Models to Determine Airport Capacity

Federal Aviation Administration

Separation Minima Application: between Departing Aircraft

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

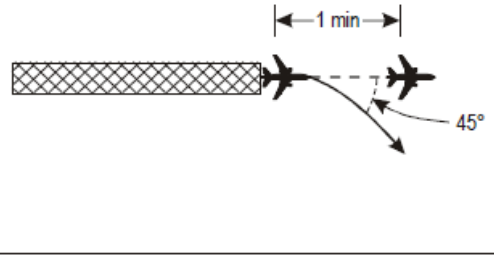


Figure 5-37. One-minute separation between departing aircraft following tracks diverging by at least 45 degrees (see 5.6.1)

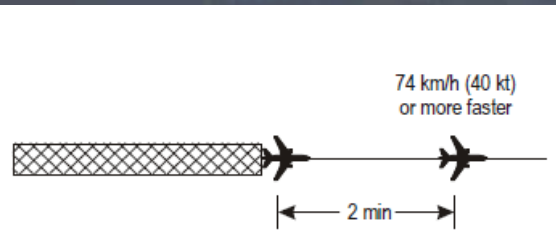


Figure 5-38. Two-minute separation between aircraft following same track (see 5.6.2)

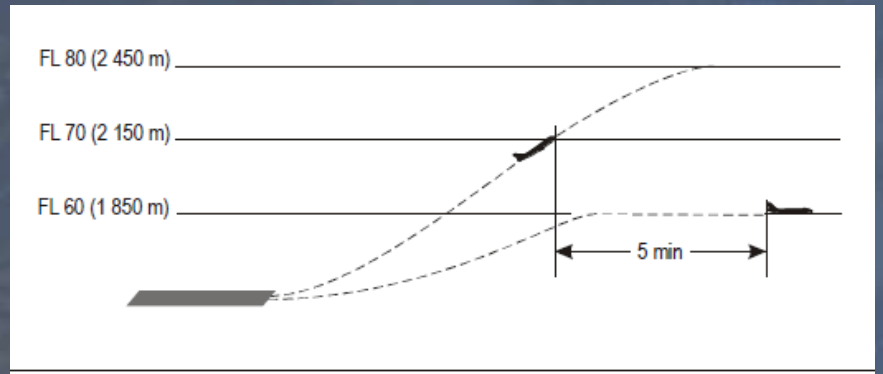


Figure 5-39. Five-minute separation of departing aircraft following same track (see 5.6.3)

Separation Minima Application: Departing Aircraft from Arriving Aircraft

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

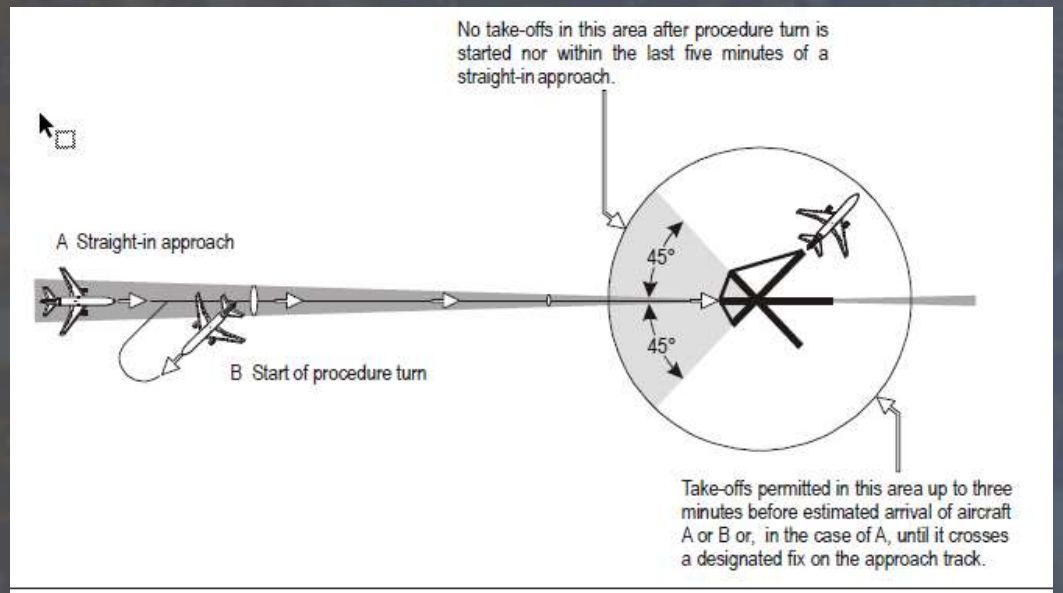


Figure 5-40. Separation of departing aircraft from arriving aircraft (see 5.7.1.1 b) and 5.7.1.2 b))

