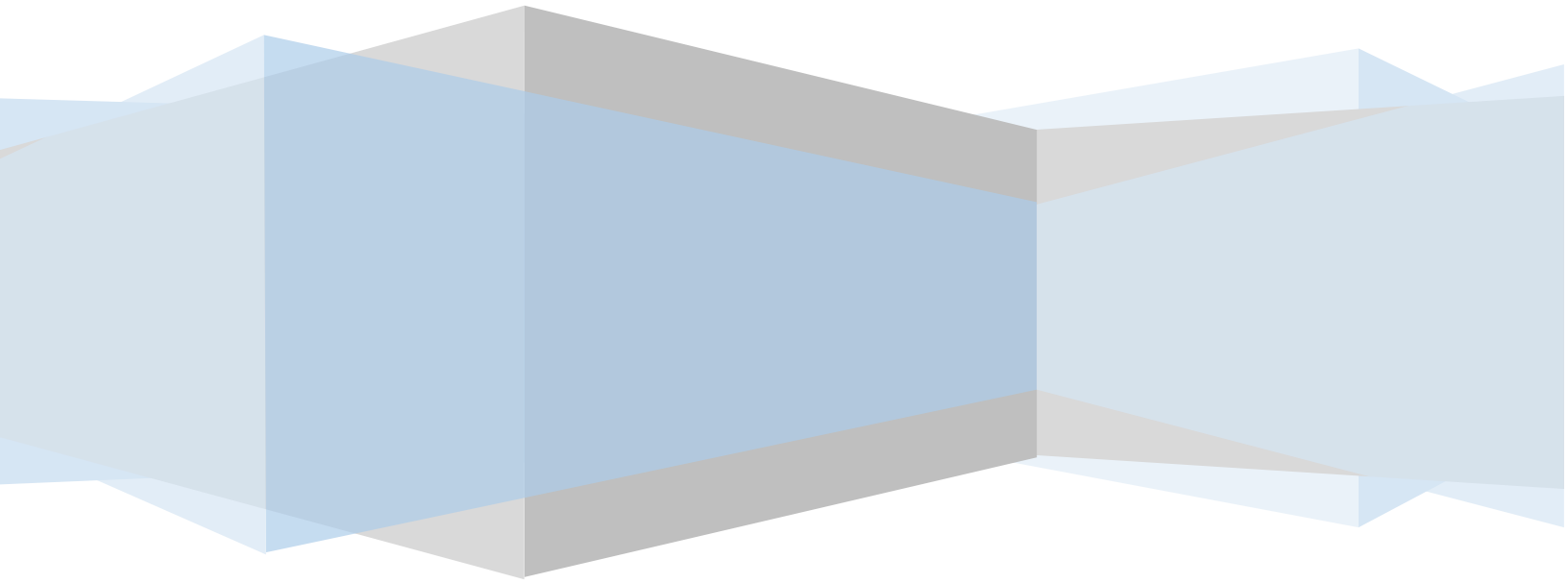
POST OPERATIONS ANALYSIS REPORT

April, 2025

CENTRAL COMMAND CENTER, C-ATFM, DELHI



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A. Executive Summary

Average Domestic air traffic (30 days) has recorded an increase of 1.9% whereas the average international air traffic has increased by 2.8 % in the month of April 2025 as compared to March '25.

On average, the Indian Airports in the ATFCM area saw 5956 IFR flights per day in the month of April 2025. The peak days were on 30th April 2025 (6389 IFR flights). Wednesday's were the busiest days throughout this month with an average of 6115 IFR flights per day.

Total Seventy (70) ATFM measures were applied this month during periods of congestion at Chennai, Delhi and Mumbai Airport.

