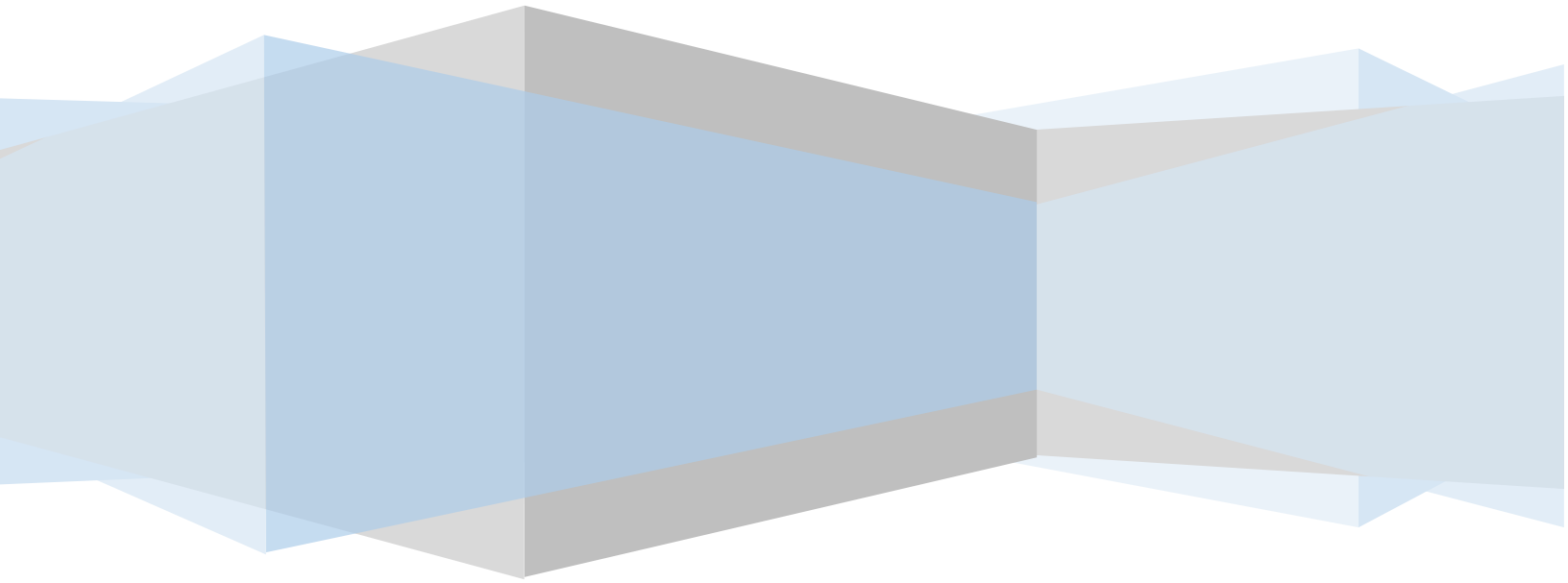
POST OPERATIONS ANALYSIS REPORT

May, 2025

CENTRAL COMMAND CENTER, C-ATFM, DELHI



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A. Executive Summary

Average Domestic air traffic (31 days) has recorded a decrease of 0.13% whereas the average international air traffic has increased by 2.14 % in the month of May 2025 as compared to April '25.

On average, the Indian Airports in the ATFCM area saw 5980 IFR flights per day in the month of May 2025. The peak days were on 02nd May 2025 (6293 IFR flights). Wednesday's were the busiest days throughout this month with an average of 6145 IFR flights per day.

Total Seventy (32) ATFM measures were applied this month during periods of congestion at Bengaluru,Chennai, Delhi, Hyderabad and Mumbai Airport.

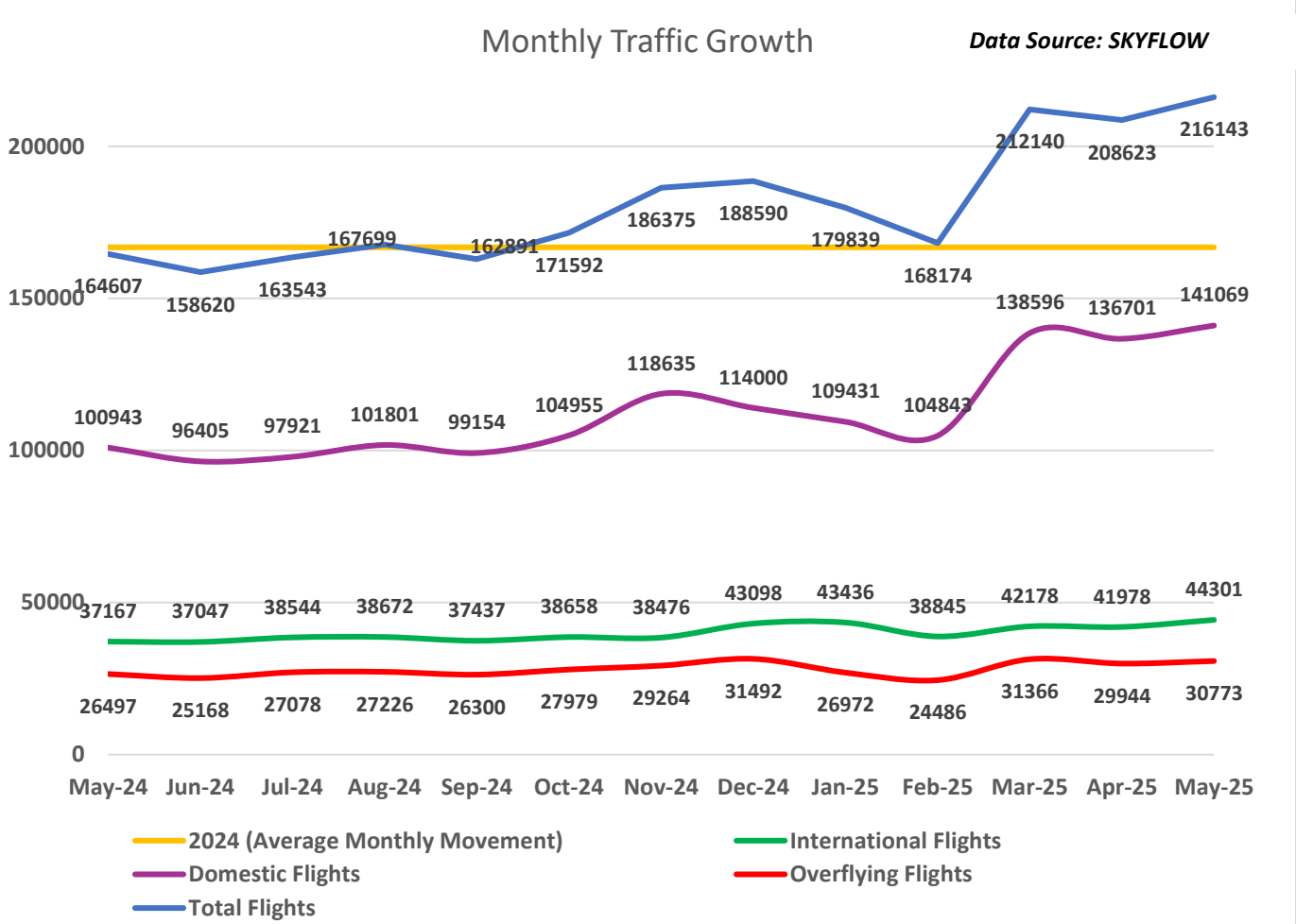


Figure 1: Monthly Traffic Growth

The graph above depicts the Domestic, International and Overflying Air traffic in Indian ATFCM Area during the last 13 months (May'24 to May'25).