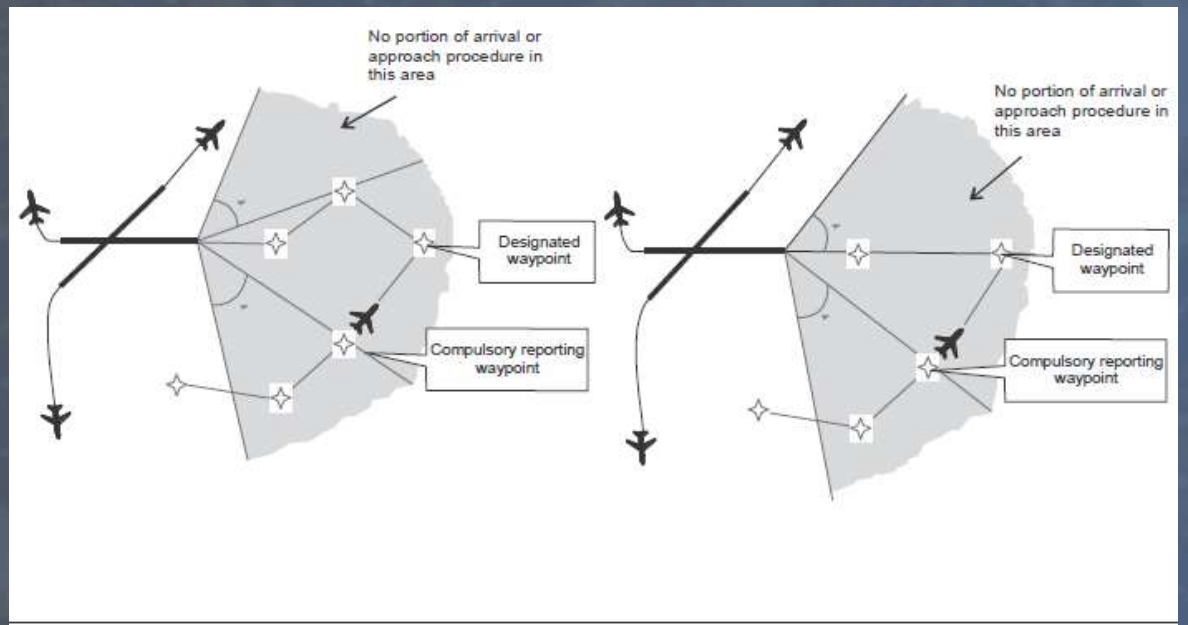


Figure 5-41. Examples of arrival protection area

Separation Minima Application: Time-based Wake turbulence separation minima

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

- **Wake turbulence separations are not required:**
  a) for arriving VFR flights landing on the same runway as a preceding landing SUPER, HEAVY or MEDIUM aircraft; and
  b) between arriving IFR flights executing visual approach when the aircraft has reported the preceding aircraft in sight and has been instructed to follow and maintain own separation from that aircraft.

- **Otherwise, the following minima shall be applied to aircraft landing behind a SUPER, a HEAVY or a MEDIUM aircraft:**
  a) HEAVY aircraft landing behind SUPER aircraft — 2 minutes;
  b) MEDIUM aircraft landing behind SUPER aircraft — 3 minutes;
  c) MEDIUM aircraft landing behind HEAVY aircraft — 2 minutes;
  d) LIGHT aircraft landing behind SUPER aircraft — 4 minutes;
  e) LIGHT aircraft landing behind a HEAVY or MEDIUM aircraft — 3 minutes.

Separation Minima Application: Time-based Wake turbulence separation minima

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

When aircraft are using:

- the same runway (see Figure 5-42);
- parallel runways separated by less than 760 m (2 500 ft) (see Figure 5-42);
- crossing runways if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below (see Figure 5-43);
- parallel runways separated by 760 m (2 500 ft) or more, if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below (see Figure 5-43).

Traditional Wake Categories

- HEAVY aircraft taking off behind a SUPER aircraft — 2 minutes;
- LIGHT or MEDIUM aircraft taking off behind a SUPER aircraft — 3 minutes;
- LIGHT or MEDIUM aircraft taking off behind a HEAVY aircraft — 2 minutes;
- LIGHT aircraft taking off behind a MEDIUM aircraft — 2 minutes

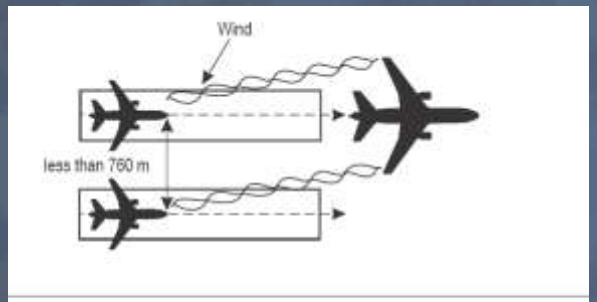


Figure 5-42. Wake turbulence separation for following aircraft (see 5.8.3.1 a) and b) and 5.8.3.2 a) and b))