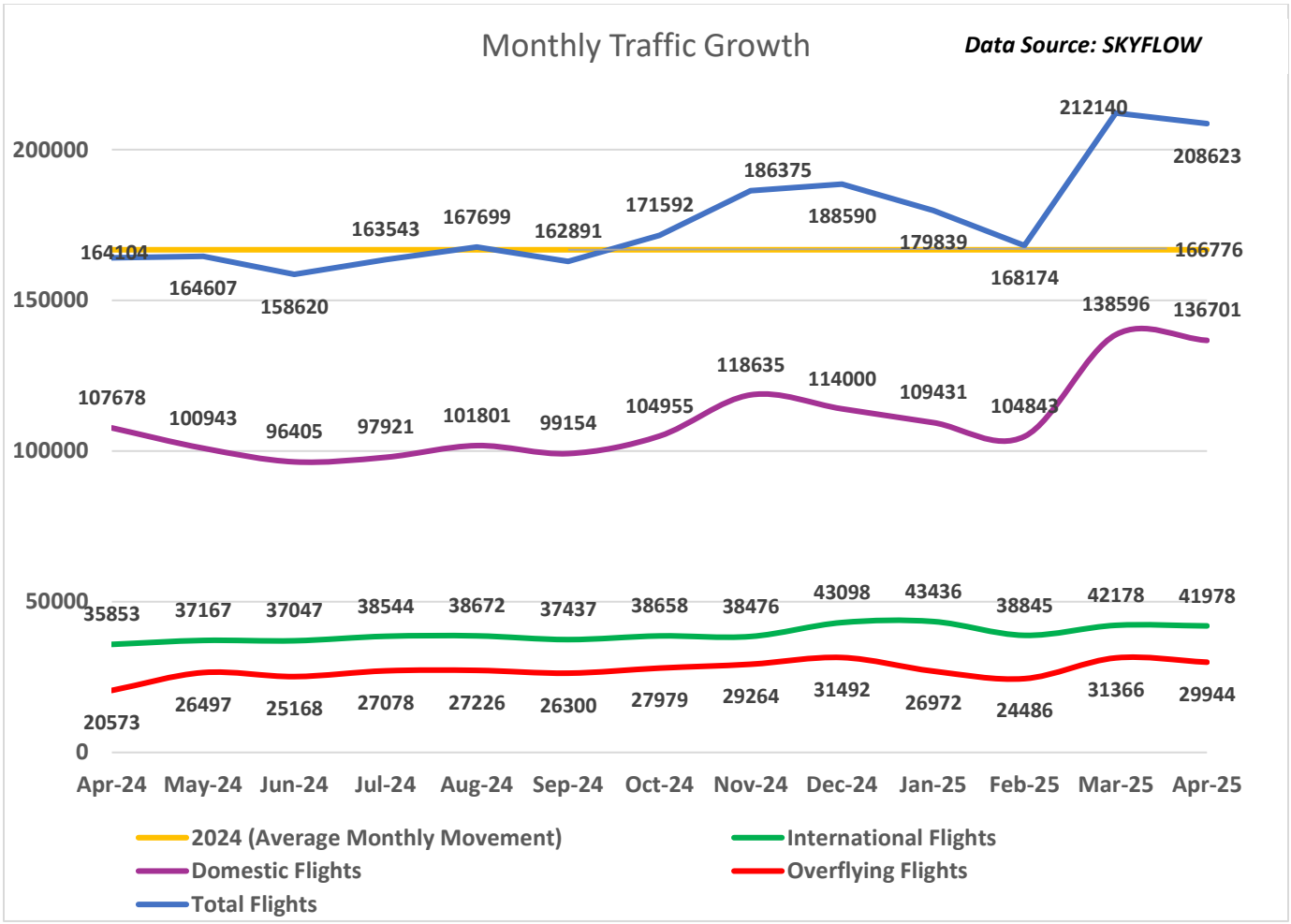


Figure 1: Monthly Traffic Growth

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

B. Traffic Analysis

I. Air Traffic Movement at Major Airports in India

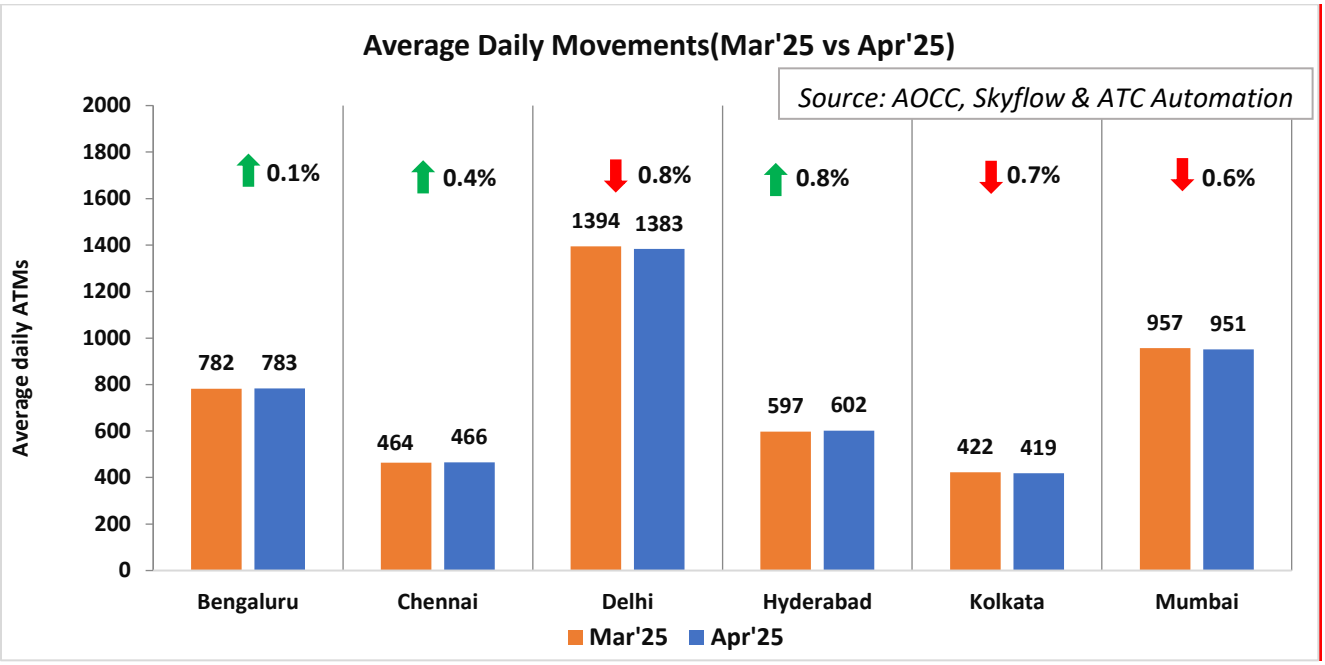


Figure 2: Average Daily Movements (Mar '25 vs Apr'25)

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

Airports\Year	Avg. Daily ATMs (YoY) for six major airports				
	Apr'21	Apr'22	Apr'23	Apr'24	Apr'25
Bengaluru	424	557	687	742	783
Chennai	286	353	407	411	466
Delhi	931	1210	1293	1307	1383
Hyderabad	305	440	487	530	602
Kolkata	290	376	384	406	419
Mumbai	480	753	883	936	951

Air Traffic Movement for each day in April 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.