B. Traffic Analysis

I. Air Traffic Movement at Major Airports in India

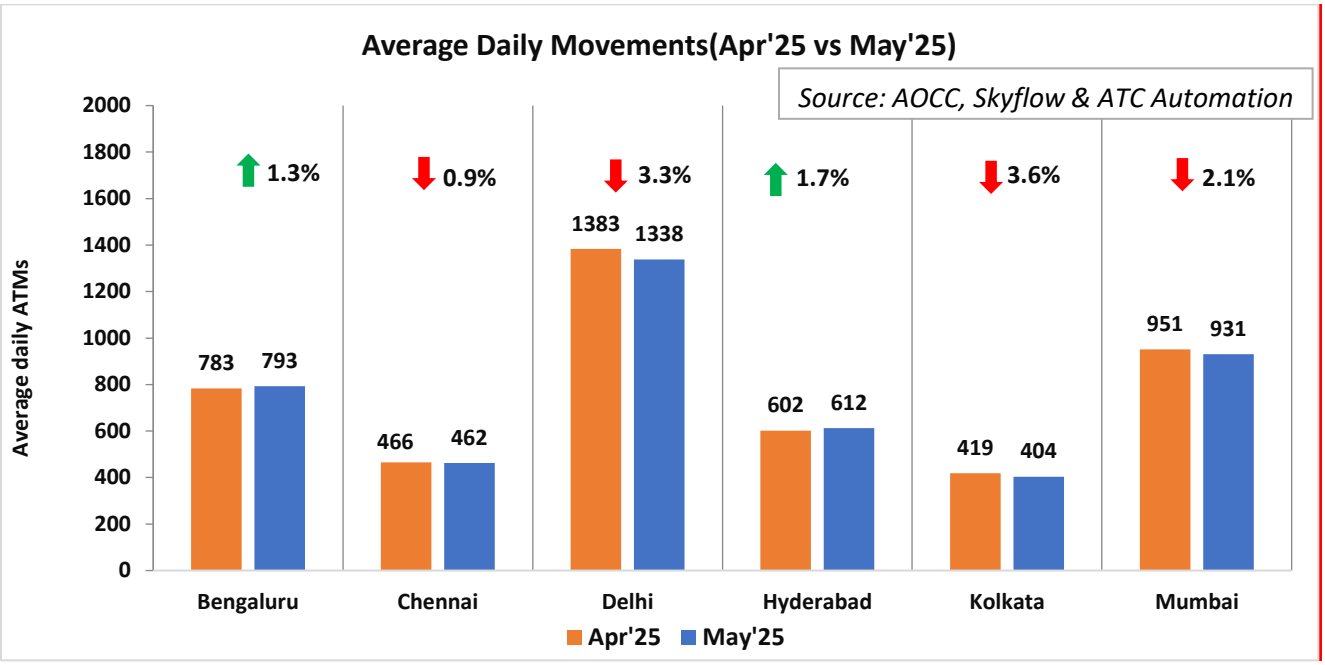


Figure 2: Average Daily Movements (Apr'25 vs May'25)

The above chart depicts the percentage change in average daily ATMs at six major Airports in May 2025 as compared to the previous month April 2025.

Airports\Year	Avg. Daily ATMs (YoY) for six major airports				
	May'21	May'22	May'23	May'24	May'25
Bengaluru	204	583	665	720	793
Chennai	141	361	403	409	462
Delhi	528	1220	1229	1324	1338
Hyderabad	157	441	467	521	612
Kolkata	143	390	373	394	404
Mumbai	252	798	871	925	931

Air Traffic Movement for each day in May 2025 is plotted for Delhi, Mumbai, Bengaluru and Hyderabad Airport along with the percentage change w.r.t. Avg. Daily Movements for the same month.