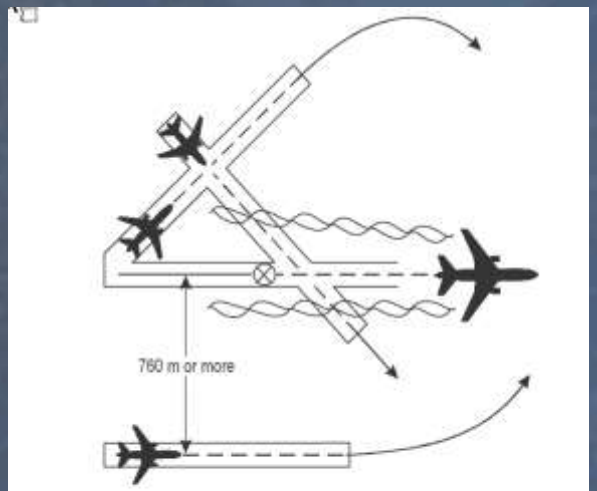


Figure 5-43. Wake turbulence separation for crossing aircraft (see 5.8.3.1 c) and d) and 5.8.3.2 c) and d))

Separation Minima Application: Time-based Wake turbulence separation minima

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

When aircraft are using:

- the same runway (see Figure 5-42);
- parallel runways separated by less than 760 m (2 500 ft) (see Figure 5-42);
- crossing runways if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below (see Figure 5-43);
- parallel runways separated by 760 m (2 500 ft) or more, if the projected flight path of the second aircraft will cross the projected flight path of the first aircraft at the same altitude or less than 300 m (1 000 ft) below (see Figure 5-43).

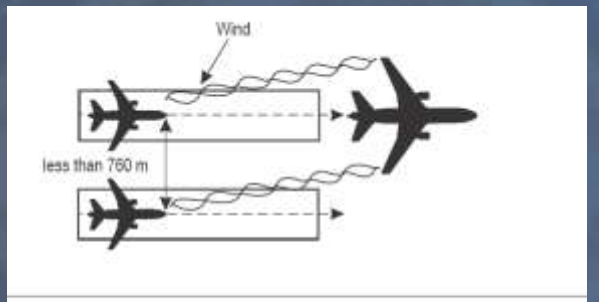


Figure 5-42. Wake turbulence separation for following aircraft (see 5.8.3.1 a) and b) and 5.8.3.2 a) and b))

Preceding aircraft wake turbulence group	*Succeeding aircraft wake turbulence group*	*Time-based wake turbulence separation minima*
A	B	100 seconds
	C	120 seconds
	D	140 seconds
	E	160 seconds
	F	160 seconds
	G	180 seconds
B	D	100 seconds
	E	120 seconds
	F	120 seconds
	G	140 seconds
C	D	80 seconds
	E	100 seconds
	F	100 seconds
	G	120 seconds
D	G	120 seconds
E	G	100 seconds

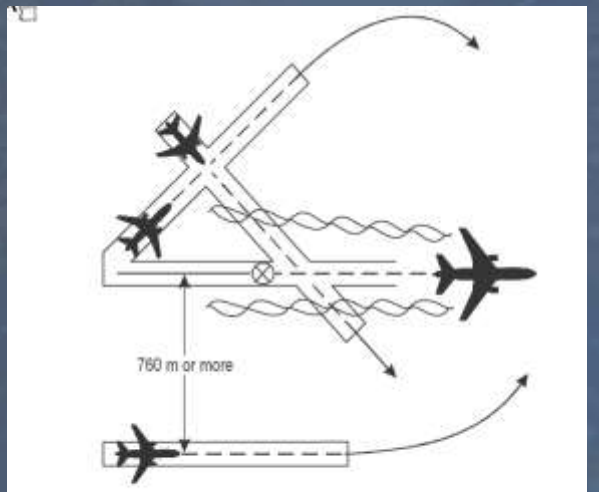


Figure 5-43. Wake turbulence separation for crossing aircraft (see 5.8.3.1 c) and d) and 5.8.3.2 c) and d))

Separation Minima Application: Time-based Wake turbulence separation minima

PANS-ATM, ICAO Doc 4444 — Separation Methods and Minima, Chapter 5

For aircraft taking off from an intermediate part of the same runway or an intermediate part of a parallel runway separated by less than 760 m (2 500 ft) (see Figure 5-44), the following minimum separations shall be applied:

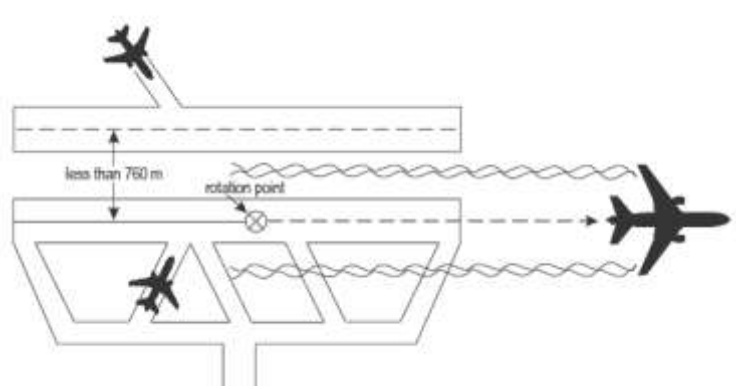


Figure 5-44. Wake turbulence separation for following aircraft (see 5.8.3.3 and 5.8.3.4)