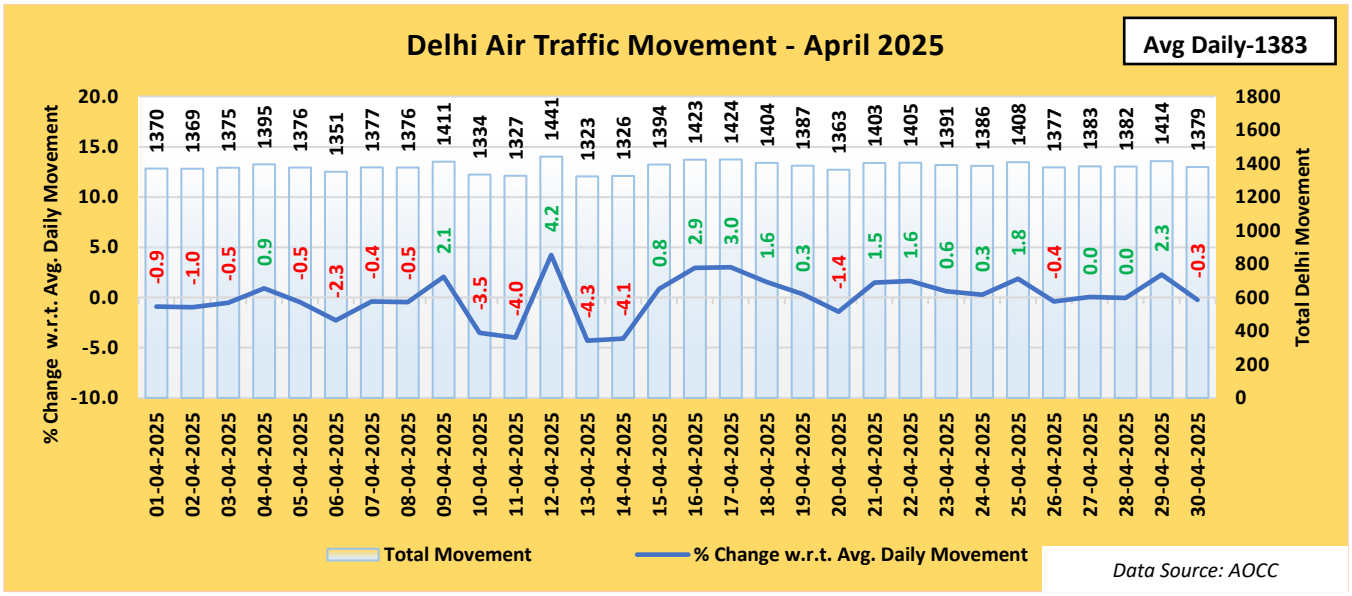


Figure 3: Air Traffic Movement for Delhi –Apr'25

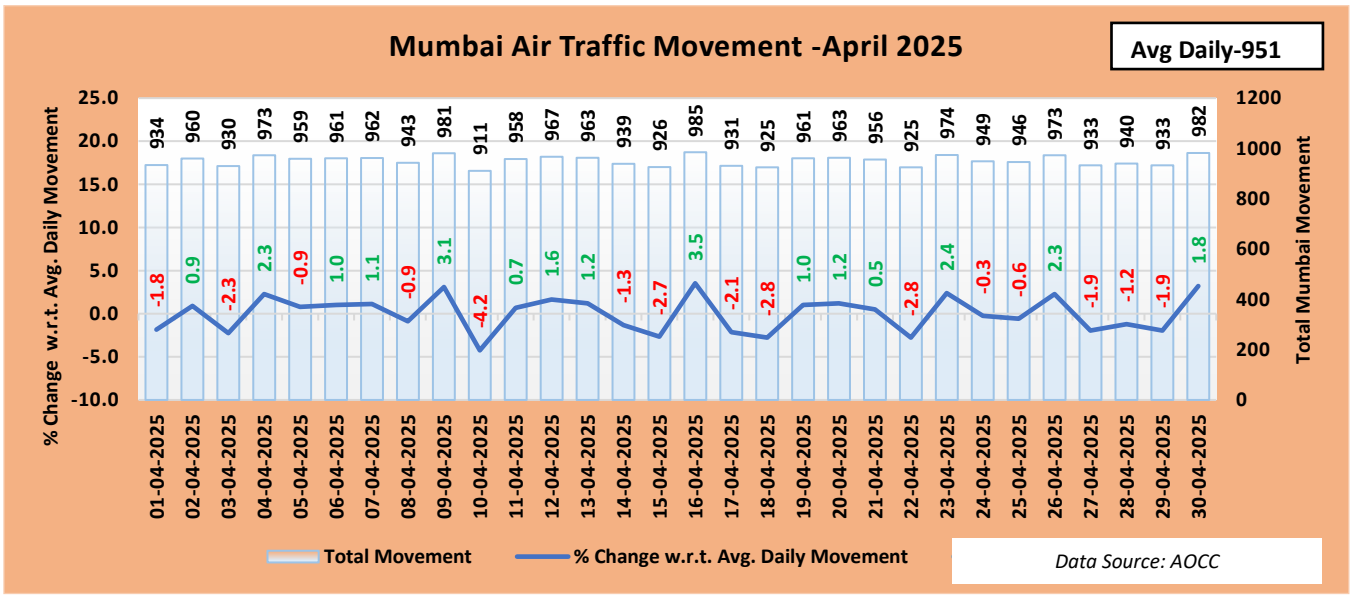


Figure 4: Air Traffic Movement for Mumbai – Apr'25

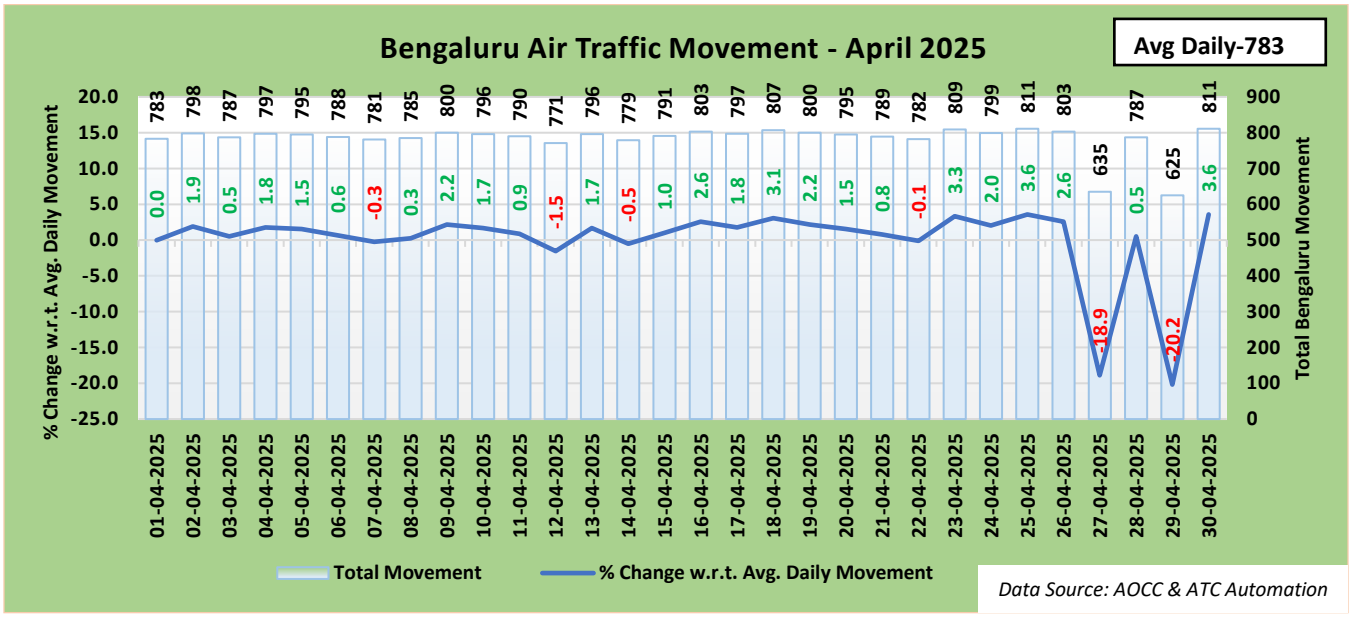


Figure 5: Air Traffic Movement for Bengaluru – Apr'25

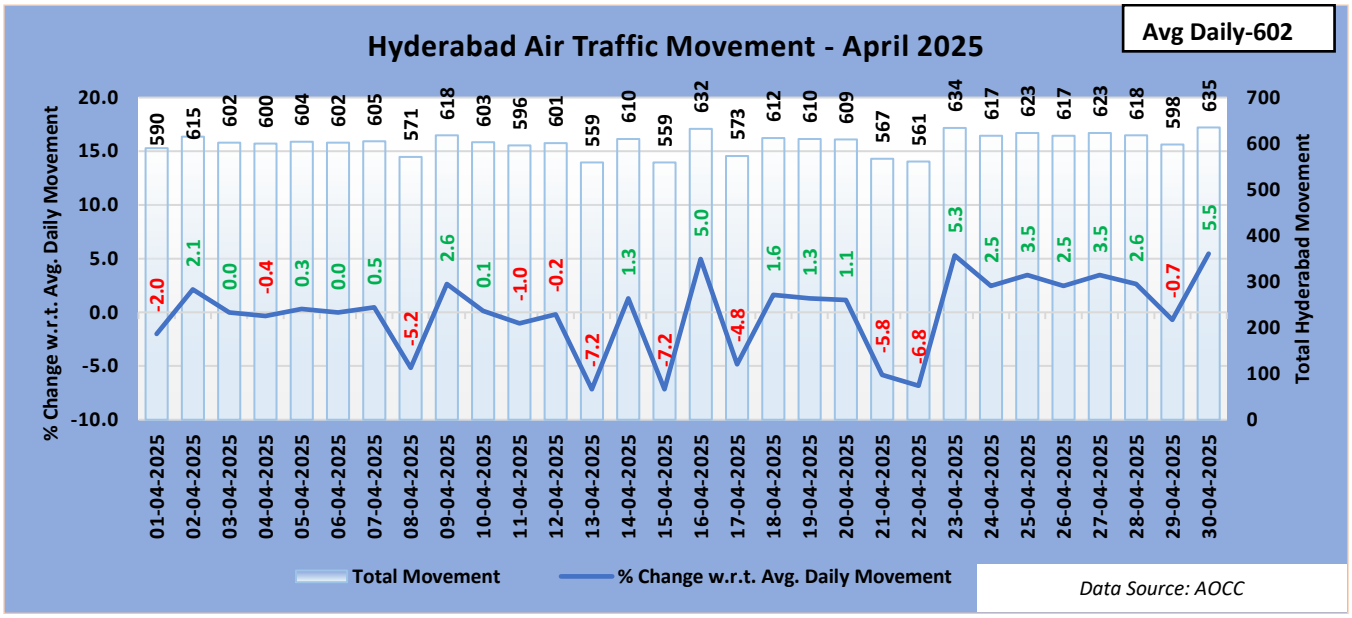


Figure 6: Air Traffic Movement for Hyderabad – Apr'25

It can be concluded from the above charts that the ATM at Delhi, Mumbai, Bengaluru and Hyderabad exceeds the average daily movement for 16 days, 15 days, 24 days and 19 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 April 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.