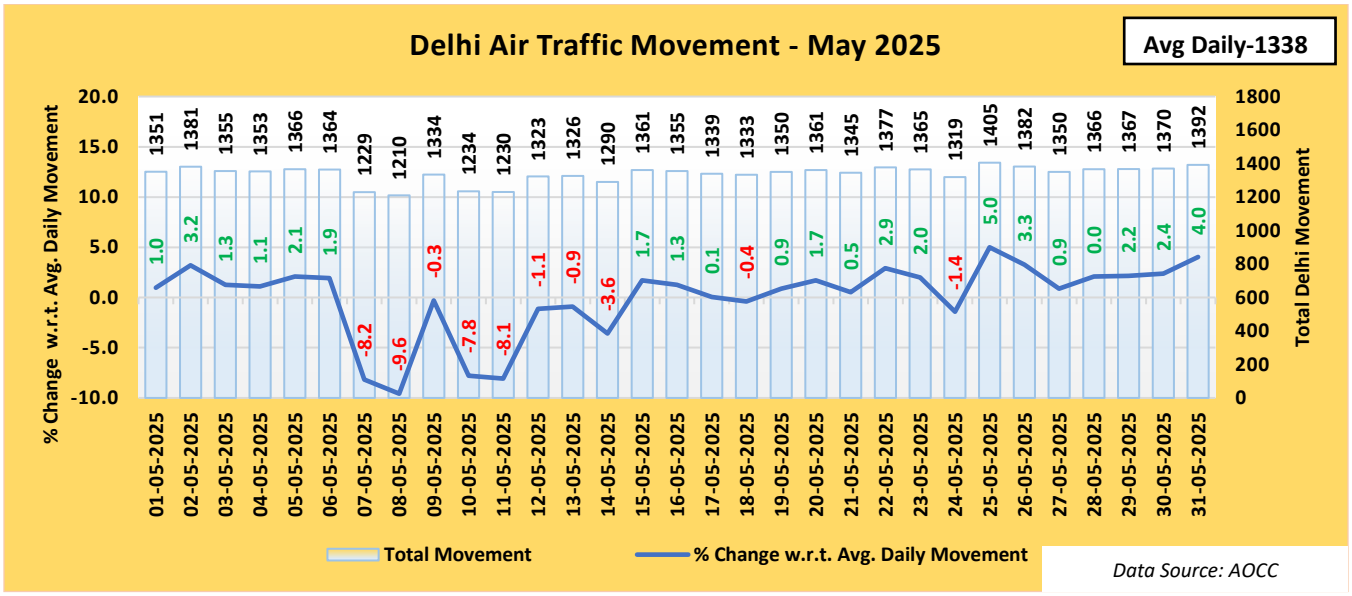


Figure 3: Air Traffic Movement for Delhi –May'25

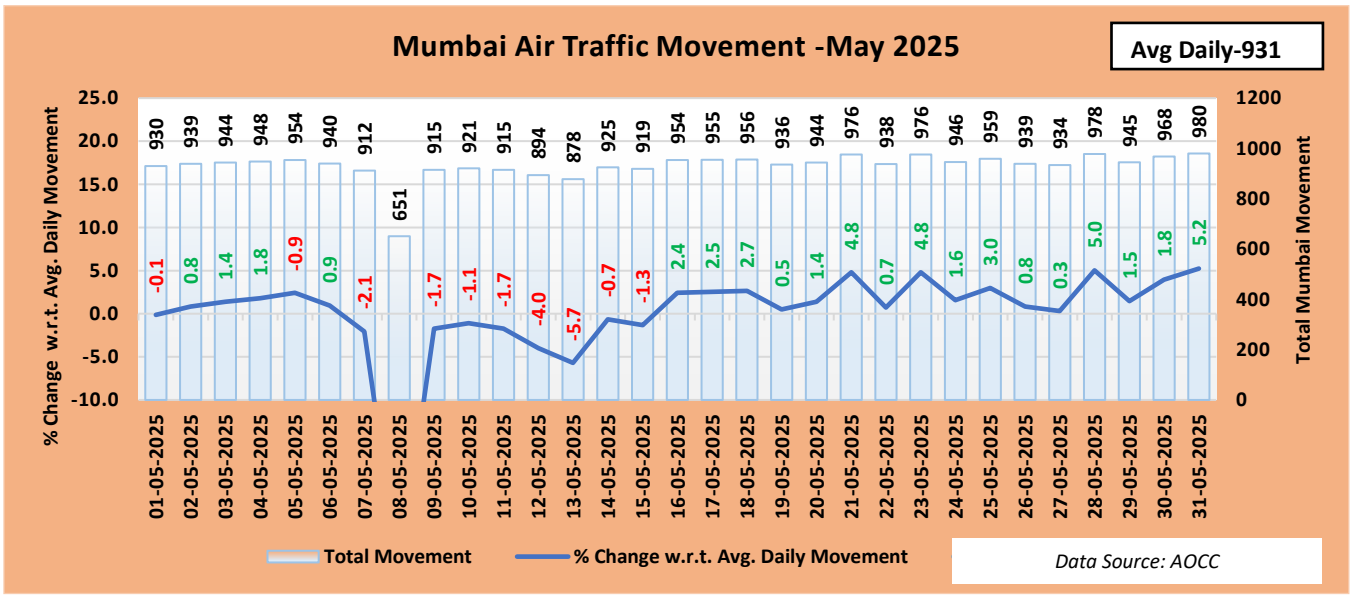


Figure 4: Air Traffic Movement for Mumbai – May'25

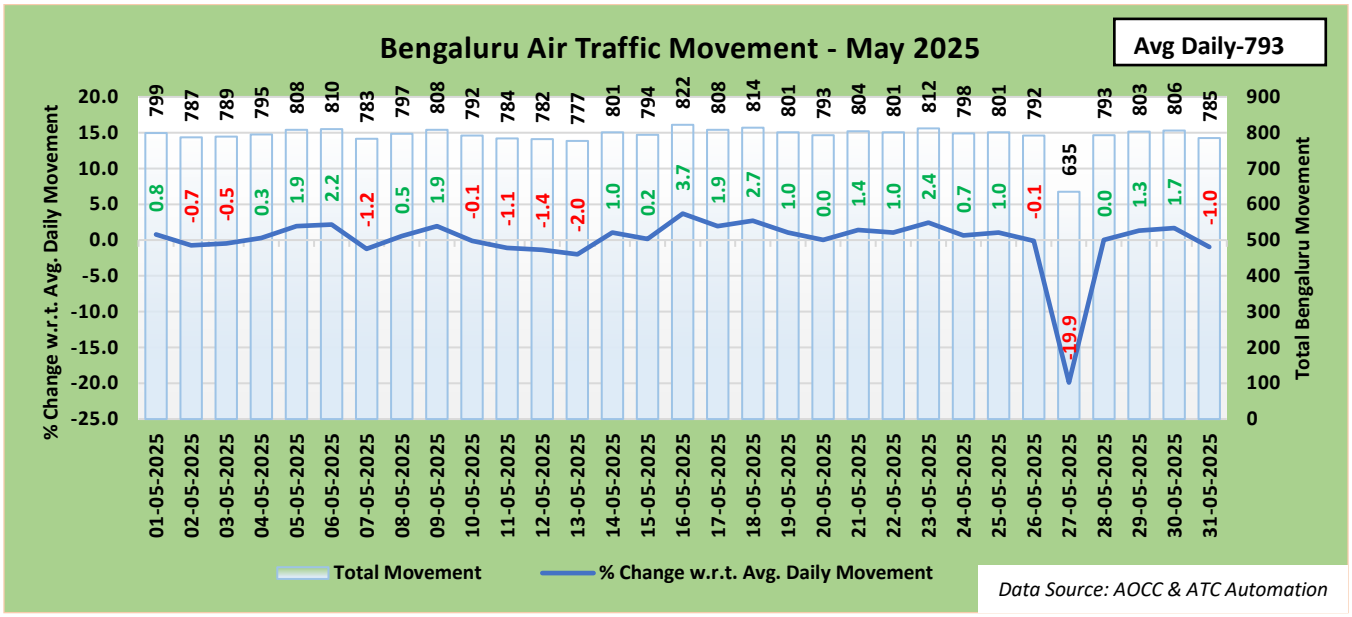


Figure 5: Air Traffic Movement for Bengaluru – May'25

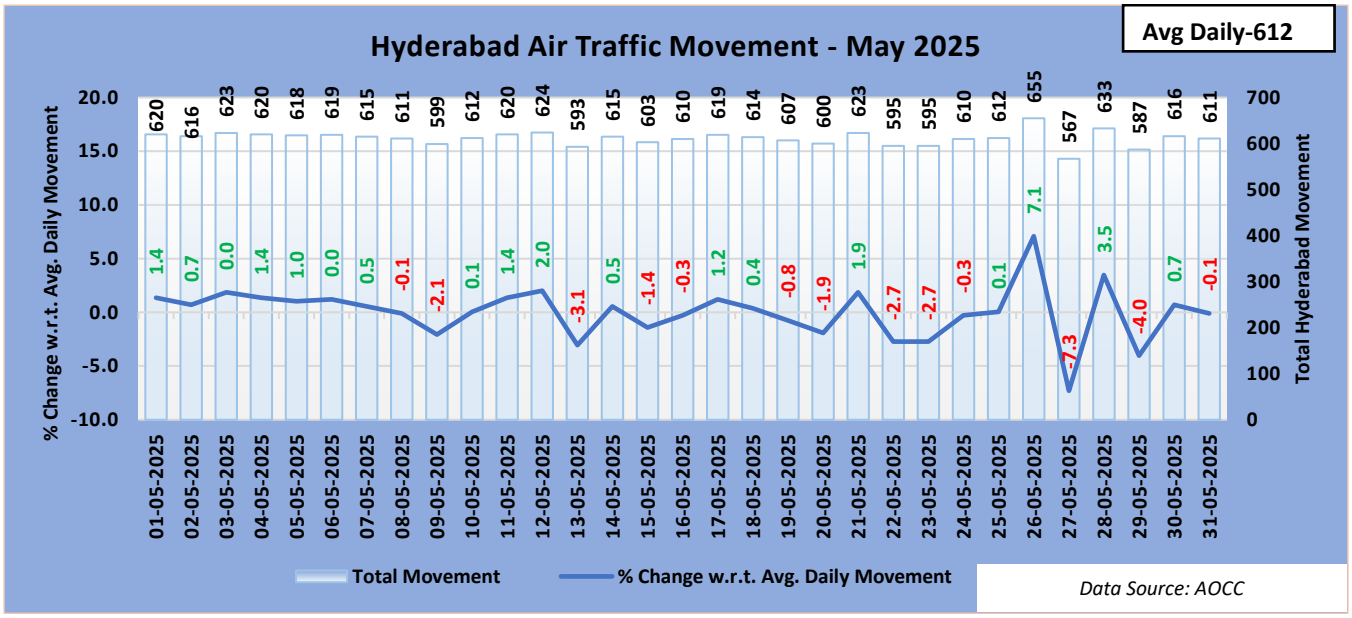


Figure 6: Air Traffic Movement for Hyderabad – May'25

It can be concluded from the above charts that the ATM at Delhi, Mumbai, Bengaluru and Hyderabad exceeds the average daily movement for 21 days, 20 days, 21 days and 18 days respectively in the month of April 2025.

II. Comparison of total ATMs (YoY) and Monthwise

The total Air traffic movement(ATMs) including Passenger and other flights such as Cargo flights, International scheduled, International non-scheduled, Domestic scheduled, Domestic non-scheduled, Air taxi & commercial business flights at six major Indian Airports namely Delhi, Mumbai, Bengaluru, Hyderabad, Kolkata and Chennai is plotted for the month of May for two consecutive years 2024 and 2025 respectively. Air Traffic movement is also plotted Airline wise for the last six months for the major Scheduled Operators.

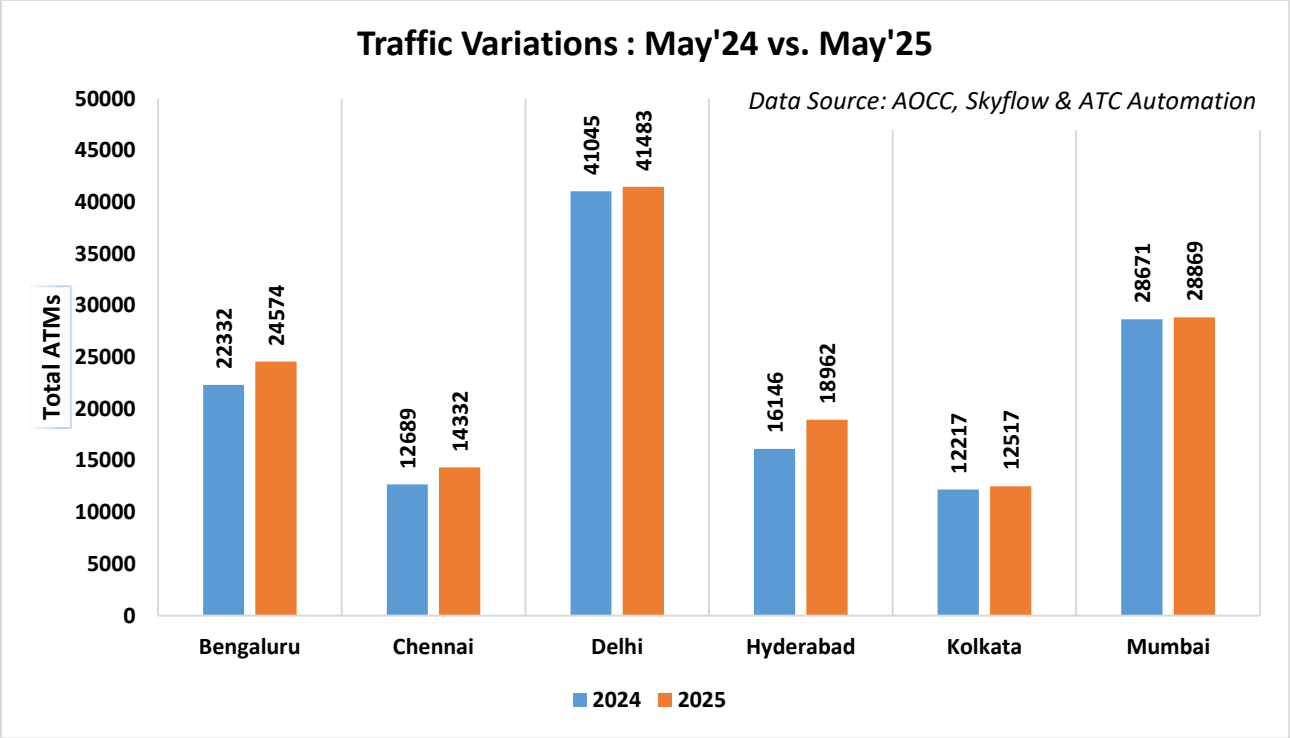


Figure 7: Traffic Variation (YoY)