Traditional Wake Categories

- HEAVY aircraft taking off behind a SUPER aircraft — 3 minutes;
- LIGHT or MEDIUM aircraft taking off behind a SUPER aircraft — 4 minutes;
- LIGHT or MEDIUM aircraft taking off behind a HEAVY aircraft — 3 minutes;
- LIGHT aircraft taking off behind a MEDIUM aircraft — 3 minutes

Preceding aircraft wake turbulence group	*Succeeding aircraft wake turbulence group*	*Time-based wake turbulence separation minima*
A	B	160 seconds
	C	180 seconds
	D	200 seconds
	E	220 seconds
	F	220 seconds
	G	240 seconds
B	D	160 seconds
	E	180 seconds
	F	180 seconds
	G	200 seconds
C	D	140 seconds
	E	160 seconds
	F	160 seconds
	G	180 seconds
D	G	180 seconds
E	G	160 seconds

Models to Determine Airport Capacity

Calculating and Expressing Airport Capacity

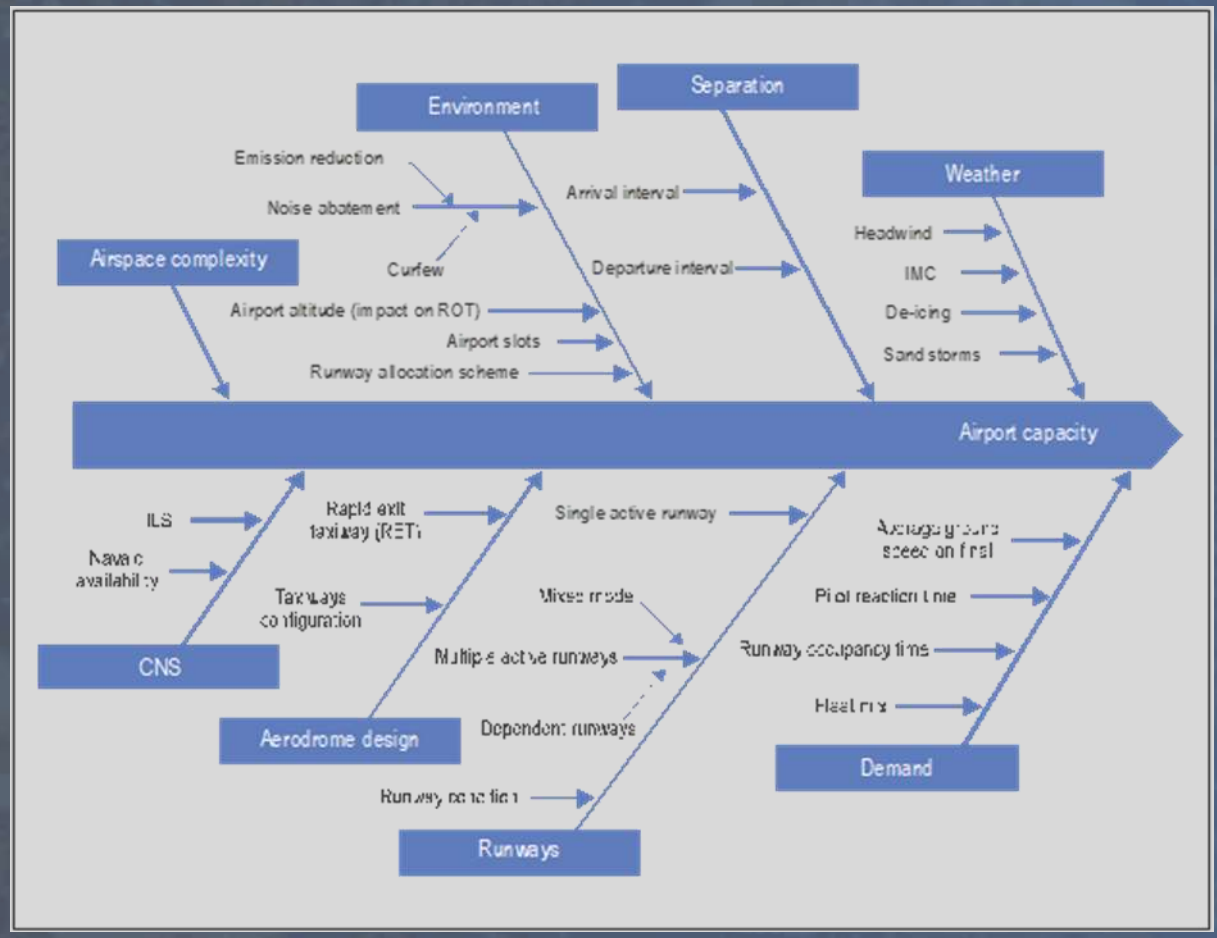
Contributing Factors

Normally defined as the total number of movements, i.e. arrivals and departures, that the aerodrome can handle during the given period of time.