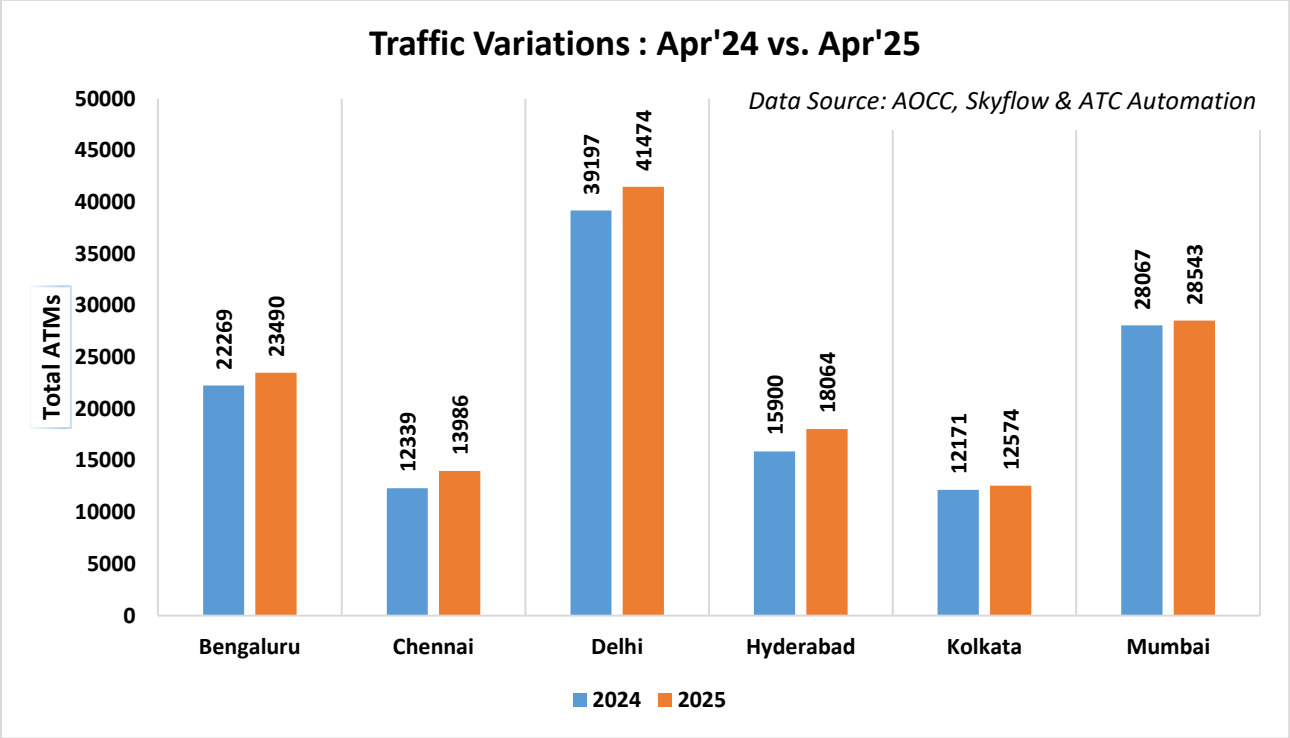


Figure 7: Traffic Variation (YoY)

III. Flight Operations – Airlinewise

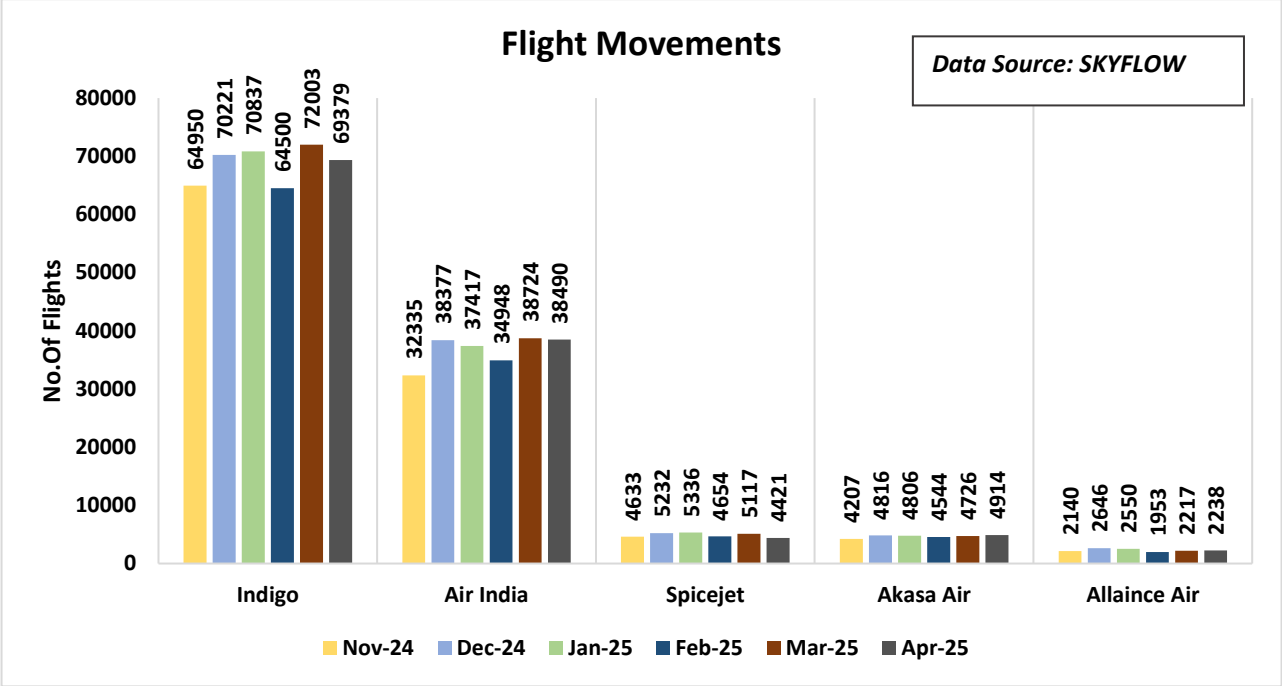


Figure 8: Flight Movements –Airlinewise

Inference:

1. Air India, Akasa and Alliance air airlines have recorded an increase in the monthly average(30 days) Flight movement in April'25 as compared to March'25 while Indigo and Spicejet airlines have recorded a decline during the same period.

C. ATFM Post Operations – CDM Analysis

I. Introduction

Analysis Period **1st – 30th April 25**

Back Ground During the above mentioned period, **Nine (09)** ATFM measures were applied **for Chennai Airport, Fifty Five (55)** ATFM measures were applied **for Delhi Airport and Six (06)** ATFM measures were applied **for Mumbai Airport** due to the following reasons as illustrated in the bar chart below:–