III. Flight Operations – Airlinewise

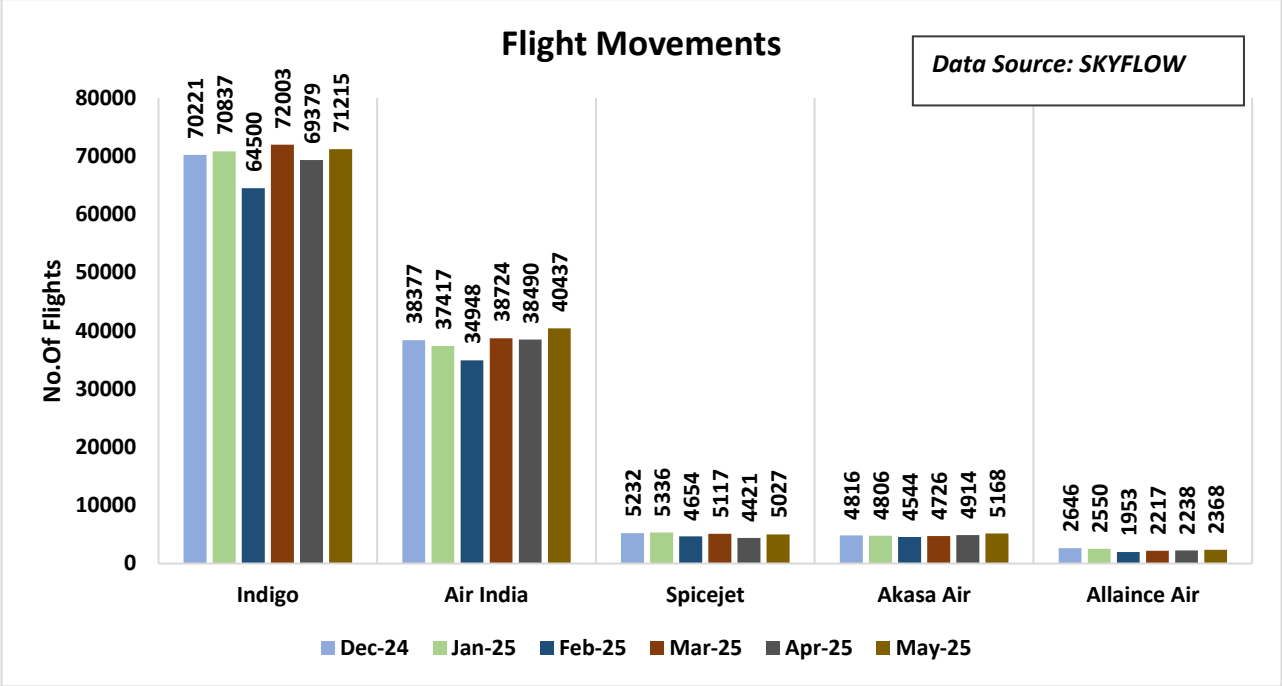


Figure 8: Flight Movements –Airlinewise

Inference:

1. Air India, Akasa, Spicejet and Alliance air airlines have recorded an increase in the monthly average(31 days) Flight movement in May'25 as compared to April'25 while Indigo airlines have recorded a decline during the same period.

C. ATFM Post Operations – CDM Analysis

I. Introduction

Analysis Period **1st – 31st May 25**

Back Ground During the above mentioned period, **Three (03)** ATFM measures were applied **for Bengaluru Airport, Nine (09)** ATFM measures were applied **for Chennai Airport, Five (05)** ATFM measures were applied **for Delhi Airport, One (01)** ATFM measures was applied **for Hyderabad Airport and Fourteen (14)** ATFM measures were applied **for Mumbai Airport** due to the following reasons as illustrated in the bar chart below:–

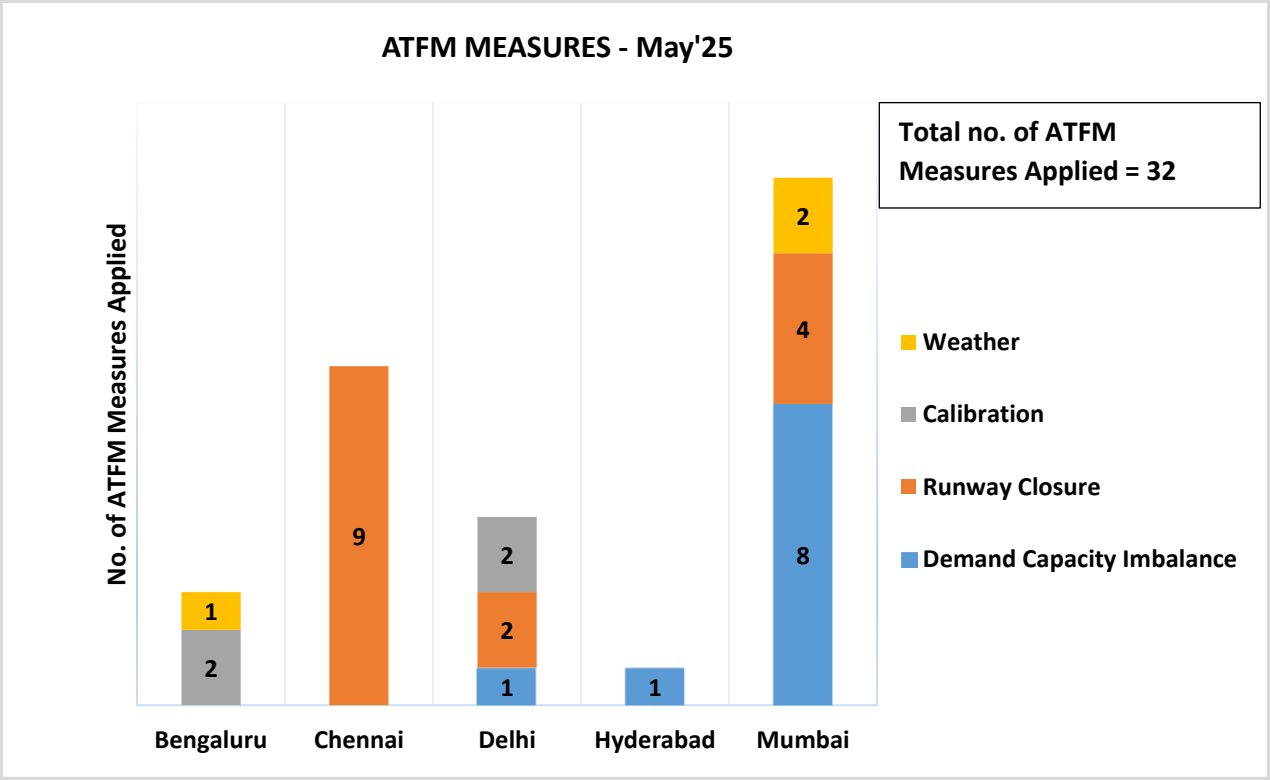


Figure 9: ATFM Measures –May'25

II. ATFM Measures Overview

Constrained Airport	Bengaluru	Chennai	Delhi	Hyderabad	Mumbai
Number of ATFM measures applied	3	9	5	1	14
Average ATFM Ground delay(in min) due to measures*	44.5	25.1	19.5	26.5	38.4
Maximum ATFM Ground delay(in min) due to measures	110	49	41	51	90
% Compliance	97.9	98.8	96.5	100	98.6

Note: * $Average\ ATFM\ Delay = \frac{Total\ ATFM\ Delay}{Total\ Domestic\ Arrivals}$

Total Arrivals	1855
Total International Arrivals(exempted)	401
Total affected flights in scenario (Domestic Arrivals)	1454
Total Domestic Arrivals with zero ATFM delay	88
Total Domestic Arrivals with ATFM delay	1366