- Capacity values are calculated for each aerodrome runway configuration and for the anticipated range of weather conditions, i.e., visual meteorological conditions, instrument meteorological conditions, and low visibility conditions

Often infrastructure-related, as opposed to ATCO workload-related, airport capacity is easier to calculate using mathematical models.

- Nonetheless, the ATCO workload element, e.g., the need for the ATCO to coordinate departures with the adjoining unit, remains important and should be assessed during the calculation of aerodrome capacity



Determining the Aerodrome Arrival Rate (1/5)

Example: Doc 9971, Appendix II-B

Definitions

- Aerodrome arrival rate (AAR)—a dynamic parameter specifying the number of arrival aircraft that an aerodrome, in conjunction with terminal airspace, ramp space, parking space, and terminal facilities, can accept under specific conditions during any consecutive 60-minute period.
- Aerodrome primary runway configuration– an aerodrome configuration that handles three percent or more of the annual operations.

Administrative Considerations

- Identify the organization responsible for the establishment and implementation of AARs at selected aerodromes;
- Establish optimal AARs for the aerodromes identified; and
- Review and validate the aerodrome primary runway configurations and associated AARs at least once each year.

Simplified methodology based on the scientific process developed by the FAA for establishing AARs, as outlined in FAA Order JO 7210.3EE, Facility Operation and Administration, Chapter 10, Section 7

Optimal AAR
Maximum arrival capacity

Adjusted arrival capacity
Operational AAR

Determining the Aerodrome Arrival Rate (2/5)

Optimal AAR

Calculate optimal AAR—the strategic capacity of a runway configuration– for the following meteorological conditions:

- visual meteorological conditions (VMC): meteorological conditions allow vectoring for visual approaches;
- marginal VMC: meteorological conditions do not allow vectoring for visual approaches, but visual separation on final is possible;
- instrument meteorological conditions (IMC): visual approaches and visual separation on final are not possible;
- low IMC: meteorological conditions dictate Category II or III operations.

Determining the Aerodrome Arrival Rate (3/5)

Maximum runway arrival capacity

Calculate the maximum runway arrival capacity as follows:

- Determine the average ground speed over the runway threshold and the spacing interval required between successive arrivals
- Divide the ground speed by the spacing interval to determine the optimum AAR
- Round down to the next whole number, or refer to ICAO Doc 9971, Table II-App B-1

130 KTS/3.25 NM = 40
Maximum runway arrival capacity = 40 arrivals per hour

125 KTS/3.0 NM = 41.66
Maximum runway arrival capacity = 41 arrivals per hour

Table I. Maximum Runway Arrival Capacity

Ground Speed at the runway threshold (knots)	Spacing interval between aircraft at the runway threshold (NM)									
	3	3.5	4	4.5	5	6	7	8	9	10
140	46	40	35	31	28	23	20	17	15	14
130	43	37	32	28	26	21	18	16	14	13
120	40	34	30	26	24	20	17	15	13	12
110	36	31	27	24	22	18	15	13	12	11

Determining the Aerodrome Arrival Rate (4/5)

Adjusted runway arrival capacity

Identify any conditions that may adjust the runway arrival capacity, including:

- intersecting arrival and departure runways;
- lateral distance between arrival runways;
- dual use runways — runways that share arrivals and departures;
- land and hold short operations;
- availability of high-speed taxiways;
- airspace limitations and constraints;
- procedural limitations (noise abatement, missed approach procedures);
- taxiway layouts; and
- meteorological conditions.

Determine the adjusted runway arrival capacity using the previous factors listed for each runway used in an aerodrome configuration:

- add the adjusted runway arrival capacity values for all runways used in an aerodrome configuration to determine the optimal AAR for that airport configuration

Determining the Aerodrome Arrival Rate (5/5)

Operational AAR

Calculate the operational AAR by accounting for real-time factors that require dynamic adjustments to the optimal AAR.

- aircraft type and fleet mix on final;
- runway conditions;
- runway/taxiway construction;
- equipment outages;
- approach control constraints; and
- wind (speed & direction)

Table II. Examples of Operational AAR

RUNWAY CONFIGURATION	AAR for VMC	AAR for MARGINAL VMC	AAR for IMC
RWY 13	24	21	19
RWY 31	23	20	17

Operational AAR = Optimal AAR - Adjustment Factors

ATL

NOTE: The data depicted in these tables are for estimating purposes only and do not necessarily reflect the current operational plan or current traffic balancing activities. All data is for informational purposes only.

