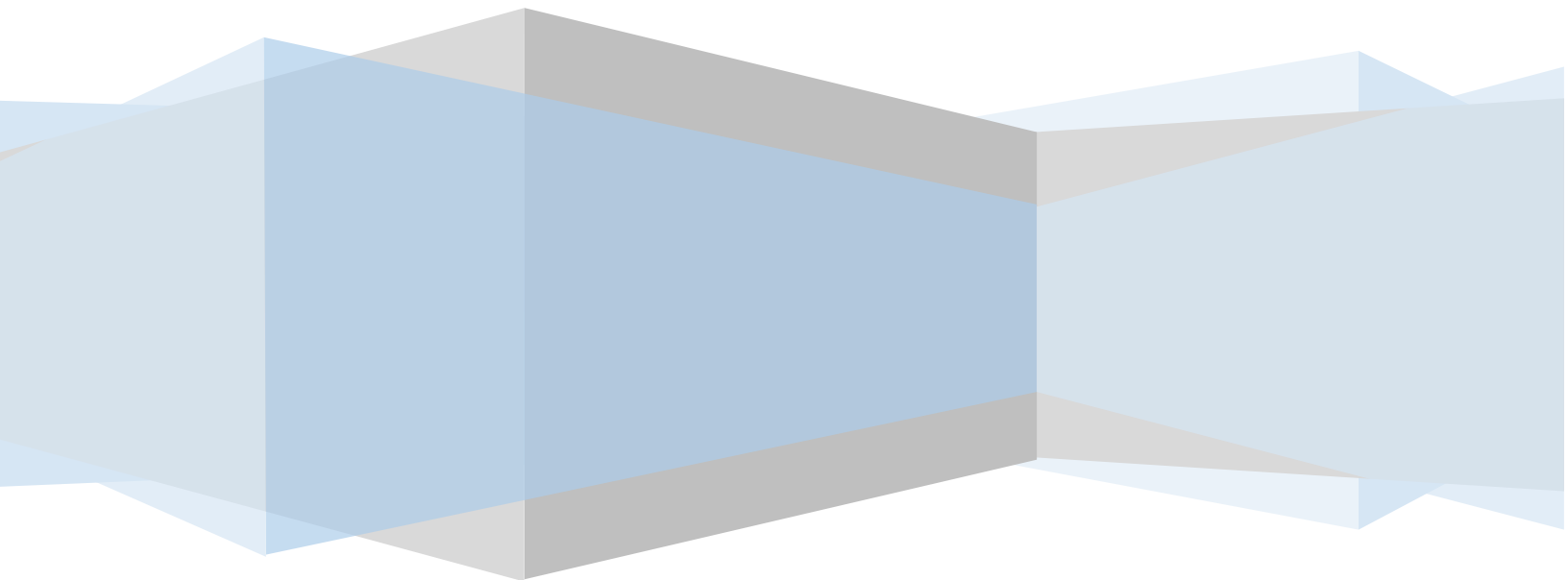


ANNUAL REPORT
ATFM OPERATIONS
(Jan 2022 to Dec 2022)

CENTRAL COMMAND CENTER, C-ATFM, DELHI







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A. Executive Summary

In February'22, the conflict between Russia and Ukraine escalated into a war between the nations. The war has had a direct impact on the world economy, including the civil aviation industry.

In March, the European Union, Canada, the United States, and some other countries closed their airspaces to Russian aircraft and airlines. Shortly after, Russia retaliated with the same measures, which has impacted the routes operated by certain airlines. Even though a relatively small portion of global traffic directly involved Russia or Ukraine, the war and associated sanctions have global implications for airlines. The large detours for many airlines that served destinations requiring overflying the Russian airspace including travel from Europe to Asia, North America to Asia and North America to the Middle East has affected over 10% of pre-COVID-19 international travel volumes (RPK basis). The war has also caused a huge volatility in the oil price. As fuel is an airline's largest variable cost, the absorbing such a massive price hike just as the industry is struggling to emerge from the two-year COVID-19 crisis is a huge challenge.