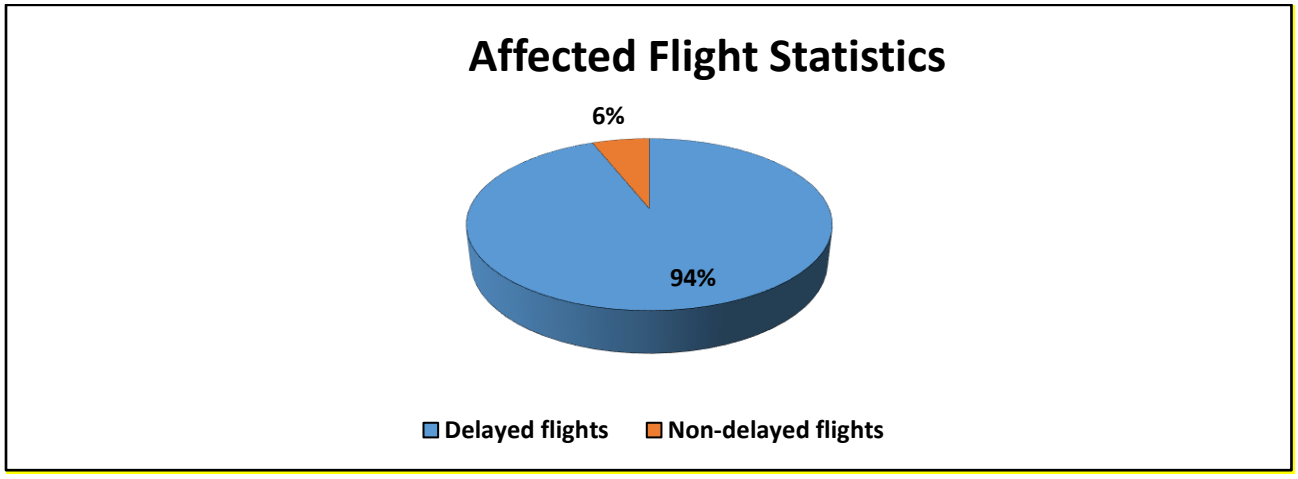


Figure 10: Affected Flight Statistics –May'25

III. Overall Compliance

Total arrivals	1855
Domestic arrivals	1454
Flights with complete data (ATOT)	1432
Flights with incomplete data	9
Flights Not Operated	13
Compliant*	1404
Non-Compliant	28

*Total No. of Revised CTOTs issued = 427 (Compliance calculation for flights which were issued revised CTOT is w.r.t. new CTOT issued)

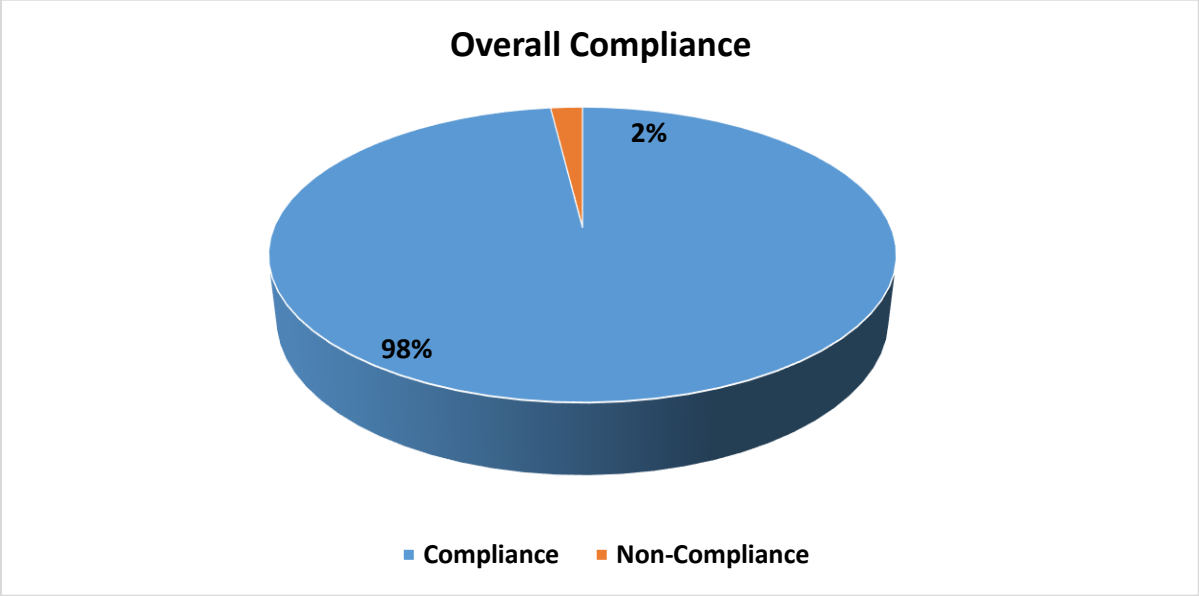


***Figure 11*: Overall Compliance – May'25**

NOTE: Flights with required data (i.e. ATOT) are only considered for compliance measurement

Out of the total domestic arrivals with complete data in the CDM scenario, 98% arrivals are compliant for the month of May 2025.

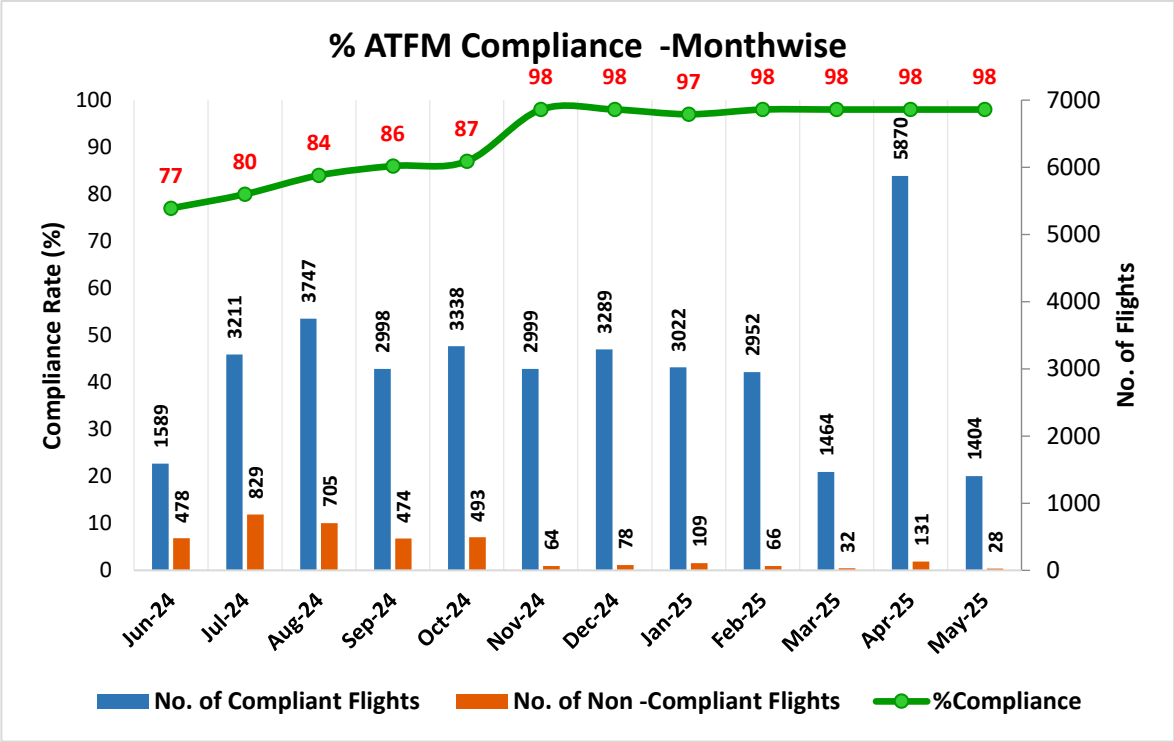


Figure 12: Compliance(Monthwise)

Inference

1. Out of the total arrivals captured(1855 flights) during the CDM scenario for the constrained Airports, 78.4% of flights i.e. domestic arrivals(1454 flights) were candidates for ground delay(participating).
2. Out of these Domestic Arrivals(1454), 93.9% (1366 flights) are assigned ATFM ground delay.
3. Out of the total arrivals captured(1855 flights) to the constrained Airport during the ATFM scenario, 73.6% of flights(1366 flights) were assigned ATFM Ground Delay.