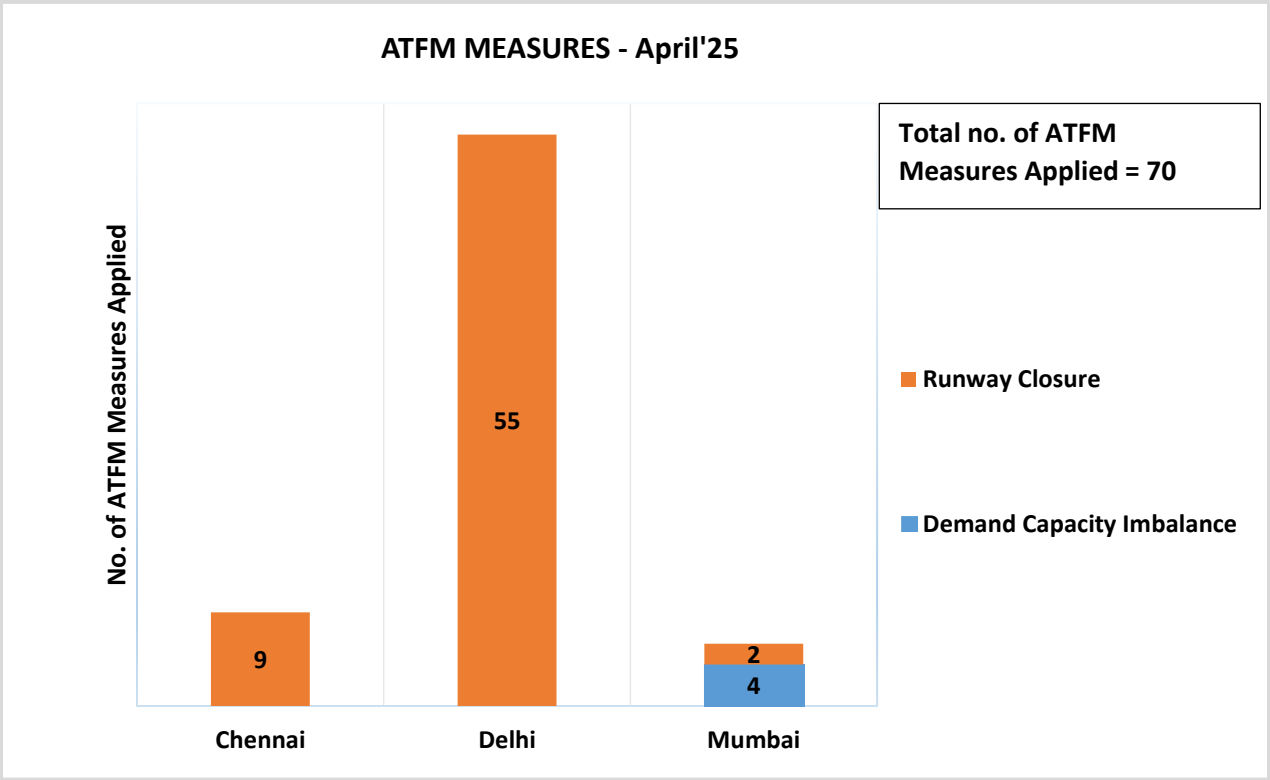


Figure 9: ATFM Measures –Apr'25

II. ATFM Measures Overview

Constrained Airport	Chennai	Delhi	Mumbai
Number of ATFM measures applied	9	55	6
Average ATFM Ground delay(in min) due to measures*	28.5	40.1	22.5
Maximum ATFM Ground delay(in min) due to measures	65	137	50
% Compliance	98.8	97.7	100

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

Total Arrivals	7532
Total International Arrivals(exempted)	1454
Total affected flights in scenario (Domestic Arrivals)	6078
Total Domestic Arrivals with zero ATFM delay	596
Total Domestic Arrivals with ATFM delay	5482

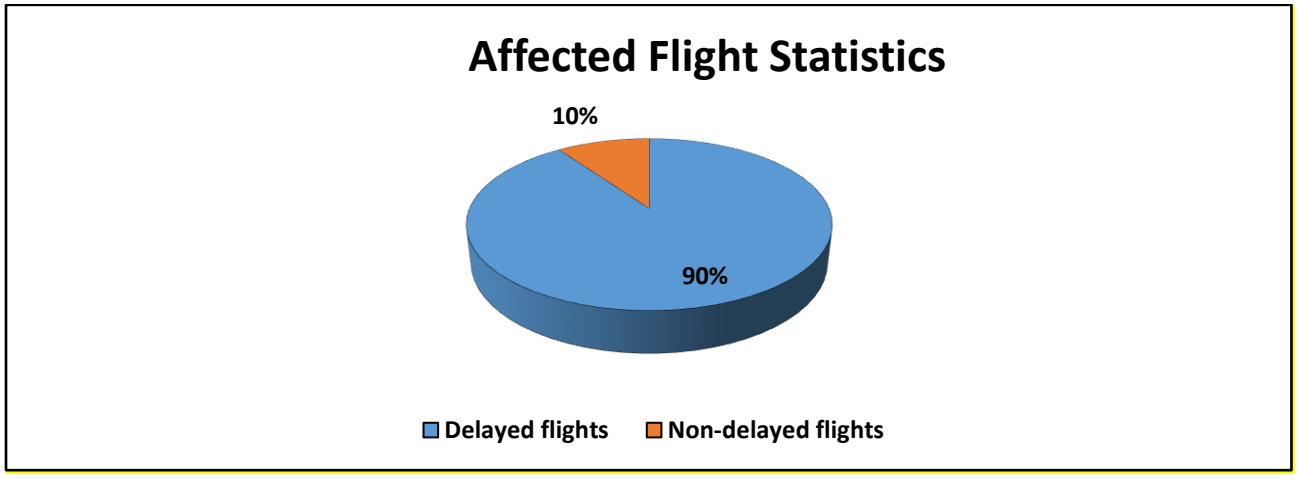


Figure 10: Affected Flight Statistics –Apr'25

III. Overall Compliance

Total arrivals	7532
Domestic arrivals	6078
Flights with complete data (ATOT)	6001
Flights with incomplete data	14
Flights Not Operated	63
Compliant*	5870
Non-Compliant	131

*Total No. of Revised CTOTs issued = 1503 (Compliance calculation for flights which were issued revised CTOT is w.r.t. new CTOT issued)

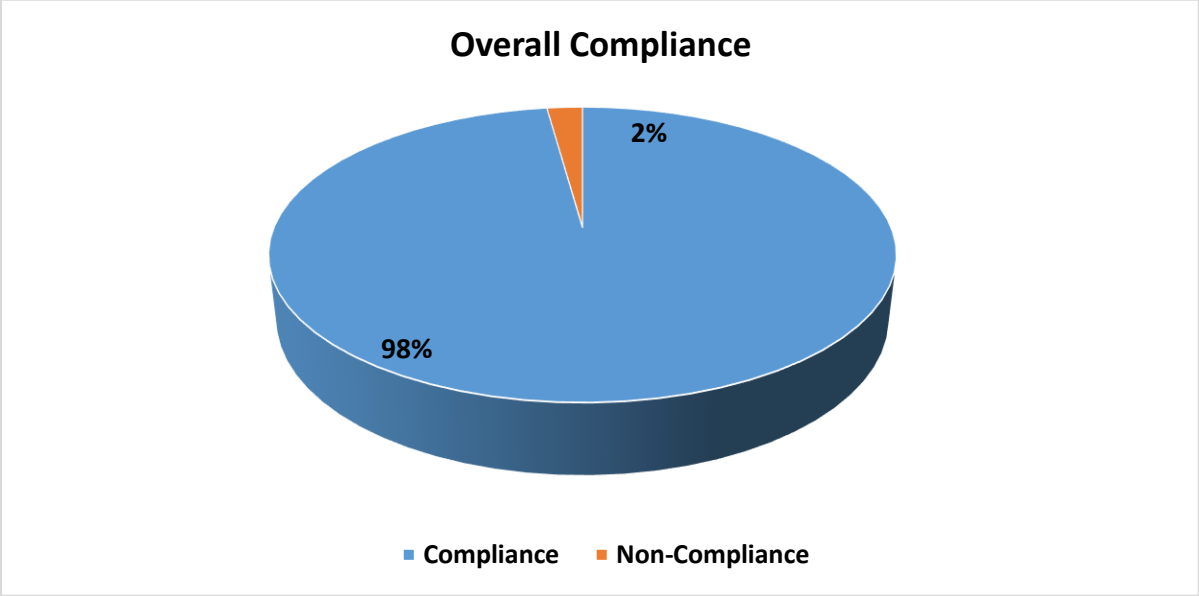


***Figure 11*: Overall Compliance – Apr'25**

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 April 2025.