Fresh rise in cases of Covid-19 across the globe was observed towards the end of the year resulting in many countries beefing up their Covid-19 protocols at the airports. Several countries have even imposed restrictions on travellers from China, Hong Kong, Japan, South Korea, etc. which are witnessing a rise in the number of Covid cases.

Most regions saw small month over month increases in traffic in December, offset again by traffic decreases in the large markets of Europe and North America. Asia saw an additional 2,000 flights daily over November, a welcome sign in a region where recovery in air travel, particularly international travel, has been behind that of other regions.

In India, During the pandemic-induced lockdown and other restrictions, the aviation sector was completely shut, and the industry was facing huge losses. As the restrictions have eased, the aviation sector gradually seems to be recovering to Pre-covid levels.

India is expected to be among the top three aviation markets in the world with projected passenger traffic growth of almost double in the coming 10 years supported by rising income levels and ongoing investments in its aviation infrastructure.

Delhi, Mumbai, and Bengaluru are the three major airports of India which handle the majority of passengers, especially international travellers. While the passenger levels are rising rapidly, the airport infrastructure needs enhancement with rising chaotic scenes at the airports due to a large influx of passengers. Additionally, the rise in demand and increasing fleet size has put further pressure on the airside at these airports.

The successful privatization of Air India to the Tata group has been the top aviation news in India. Air India gained the prestige of being India's most punctual airline in November'22 by topping the list in on-time performance. The



carrier has announced plans to increase its fleet size which will aid in long-haul and domestic expansion as the carrier hopes to become the central competitor in India.

The ripple effects of Air India's privatization affected three others, AirAsia India, Air India Express, and Vistara, all owned wholly or partially by the Tata Group. Inevitably, consolidation came in November, with Tata announcing that Vistara, would be merged with Air India. Meanwhile, AirAsia India and Air India Express would become the budget airline for the flag carrier.

As aviation emerged from its darkest period in the recent past, India welcomed its latest carrier, Akasa Air. Since its debut in August, Akasa now flies to 10 destinations across India and hopes to go international in 2023, after it takes delivery of 20 aircraft. The carrier plans to grow by connecting Tier-2 and 3 cities to major hubs, boosting traffic while slowly expanding across the busier routes as well.

Four years after seizing operations in India, the saga of Jet Airways revival continues. The Airline is yet to operate a passenger flight.

The Ministry of Civil Aviation (MoCA), Government of India released the National Civil Aviation Policy in the year 2016. One of the objectives of NCAP 2016 was to “enhance regional connectivity through fiscal support and infrastructure development” through a Regional Air Connectivity Scheme (RCS). Till 15th Dec'22, 455 RCS routes have been operationalised.

B. Introduction

Air Traffic Flow Management is being implemented in phased manner in India. The operational structure comprises of Central Command Centre (CCC) established in Delhi, at the helm of affairs, supported by Flow Management positions (FMPs) at designated Air Traffic Control Towers, Approach and Area Control Centers. The Phase-I implementation involved activation of 36 Flow Management positions in different ATS units including 8 joint civil-military Airports and application of Ground Delay Program (GDP) and Ground Stop Program (GSt) to regulate traffic (resolve Demand Capacity imbalance) at constrained Airport.

Five new Flow Management Positions (FMP) supporting the ATFM network have been operationalized in December'22 at Dehradun, Vadodara, Surat, Vijayawada and Rajahmundry airports.

Airport CDM of 8 Airports- Mumbai, Kolkata, Chennai, Delhi, Jaipur, Guwahati, Trivandrum and Ahmedabad has been integrated with the ATFM SKYFLOW system. The Departure Planning Information (DPI) message exchanged bring airports into the loop of the ATFM decision making process. The Flight Update Message (FUM)/DPI message exchange ensure the punctual updating of flight data, more consistent slot calculation and improved slot adherence.



Despite continuous efforts, the presence of correct and timely flight plan intent in SKYFLOW has been a challenging task. To resolve this constraint, an integrated initial Flight Plan processing system is being implemented as a part of the ATFM system. After successful training of CCC officers and site acceptance test (SAT), the system is required to pass the pending system reliability and stability test (SRST) before operationalization.