IV. CTOT Compliance rate – Airportwise

MUMBAI FIR (100%)*	Compliant	Non Compliant	% Compliant
Ahmedabad	50	0	100%
Aurangabad	6	0	100%
Mumbai	71	0	100%
Bhuj	5	0	100%
Vadodara	9	0	100%
Bhopal	18	0	100%
Diu	1	0	100%
Gondia	1	0	100%
Hirasar, rajkot	5	0	100%
Indore	23	0	100%
Jabalpur	6	0	100%
Jalgaon	2	0	100%
Jamnagar	3	0	100%
Kandla	3	0	100%
Kolhapur	2	0	100%
Nagpur	23	0	100%
Pune	12	0	100%
Shirdi	4	0	100%
Surat	7	0	100%
Udaipur	13	0	100%
KOLKATA FIR (98%)*	**Compliant**	**Non Compliant**	**% Compliant**
Prayagraj	5	3	63%
Agartala	1	0	100%
Ayodhya	10	0	100%
Siliguri	27	0	100%
Shillong	1	0	100%
Varanasi	28	0	100%
Bhubaneswar	36	0	100%
Kolkata	73	0	100%
Chakeri	1	0	100%
Durgapur	5	0	100%
Darbhanga	9	0	100%

Deoghar	4	0	100%
Gorakhpur	3	0	100%
Guwahati	26	0	100%
Gaya	2	0	100%
Jharsuguda	3	0	100%
Jagdalpur	1	0	100%
Aizawl	0	1	0%
Dibrugarh	2	1	67%
Dimapur	2	0	100%
Patna	33	0	100%
Ranchi	17	0	100%
Raipur	13	0	100%
DELHI FIR (96%)*	**Compliant**	**Non Compliant**	**% Compliant**
Amritsar	16	0	100%
Adampur	1	0	100%
Bikaner	1	1	50%
Bareilly	1	0	100%
Chandigarh	27	3	90%
Dehradun	17	0	100%
Delhi	155	4	97%
Hindon	2	1	67%
Kangra	2	0	100%
Gwalior	2	0	100%
Jodhpur	8	0	100%
Jaipur	21	0	100%
Jammu	4	1	80%
Leh	6	2	75%
Lucknow	32	0	100%
Srinagar	13	1	93%
CHENNAI FIR (98%)*	**Compliant**	**Non Compliant**	**% Compliant**
Hal Bangalore	1	0	100%
Bangalore	110	1	99%
Belgaum	1	0	100%
Bidar	1	0	100%
Vijayawada	20	0	100%
Coimbatore	33	0	100%

Kochi	40	3	93%
Calicut	1	1	50%
Kadapa	1	0	100%
MOPA Goa	29	0	100%
Gulbarga	1	0	100%
Goa	45	0	100%
Hubli	2	0	100%
Shamsabad, Hyderabad	81	1	99%
Vijaynagar	1	0	100%
Kannur	6	0	100%
Madurai	25	0	100%
Mangalore	17	1	94%
Chennai	57	0	100%
Nanded	1	0	100%
Port Blair	7	2	78%
Rajahmundry	5	0	100%
Shivamogga	3	0	100%
Tuticorin	9	0	100%
Tirupati	4	0	100%
Tiruchirappally	7	0	100%
Thiruvananthapuram	15	0	100%
Visakhapatnam	6	1	86%

**FIR wise compliance rate (decimals rounded off to nearest integer value).*
Note: The above list contains only those airports which had flights to the Constrained Airport and are affected by ATFM measures.
Airports with % compliance less than the average compliance(98%) for the month are highlighted in red.

V. CTOT Compliance rate – Airlinewise

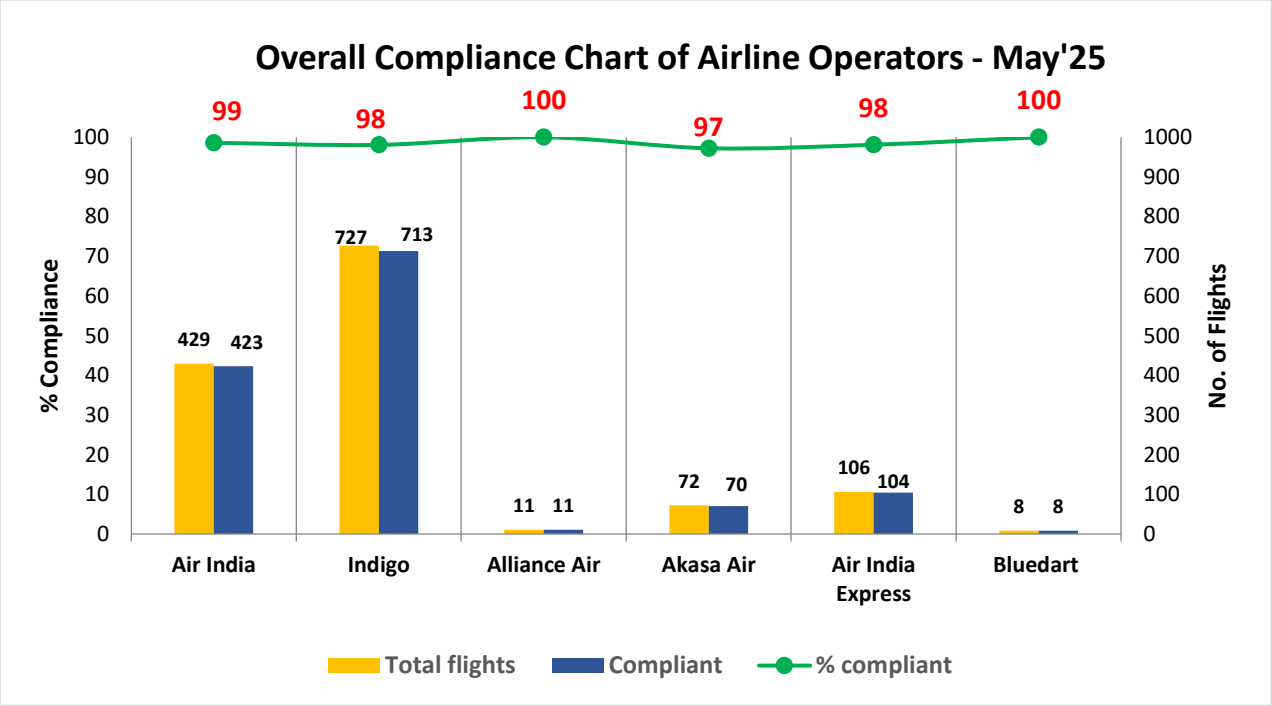


Figure 13: Airline wise Compliance –May'25

Inference

1. Mumbai region record the highest compliance of 100% whereas Delhi region has the lowest percentage compliance of 96%.
2. Air India, Air India Express,Alliance air,Blue dart, Indigo and Spicejet Airlines have a CTOT compliance higher than or equal to the average recorded compliance for the month of May'25.

VI. Reason For Non Compliance

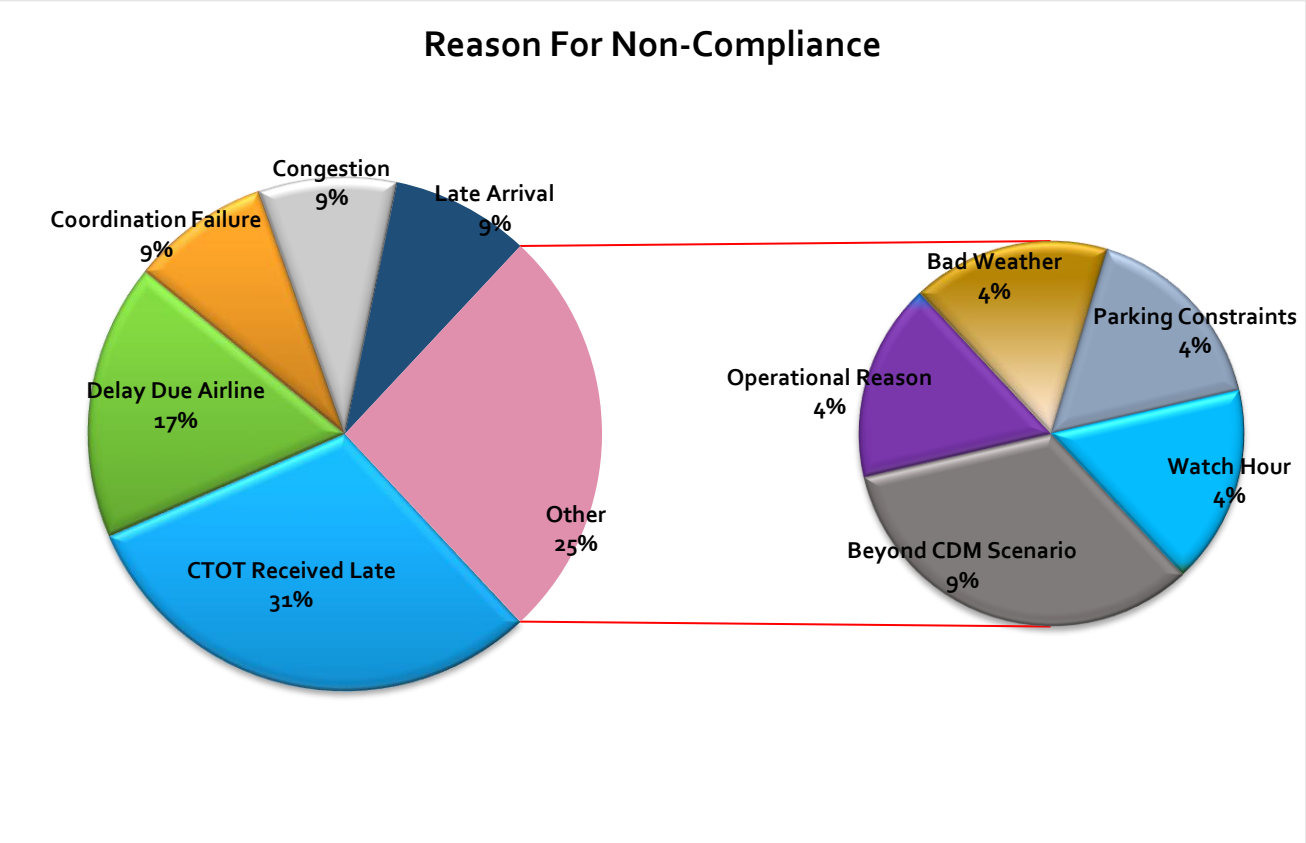


Figure 14: Reason for Non-Compliance as provided by FMPs

Inference:

1. 31 % of the CTOT Non- compliance was reported by concerned FMPs to be due to late receipt of CTOTs and by the time the aircraft had already initiated pushed back or start up .
2. 17 % of the CTOT Non- compliance was due to Delay by airlines and 9 % of CTOT Non- Compliance was reported by concerned FMPs to be due to coordination failure.
3. 9 % of the CTOT Non- compliance was due to ground traffic congestion at airports and 4% due to parking constarints at various airports.
4. 9 % of the CTOT Non- compliance was reported by concerned FMPs to be due to late arrivals from previous station.
5. 4 % of the CTOT Non- compliance was reported by concerned FMPs to be due to Operational reasons (due to Bird Activity on Runway, ATC handling emergency etc) & 4% of the CTOT Non- compliance due to bad weather at the concerned station.

VII.Air Delay during the CDM Scenario period

Average Air Delay to domestic arrivals* within the CDM Scenario period for Bengaluru, Chennai, Delhi, Hyderabad and Mumbai was 7.5, 9.6, 15.1, 19.3 and 11.6 minutes respectively.

**Note: Only calculated for domestic arrivals with both ATOT and ALDT information*

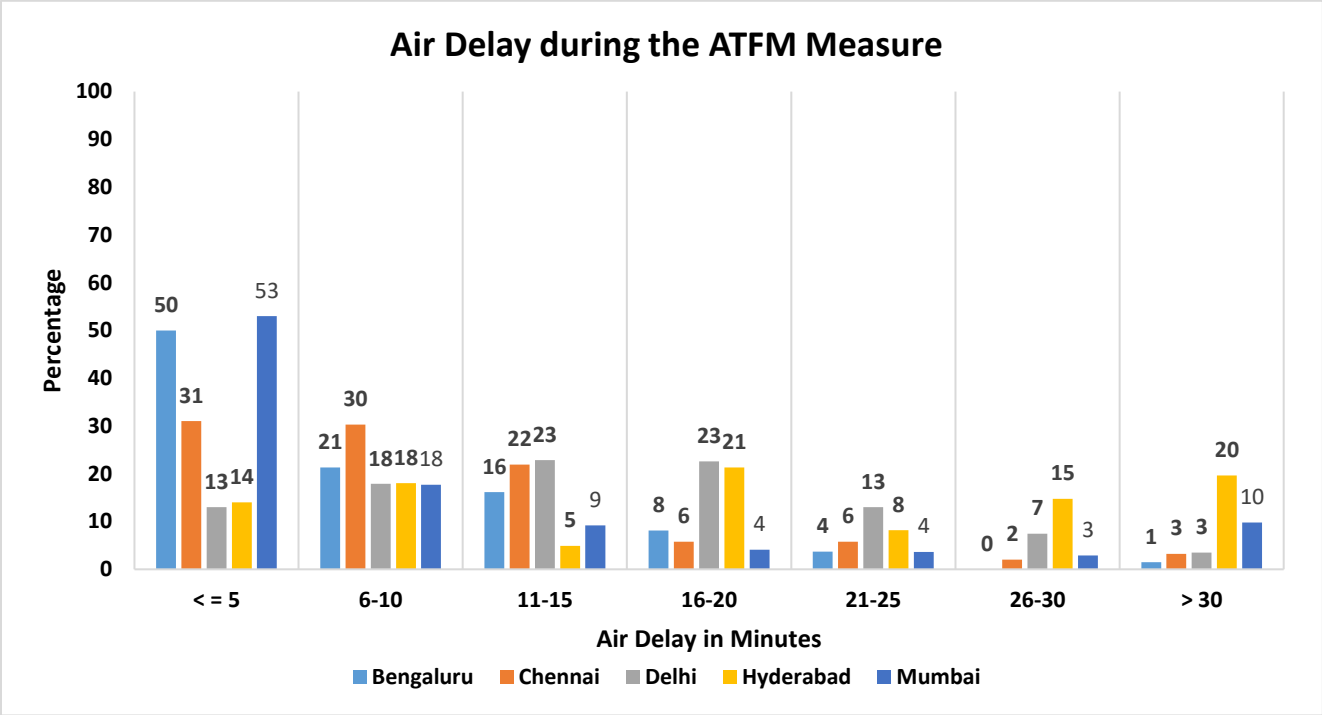


Figure 15: Air Delay distribution during the CDM period

Inference

1. 71% of domestic arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period.
2. 61% of domestic arriving flights to Chennai had an Air delay of equal to or less than 10 minutes during the CDM period.
3. 31% of domestic arriving flights to Delhi had an Air delay of equal to or less than 10 minutes during the CDM period.
4. 32% of domestic arriving flights to Hyderabad had an Air delay of equal to or less than 10 minutes during the CDM period.
5. 71% of domestic arriving flights to Mumbai had an Air delay of equal to or less than 10 minutes during the CDM period.

VIII. Tangible Benefits due to ATFM Measures

A modest attempt is made to find out the tangible benefit of ATFM measures applied.

Assumptions:

•When ATFM measures are not in force, all flights take off at their ETOT where Estimated take off time(ETOT)= Estimated off block time(EOBT) + default taxi time

•All flights have an Estimated elapsed time(EET) as calculated by SKYFLOW using the Flight Plan information and Basic Aircraft data.

Methodology:

Air delay (with ATFM measures in force) is calculated during the period when ATFM measures are in force by summing the air delay for all the flights landing at constrained Airport.

i.e. **Total Air Delay = ∑ (Actual Flying time – SKYFLOW calculated EET)**

Air delay (with no ATFM measures) is calculated as the sum of Air delay for all the flights during the above said period with no ATFM measures in place and the air delay for each flight is the difference in its ideal landing time and its ideal estimated landing time.

Total Air Delay (with no ATFM measures) = **∑ (Ideal LDT - Ideal ELDT)**

*Ideal LDT is taken by assuming every flight is landing at a specified interval based on the Arrival acceptance rate(AAR) defined,

*Ideal ELDT = ETOT + SKYFLOW calculated Flying time

Fuel Saving Calculation :

Great Circle Distance(GCD)* was calculated for all the arrivals during the ATFM Measure from the point of origin to destination. Assuming Airbus 320 as reference aircraft for flights (flight distance equal to or less than 3000 nm) and B777 for international flights (flight distance more than 3000nm):

Fuel consumption (Kgs / nm) for each affected flight in the scenario was then calculated using the Reference document: ICAO Carbon emissions calculator methodology, version10, Appendix C: ICAO Fuel Consumption Table.

The Fuel consumed per minute(Kg/min) was calculated for each affected flight.

Total Air Delay(with ATFM Measures)= 18525 mins

Total Air Delay (with no ATFM measures) = 33825 mins

Reduction in Air delay due to ATFM measures= (33825-18525) = **15300 mins**

Fuel Saving Calculation:

Total Fuel saved during the ATFM Measure: ***9,79,799.6 Kg***

Total reduction in CO_2 emission : 3.16(KgCO_2/kg fuel)* 9,79,799.6 **Kg** ***= 30,96,166.68 Kg***

**GCD (Great Circle Distance): The distance between origin and destination airports is derived from latitude and longitude coordinates originally obtained from ICAO Location Indicators database.*

3.16 = constant representing the number of tonnes of CO2 produced by burning a tonne of aviation fuel.