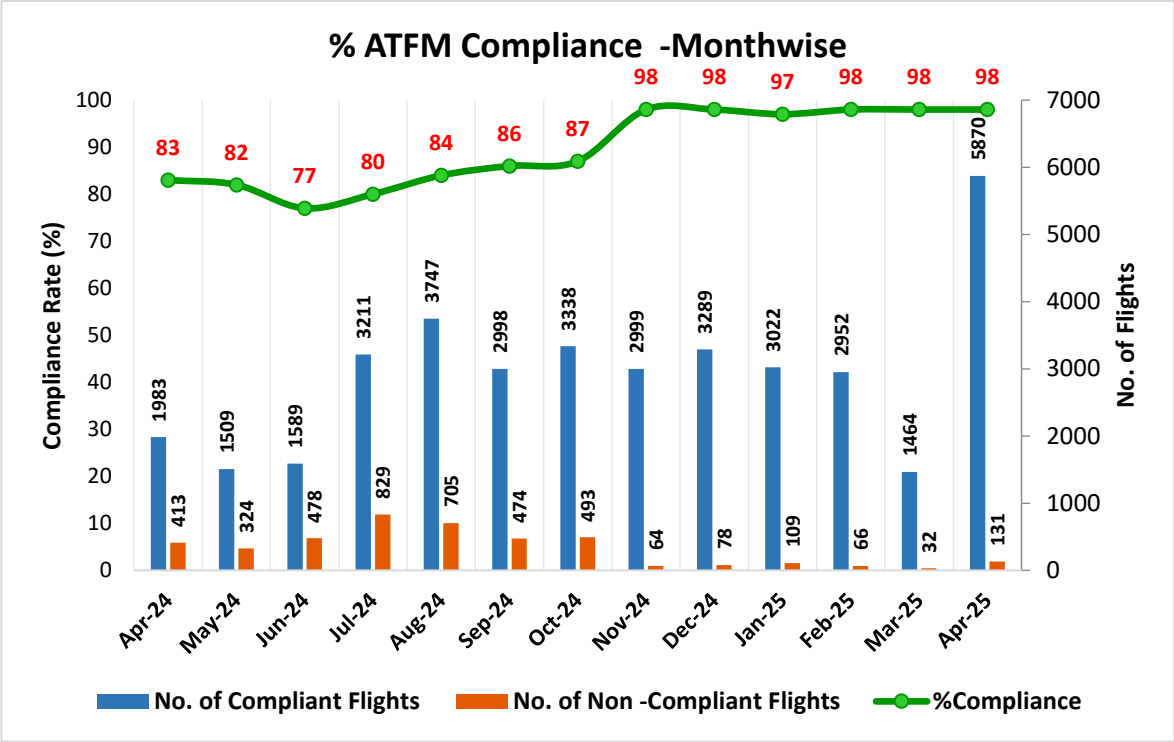


Figure 12: Compliance(Monthwise)

Inference

1. Out of the total arrivals captured(7532 flights) during the CDM scenario for the constrained Airports, 80.7% of flights i.e. domestic arrivals(6078 flights) were candidates for ground delay(participating).
2. Out of these Domestic Arrivals(6078), 90.1% (5482 flights) are assigned ATFM ground delay.
3. Out of the total arrivals captured(7532 flights) to the constrained Airport during the ATFM scenario, 72.8% of flights(5482 flights) were assigned ATFM Ground Delay.

IV. CTOT Compliance rate – Airportwise

MUMBAI FIR (98%)*	Compliant	Non Compliant	% Compliant
Ahmedabad	220	0	100%
Aurangabad	23	0	100%
Mumbai	587	8	99%
Bhuj	6	2	75%
Vadodara	60	0	100%
Bhopal	60	0	100%
Diu	2	0	100%
Hirasar, Rajkot	21	1	95%
Indore	122	0	100%
Jabalpur	16	2	89%
Jalgaon	2	0	100%
Jamnagar	2	0	100%
Kandla	2	0	100%
Kolhapur	1	0	100%
Mundra	1	0	100%
Nagpur	74	1	99%
Nasik	15	1	94%
Pune	176	10	95%
Shirdi	17	0	100%
Surat	63	0	100%
Udaipur	56	0	100%
KOLKATA FIR (98%)*	**Compliant**	**Non Compliant**	**% Compliant**
Prayagraj	18	3	86%
Agartala	13	0	100%
Ayodhya	50	1	98%
Siliguri	103	1	99%
Shillong	2	1	67%
Varanasi	81	2	98%
Bhubaneswar	130	2	98%
Bilaspur	5	0	100%
Kolkata	267	5	98%
Chakeri	16	0	100%

Durgapur	10	0	100%
Darbhanga	38	0	100%
Deoghar	18	1	95%
Kalaikunda Air Force Station	1	0	100%
Gorakhpur	55	0	100%
Guwahati	152	3	98%
Gaya	12	0	100%
Hollongi	6	0	100%
Imphal	23	0	100%
Jharsuguda	14	0	100%
Khajuraho	1	0	100%
Aizawl	13	3	81%
Dibrugarh	22	1	96%
Dimapur	9	1	90%
Patna	162	3	98%
Ranchi	99	4	96%
Raigarh	1	0	100%
Raipur	86	0	100%
DELHI FIR (96%)*	Compliant	Non Compliant	% Compliant
Agra	3	0	100%
Amritsar	124	5	96%
Awantipur Air Force Station	1	0	100%
Bikaner	12	1	92%
Bakshi Talab,Lucknow	1	0	100%
Bhuntar	15	0	100%
Bathinda	8	1	89%
Bareilly	0	1	0%
Chandigarh	95	7	93%
Safdarjung,New Delhi	0	1	0%
Dehradun	96	3	97%
Delhi	79	1	99%
Hindon	1	0	100%
Kangra	50	1	98%
Gwalior	13	3	81%
Hisar	2	1	67%
Jodhpur	26	2	93%
Jaipur	59	0	100%

Jaisalmer	1	0	100%
Jammu	71	6	92%
Kishangarh	3	0	100%
Leh	116	4	97%
Lucknow	124	1	99%
Pithoragarh	1	1	50%
Pathankot	2	0	100%
Pantnagar	22	0	100%
Shimla	13	0	100%
Sarsawa Air Force Station	6	0	100%
Srinagar	254	12	95%
Sirsa	2	0	100%
Thoise	2	1	67%
Uttarlai	2	0	100%

CHENNAI FIR (99%)*	Compliant	Non Compliant	% Compliant
Hal Bangalore	3	1	75%
Bangalore	426	3	99%
Belgaum	16	0	100%
Vijayawada	52	2	96%
Coimbatore	71	0	100%
Kochi	121	3	98%
Calicut	13	0	100%
MOPA Goa	113	0	100%
Goa	123	6	95%
Hubli	11	0	100%
Shamsabad, Hyderabad	299	3	99%
Begumpet Hyderabad	3	0	100%
Kannur	12	0	100%
Madurai	32	0	100%
Mangalore	26	2	93%
Chennai	242	1	100%
Port Blair	14	0	100%
Rajahmundry	10	0	100%
Tuticorin	8	0	100%
Tirupati	17	0	100%
Tiruchirappally	8	0	100%
Thiruvananthapuram	61	1	98%
Visakhapatnam	52	1	98%