AAR						
Arrival	Departure	VMC (3600/7)	LOW VMC	IMC	LOW IMC	Notes
26R|27L|28	26L|27R	132	124	110	98	During VMC: 132 for triple Visuals, 124 for Visuals/ILS'/Visuals, 118 for ILS'/ILS'/Visuals on RWYs 26R|27L|28, respectively. Rate set by the TMC and Approach OS based on actual conditions and PIREPS on ceilings/visibility.
26R|27L|28 (sharing 28)	26L|27R|28 (sharing 28)	118	110	98	84	AAR in this row applies to any three-runway arrival configuration with one runway being shared.
26R|27L	26L|27R|28	100	90	80	72	
26R|28	26L|27L|28	100	90	80	72	
27L|28		100	90	80	72	
08L|09R|10	8R|9L	132	124	110	98	During VMC: 132 for triple Visuals, 124 for Visuals/ILS'/Visuals, 118 for ILS'/ILS'/Visuals on RWYs 8L/9R/10, respectively. Rate set by the TMC and Approach OS based on actual conditions and PIREPS on ceilings/visibility.
08L|09R|10 (sharing 10)	08R|09L|10 (sharing 10)	118	110	98	84	
08L|09L|10	08R|09R	124	118	110	98	
08R|09R|10	08L|09L	124	118	110	98	
08R|09L|10	08L|09R	124	118	110	98	
08L|09R	08R|09L	100	90	80	72	
08L|10		100	90	80	72	
09R|10		100	90	80	72	

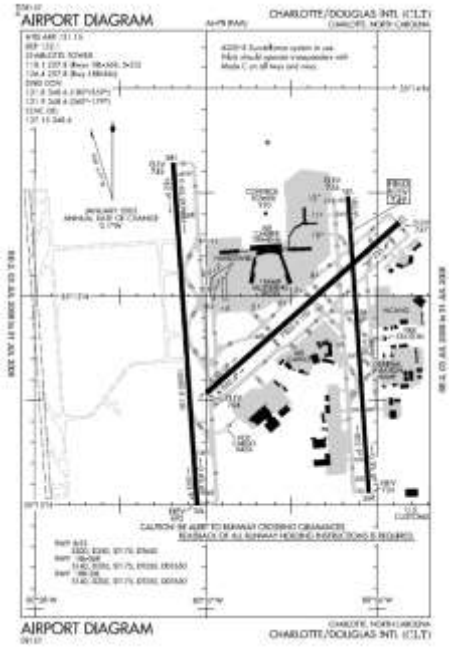
Arrival Flows	
Centers	Fixes
	DALAS: NW
	LOGEN: NE
	TIROE: SW
	HUSKY: SE

Category Minimums	
Category	RVR
I	1800 ft.
II	1200 ft.
IIIa	700 ft.
IIIb	150 ft.
IIIc	0 ft.

CLT

NOTE: The data depicted in these tables are for estimating purposes only and do not necessarily reflect the current operational plan or current traffic balancing activities. All data is for informational purposes only.

AAR						
Arrival	Departure	VMC	LOW VMC	IMC	LOW IMC	Notes
18R|18C|18L	18C|18L	87	80	80	37	Trips South.
18R|18L	18C|18L	72	72	72	37	South Outboard approaches
36L|36C|36R	36C|36R	87	80	80	74	Trips North.
36L|36R	36C|36R	72	72	72	63	North Outboard approaches