D. Glossary

ATFM Parameters	**Definition**
Affected Flight statistics	An insight of participating traffic in the scenario i.e. ratio of the domestic arrivals to the constrained airport affected by ATFM measures (assigned delay by the Ground Delay Program) to the domestic arrivals not affected by ATFM measures (not assigned any delay) within the CDM scenario.
ATFM Ground delay	ATFM ground delay defined as CTOT-ETOT (Calculated take off time – Estimated take off time)
Average ATFM delay	$\frac{\boldsymbol{Total\ monthly\ ATFM\ delay\ (in\ minutes)}}{\boldsymbol{Total\ Domestic\ Arrivals}}$
Maximum ATFM delay	Maximum ATFM delay (in minutes) assigned in the month
Overall compliance rate	Defined as monthly ATFM departure slot adherence rate of regulated flights. Flights having ATOT within theATFM Slot Tolerance Window (STW) of minus 5 to plus 10 minutes of CTOTs, are considered as compliant flights
CTOT Compliance rate of Airline operators	An overview of CTOT compliance rate of various Airline operators
CTOT Compliance rate of Airports within different Regions	An overview of CTOT compliance rate of Airports within 4 FIRs
Air delay statistics	Air delay defined as difference between AET & EET, whereAET(actual elapsed time) can be obtained from (ALDT-ATOT) and estimated elapsed time(EET)can be obtained from FPL/RPL or (CLDT-CTOT). **Therefore, Air delay = AET-EET** Average Air Delay is calculated as: $\boldsymbol{Average\ Air\ Delay} = \frac{\boldsymbol{Total\ Air\ Delay\ to\ domestic\ arrivals\ (with\ values\ greater\ than\ zero)}}{\boldsymbol{Total\ Domestic\ Arrivals}}$ *CLDT: Calculated Landing Time* *CTOT: Calculated Take off Time* *ALDT: Actual Landing Time* *ATOT: Actual Take off Time*

Annexure-A

Compliance by Airlines with Flight Planning Requirements of Common Business rules(CBR)- May 2025.

I. Introduction:

Accurate and timely input in respect of flight intent is paramount to the correct traffic demand projection and eventually effective ATFM implementation. FPLs remain the main source of tactical demand prediction for ATFM systems. Early filing of error free FPL helps in improving the lead time required for ATFM measures and reduces the number of unexpected flights(pop-up). This in turn helps in improving the accuracy of demand-capacity imbalance prediction and optimizes slot utilization.

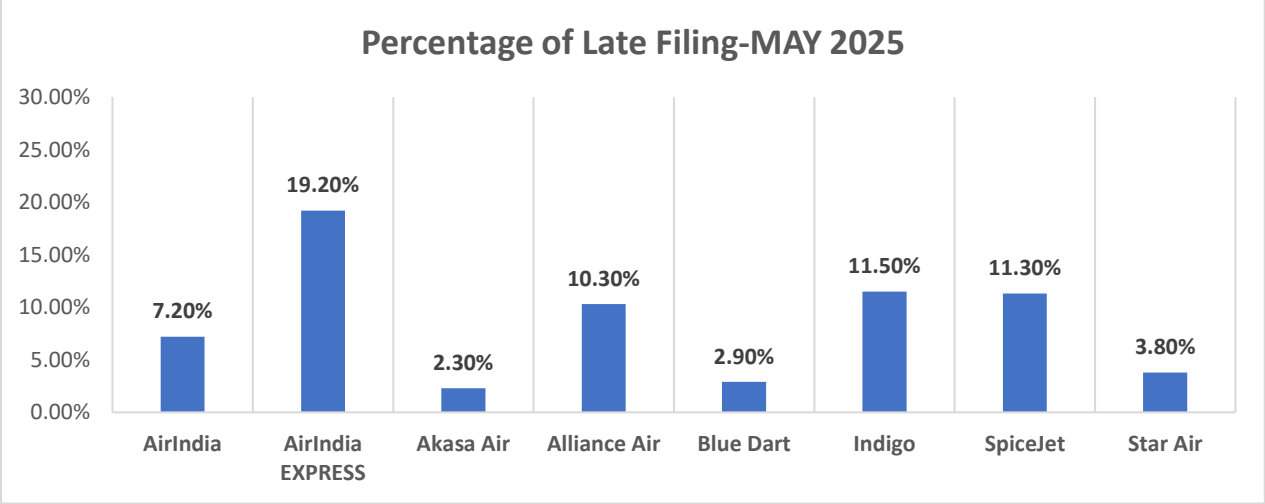
AIP India, ENR 1.9 section 4 on Flight Planning in the context of ATFM recommends Flight Planning requirements for all Airline Operators –

a) Flight plans shall be submitted at least 3 hours before the estimated off block time (EOBT);
b) The window for filing FPL is between 3 Hours and 120 Hours (Five days) before the EOBT. Earlier filing of FPL will give a realistic demand data to the CCC and hence the requirement of ATFM measures can be identified early for better planning. Late filing of a flight plan will lead to inaccuracies in predicting the demand and may lead to undesirable delay.

II. Analysis

A. An analysis has been conducted to find out the difference between the flight plan filing time and filed EOBT for all the FPLs received at ATFM system from 1st May 2025 to 31 st May 2025.
The purpose of the analysis is to monitor the compliance with provisions of AIP India, section 4, ENR 1.9 regarding Flight Planning requirements in context of the ATFM.

This flight plan filing requirement has been reiterated through the recently agreed ATFM common business rules (CBR) document and is recognized as a metrics to be monitored regularly for any improvement.



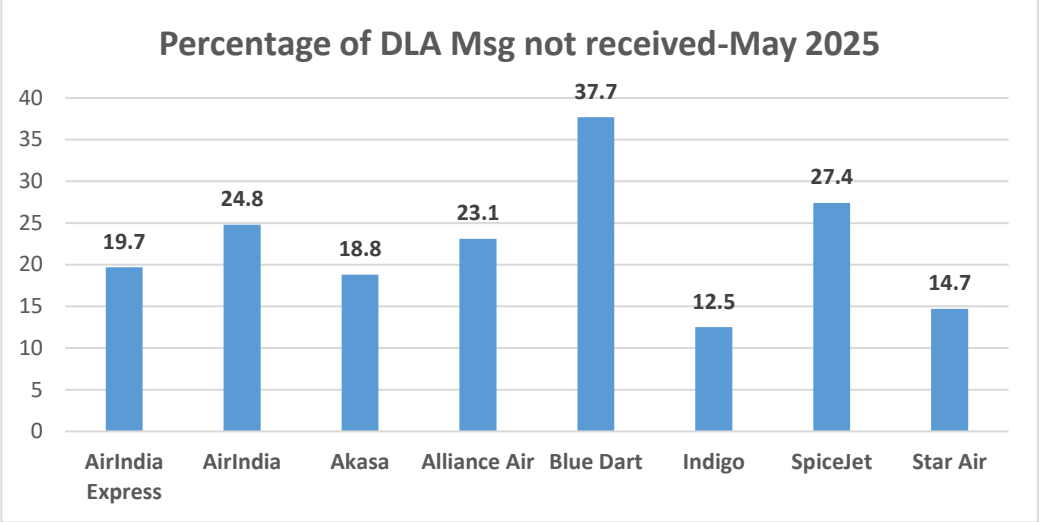
The table below lists number of filed flight plans (FPLs) with less than 3 Hours prior to EOBT:

Name of Airline	Late Filed FPL	Total No. Of FPL	% Delayed Filing
AirIndia	1577	21999	7.2%
AirIndia EXPRESS	3098	16138	19.2%
Akasa Air	108	4702	2.3%
Alliance Air	195	1893	10.3%
Blue Dart	19	665	2.9%
Indigo	7892	68856	11.5%
SpiceJet	458	4064	11.3%
Star Air	56	1475	3.8%
Total no. of FPLs for Scheduled Airlines	**13403**	**119792**	**11.2%**

B. For the analysis of non-receipt of DLA (Delay) messages for flight plans filed, the EOBT of FPL received has been compared with Actual Take off time (ATOT)received through DEP(Departure)messages.
Thus, only those FPLs were considered for analysis for which DEP messages were available and no associated DLA messages was received.

The Table below lists number of flights for which no DLA message was received in May 2025. **{(EOBT of original FPL)- (ATOT received)} > 30 minutes)**

Name of Airline	DLA Message not received	Total No. of flights considered for analysis	% of flights for which no DLA message was received
AirIndia Express	2098	10642	19.7%
AirIndia	4275	17249	24.8%
Akasa	671	3566	18.8%
Alliance Air	196	848	23.1%
Blue Dart	193	512	37.7%
Indigo	6654	53437	12.5%
SpiceJet	599	2186	27.4%
Star Air	82	559	14.7%



C. For analysis of non-receipt of CNL (cancel) messages for May 2025, annulled FPLs were considered for which no CNL/DEP/DLA messages were received. A FPL gets annulled in SKYFLOW system, if it doesn't get activated through Dep message /surveillance data/ manual activation by FMP within a defined system parameter.

The table below lists the number of Flights for which no CNL Msg. was received in May 2025:

Name of Airline	**CNL message not received**	**No. of flights annulled/cancelled**
AirIndia Express	96	294
AirIndia	10	28
Akasa	104	287
Alliance Air	9	26
Blue Dart	225	528
Indigo	174	186
SpiceJet	25	65
Star Air	125	257

-End OF Report-