should new development take place in greenfield sites deemed unacceptable because such development may impact airport operations.

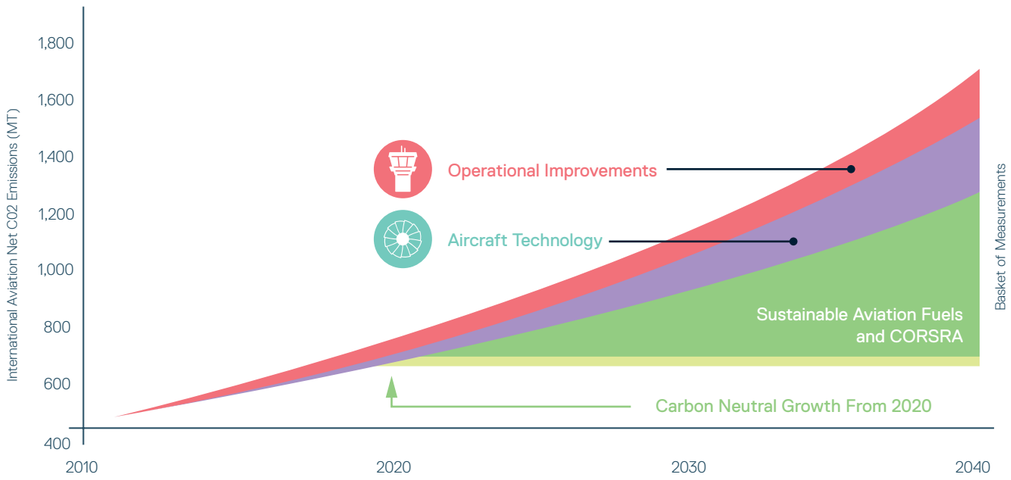
REDUCING FUEL BURN AND EMISSIONS

Aviation contributes to approximately 2 per cent of global CO2 emissions, according to the UN's Intergovernmental Panel on Climate Change.

To manage this impact in the future, a global agreement was reached in 2016 through the ICAO on a Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). This scheme supports ICAO objectives to increase fuel efficiency by 2 per cent per year and achieve carbon neutral growth in international aviation after 2020.

CORSIA is being incorporated into regulatory frameworks around the world, including Australia. Australia joins 70 other countries, representing nearly 90 per cent of total international aviation traffic, committed to CORSIA, with the voluntary phase from 2021 to 2023.

ICAO INITIATIVES TO ACHIEVE CARBON NEUTRAL GROWTH FROM 2020



HOW BRISBANE AIRPORT IS RESPONDING TO CLIMATE CHANGE

Brisbane Airport is working closely with Airservices Australia and the aviation industry to support the targets for reducing CO2 emissions. This includes the development of the finalised airspace design for Brisbane's new runway system, based on Performance Based Navigation including continuous descent and climb principles.

The application of these principles and the latest satellite based navigation technology and standards in the airspace design for Brisbane's New Runway results in optimised use of automated aircraft systems enabling the most fuel efficient flight trajectories, and reduced emissions.

NEXT GENERATION AIRCRAFT DESIGN

As part of the CORSIA initiative, ICAO adopted a new aircraft CO2 standard in 2017 which is the world's first global design certification standard governing CO2 emissions for any industry sector. It will apply to new aircraft type designs from 2020 and to aircraft type designs already in production as of 2023. Those in production aircraft which by 2028 that do not meet the standard will no longer be able to be produced unless their designs are sufficiently modified.

In addition to meeting the ICAO CO2 standards, the focus for research and development for the major aircraft manufactures, Airbus and Boeing, is on greater efficiency and environmental performance.

AIRCRAFT CATEGORY	AIRCRAFT MODEL	EMISSONS (CO_2) REDUCTION %
NARROW BODY JET (2 ENGINES)		
	B737 Max	14% less CO2
	A320neo	15-20% less CO2
MEDIUM TO LARGE WIDE BODY JET (2 ENGINES)		
	B777X	12% less CO2
	A330neo	14% less CO2
	B787	20-30% less CO2
	A350 XWG	25% less CO2
VERY LARGE WIDE BODY JET (4 ENGINES)		
	B747-8	16% less CO2
	A380	30-40% less CO2