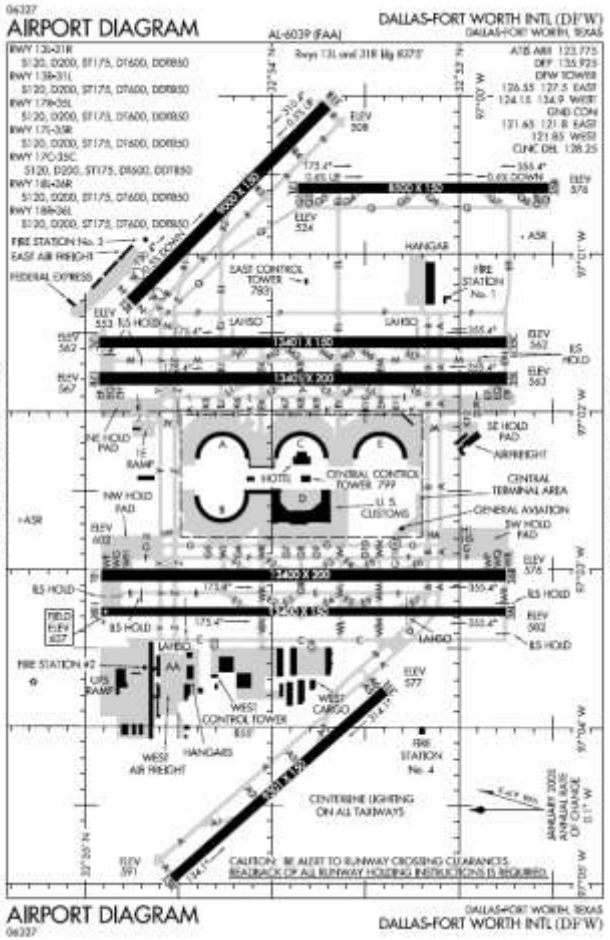


Arrival Flows	
Centers	Fixes
ZOB, ZID, ZAU ZMP, ZDV, ZLC ZSE, ZKC	LINN: NW
ZBW, ZNY, ZDC ZOB, ZID	MAJIC: NE
ZME, ZFW, ZHU ZAB, ZLA, ZOA	JONZE: SW
ZTL, ZMA, ZJX ZJX feeds CLT Approach over CTF.	RASLN: SE

Category Minimums	
Category	RVR
I	1800 ft.
II	1200 ft.
IIIa	700 ft.
IIIb	150 ft.
IIIc	0 ft.

DFW

NOTE: The data depicted in these tables are for estimating purposes only and do not necessarily reflect the current operational plan or current traffic balancing activities. All data is for informational purposes only.



AAR						
Arrival	Departure	VMC	LOW VMC	IMC	LOW IMC	Notes
13R|18R|17C|17L	18L|17R	130	116	98		RWY 13R Arrivals dependent with RWY 18L/R Departures
36L|35C|35R|31R	31L|36R|35L	124	112	94		RWY 31R Arrivals dependent with RWY 35L/C departures. Three landing rwys on E side of airport results in surface congestion.
18R|17C|17L	18L|17R	106	102	98	90	
36R|35C|35R	31L|35L	86	82	78	74	Departing 31L only on West Side
36L|35C|35R	31L|36R|35L	106	102	94	88	
17L|18R|13R	17R|18L	84	78	74		
31R|35R|36L	35L|36R	84	78	74		
13R|17C|17L	17R|18L	84	78	74		*18R CLSD*
31R|35C|35R|36R	31L|35L	102	96	90		Winds have to support departing 31L
31L|31R	36R|35L|31L	54	48	48		Used only with strong N/NW winds.
31R|31L	31R|31L	48	48	48		Used only with strong W/NW winds.
31R	31R|31L	24	24	24	24	Used only with strong W/NW winds.

Arrival Flows	
Centers	Fixes
	UKW: NW
	BYP: NE
	JEN: SW
	CQY: SE

Category Minimums	
Category	RVR
I	1800 ft.
II	1200 ft.
IIIa	700 ft.
IIIb	150 ft.
IIIc	0 ft.

Airport
ATL

Operational Day
3/31/2025

Bin Size
(•) 15 min
( ) 60 min

ATL • Monday, March 31, 2025

Weather Impact Score: 7 • Thunderstorms GS

SUI

Federal Aviation Administration

Data available since 1/1/2025

Access FM Dashboard with 2024 data here.

Summary

ATL 3/31/2025

Throughput Efficiency

Arrival: -209 fdu (Ratio: 55.5%)
Departure: -196 fdu (Ratio: 59.7%)
(Core Impact Period)

Average Taxi Time

In: 11.7 min
Out: 21.6 min

On Time Performance

A0: 26.0%
A14: 39.4%
D0: 21.7%

Completion Factor

Arrivals: 92.7%
Departures: 91.9%

Local Dep Delay

OPSNET Dep: 12 flights | 225 min
Local TMI From: 27 flights | 1,080 min

GS/GDP Delay

To: 47 flights | 4,344 min
From: 15 flights | 2,006 min

AFP Delay

To: 0 flights | 0 min
From: 90 flights | 8,779 min

Other TMI Delay

To: 2 flights | 144 min
From: 0 flights | 0 min

Airborne Holding

22 flights
680 min

Diversions

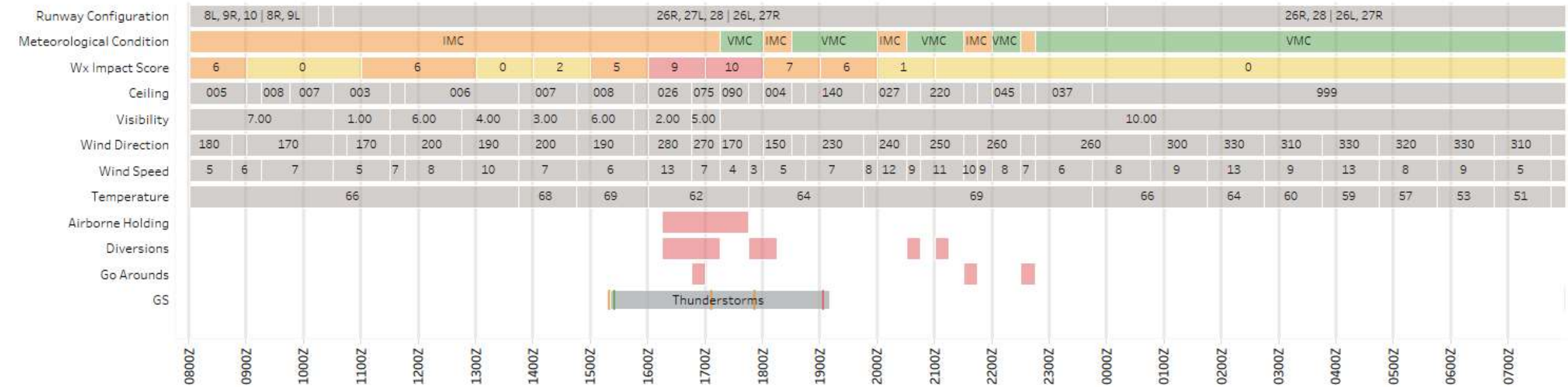
Planned Destination(ATL): 11 flights
Diversion Airport(ATL): 3 flights