**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

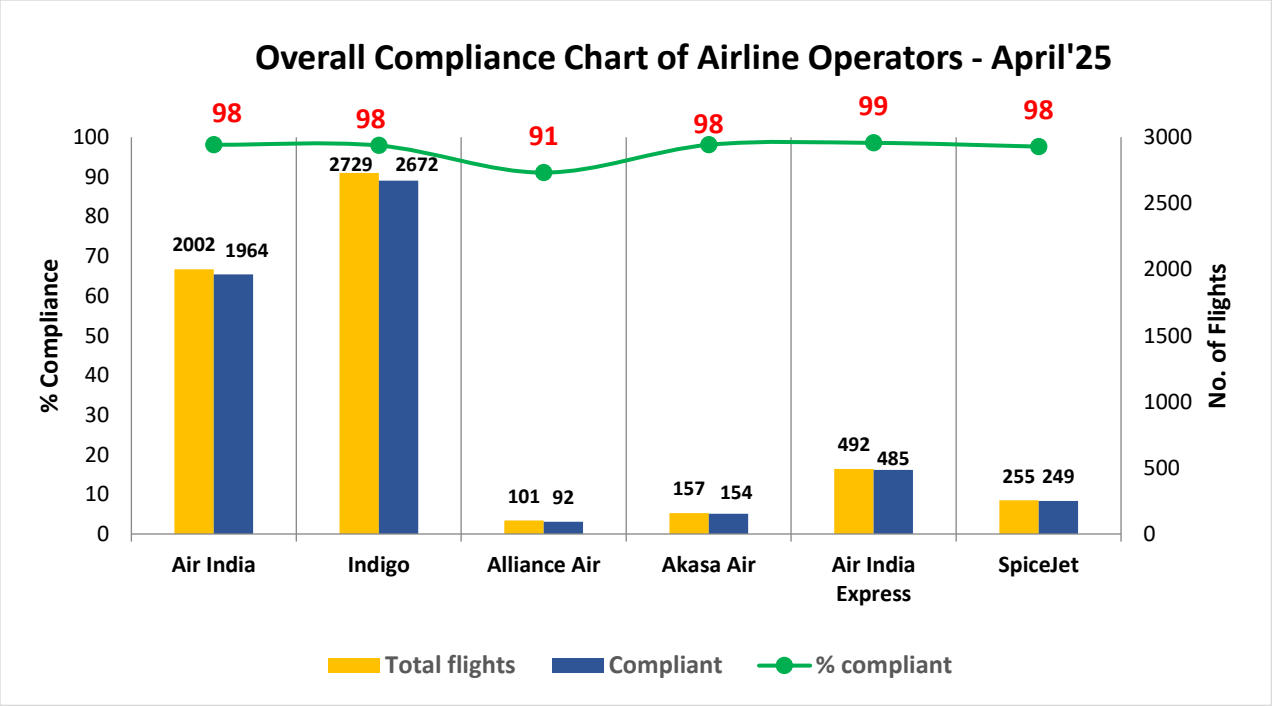


Figure 13: Airline wise Compliance –Apr'25

Inference

1. Chennai region record the highest compliance of 99% whereas Delhi region has the lowest percentage compliance of 96%.
2. Akasa, Air India, Air India Express, Indigo and Spicejet Airlines have a CTOT compliance higher than or equal to the average recorded compliance for the month of April'25.

VI. Reason For Non Compliance

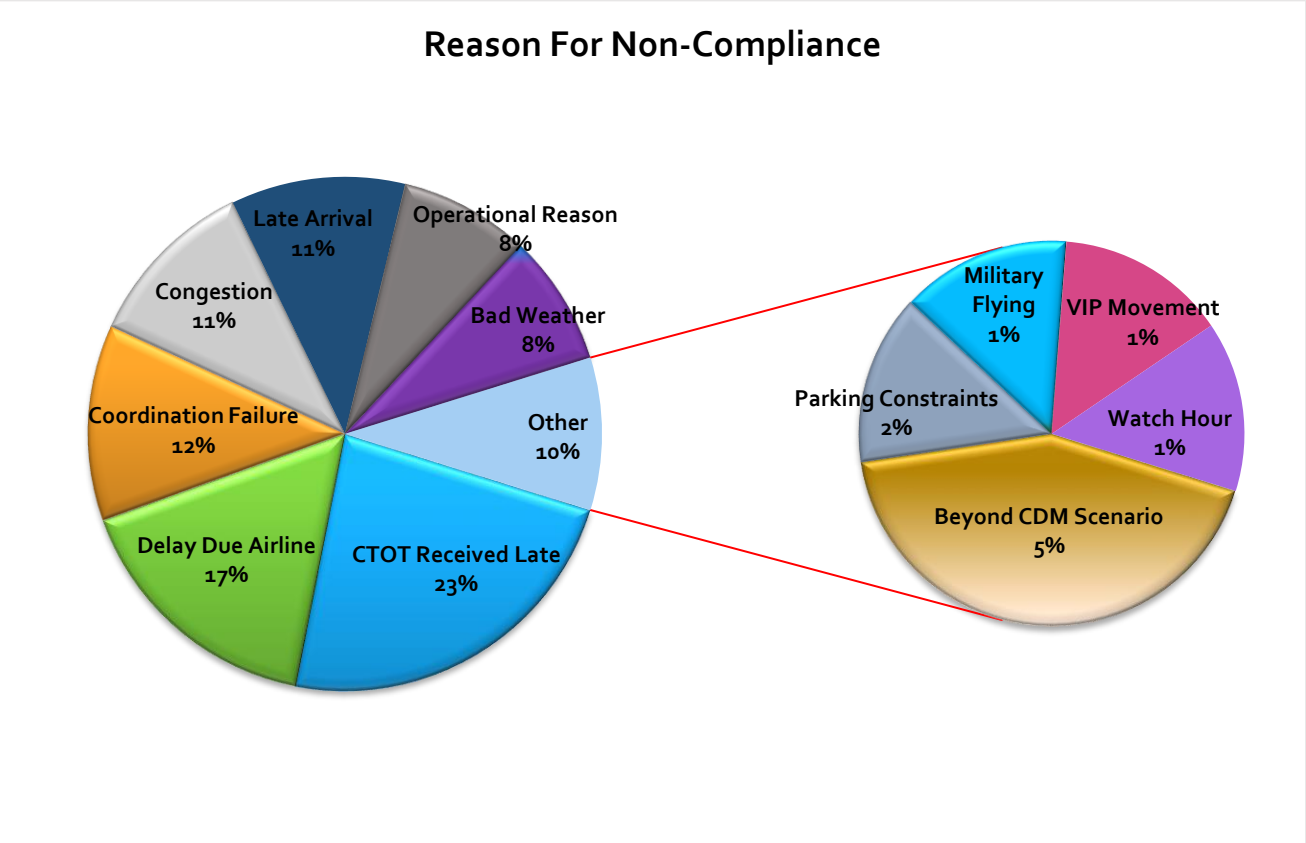


Figure 14: Reason for Non-Compliance as provided by FMPs

Inference:

1. 23 % 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 12 % of CTOT Non- Compliance was reported by concerned FMPs to be due to coordination failure.
3. 11 % of the CTOT Non- compliance was due to ground traffic congestion at airports and 2% due to parking constarints at various airports.
4. 11 % of the CTOT Non- compliance was reported by concerned FMPs to be due to late arrivals from previous station.
5. 8 % 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) & 8% 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 Chennai, Delhi and Mumbai was 8.3, 17.9 and 6.5 minutes respectively.