Cancellations

Arrival: 88 flights
Departure: 98 flights
Total: 186 flights

Operational Conditions

ATL 3/31/2025



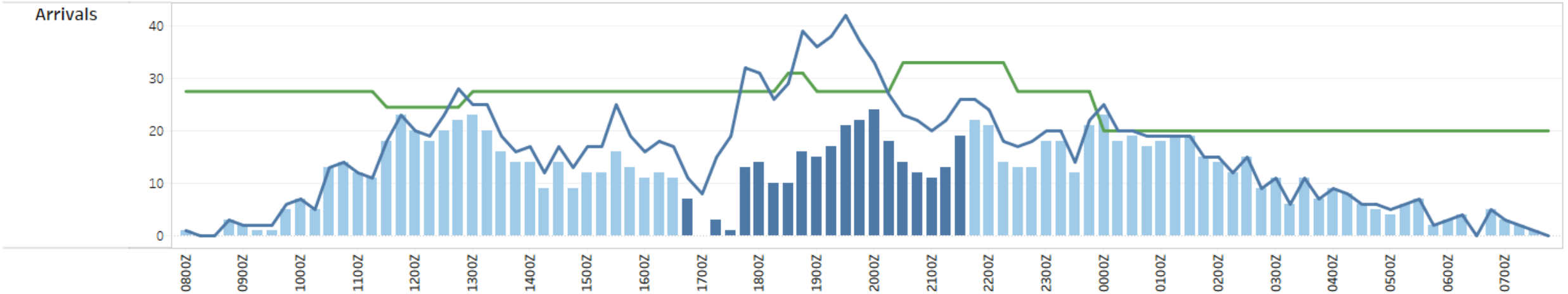
Throughput, Demand, Rates **ATL 3/31/2025**

Color Scheme
- (•) Core Impact Window
- ( ) Runway Usage
- ( ) Departure Fix

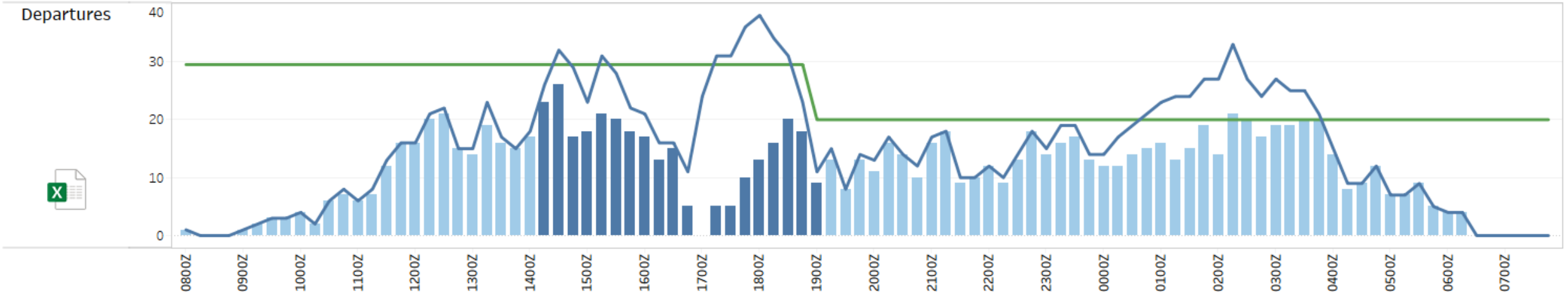
Actuals | Demand | Cumulative Flight Plan Based Demand | Rate | Final Program Rate | Initial Program Rate | Core Impact Window

	Arrivals	Departures
Actuals	1,112	1,107
Demand	1,112	1,107

Arrival Core Impact Window: 1645Z - 2145Z



Departure Core Impact Window: 1415Z - 1915Z



All data is preliminary and may be incomplete. Throughput efficiency is subject to change for up to six days after the data becomes available.

Thank you.