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

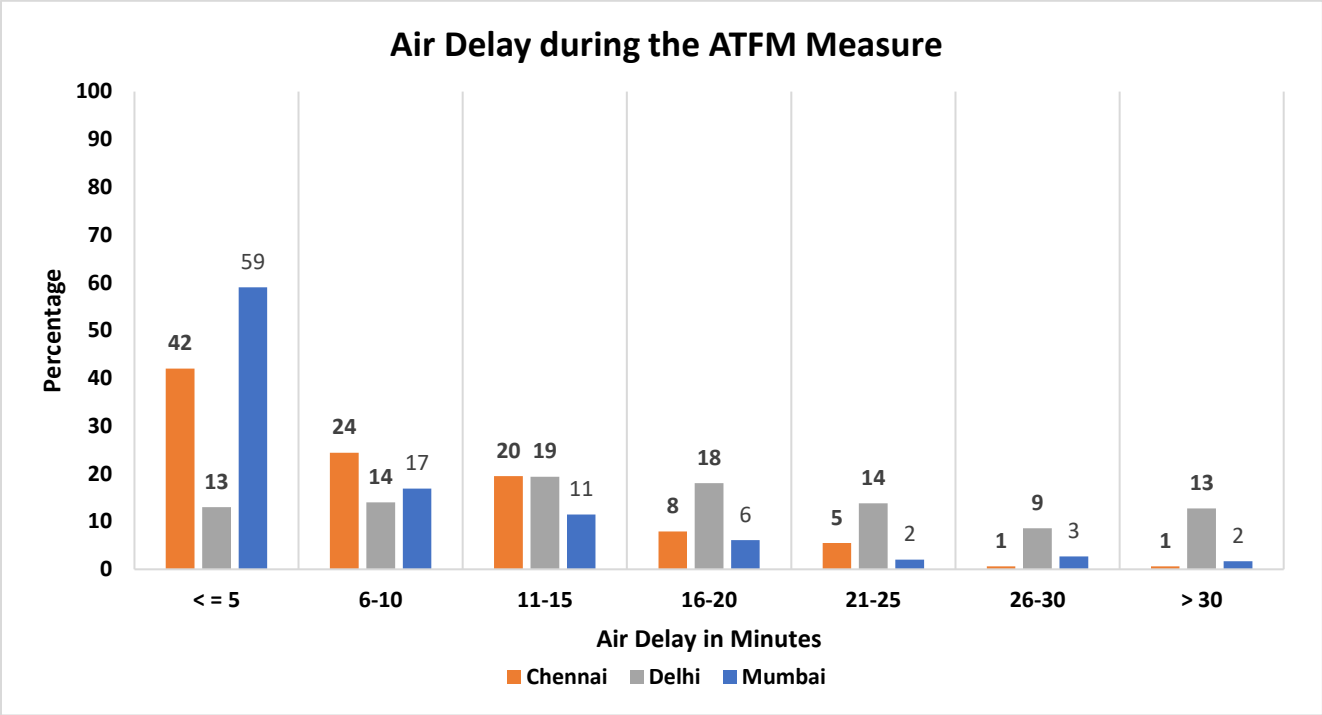


Figure 15: Air Delay distribution during the CDM period

Inference

1. 66% of domestic arriving flights to Chennai had an Air delay of equal to or less than 10 minutes during the CDM period.
2. 27% of domestic arriving flights to Delhi had an Air delay of equal to or less than 10 minutes during the CDM period.
3. 76% 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)= 119669 mins

Total Air Delay (with no ATFM measures) = 164217 mins

Reduction in Air delay due to ATFM measures= (164217-119669) = **44548 mins**

Fuel Saving Calculation:

Total Fuel saved during the ATFM Measure: ***29,85,490.98 Kg***

Total reduction in CO_2 emission : 3.16(KgCO_2/kg fuel)* 29,85,490.98 **Kg** ***= 94,34,151.51 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)- April 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.

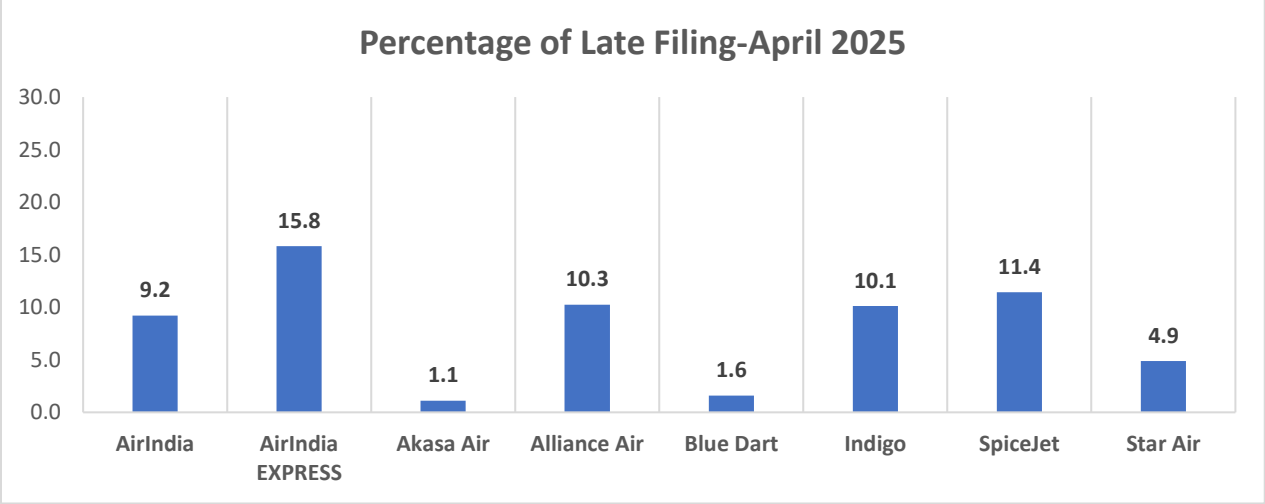
AIP India, ENR 1.9 section 4 on Flight Planning in the context of ATFM recommends Flight Planning requirements for all Airline Operators –

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 April 2025 to 30 th April 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.



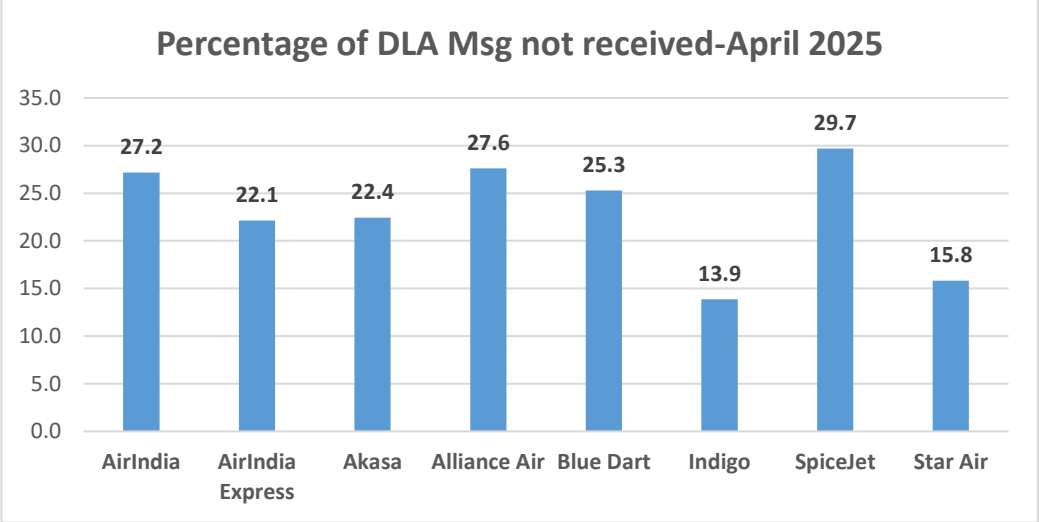
The table below lists number of filed flight plans (FPLs) with less than 3 Hours prior to EOBT:

Name of Airline	Late Filed FPL	Total No. Of FPL	% Delayed Filing
AirIndia	1994	21667	9.20
AirIndia EXPRESS	2543	16074	15.82
Akasa Air	49	4464	1.10
Alliance Air	194	1892	10.25
Blue Dart	10	622	1.61
Indigo	6909	68268	10.12
SpiceJet	451	3951	11.41
Star Air	60	1228	4.89
Total no. of FPLs for Scheduled Airlines	**12210**	**118166**	**10.33**

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 April 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	4821	17753	27.16
AirIndia Express	2622	11840	22.15
Akasa	815	3634	22.43
Alliance Air	299	1083	27.61
Blue Dart	134	530	25.28
Indigo	7353	53035	13.86
SpiceJet	860	2897	29.69
Star Air	72	455	15.82



C. For analysis of non-receipt of CNL (cancel) messages for April 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 April 2025:

Name of Airline	**CNL message not received**	**No. of flights annulled**
AirIndia Express	152	160
AirIndia	108	113
Akasa	13	14
Alliance Air	126	126
Blue Dart	10	10
Indigo	294	299
SpiceJet	62	63
Star Air	19	24

-End OF Report-