The IFPS system comprises the process of receiving flight plans and associated messages, validating this information against syntactic and semantic rules, identifying the destination addresses based on the aerodromes and route informed and distributing the information to all identified and informed addresses. This centralization of the Flight Plan processing system also ensures that each key player in the ATM process receives the same Flight Plan information.

The Common Business Rules (CBR) document defining roles and responsibilities of all stakeholders for the collaborative decision (developed and agreed upon) and a membership agreement for data exchange supporting ATFM operations was signed by the airlines and airport operators this year.



C. Traffic Analysis

I. Traffic growth in India

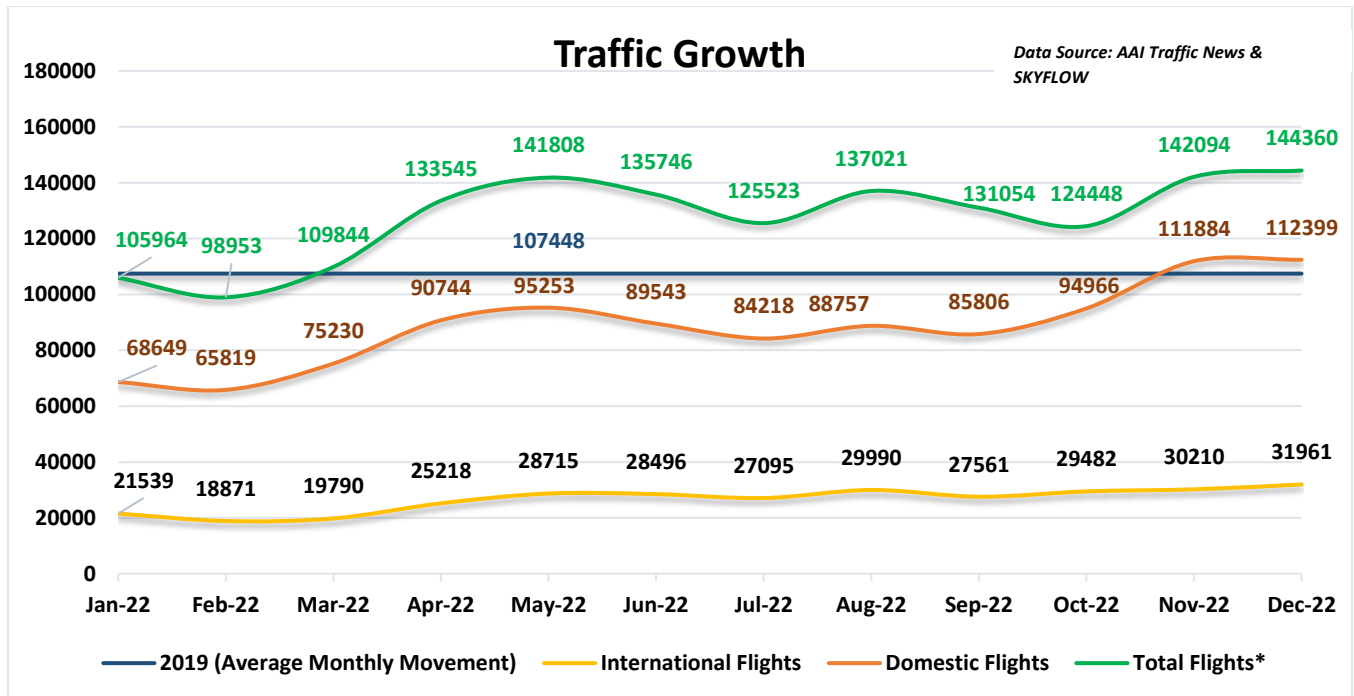


Figure 1: Traffic Growth

*Total Flights consists of Overflying traffic along with Domestic and International traffic

The graph above depicts the Domestic and international Air traffic in Indian ATFCM Area for the year 2022. The total traffic surpassed the average monthly movement of 2019 in March 2022 whereas the Domestic flight movement recorded a 4.6% increase in Dec'22 against the same reference.



II. Comparison of total ATMs (YoY)

The total Air traffic movement including Passenger and Combination of other flights i.e. All-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 year 2019, 2020, 2021 & 2022.

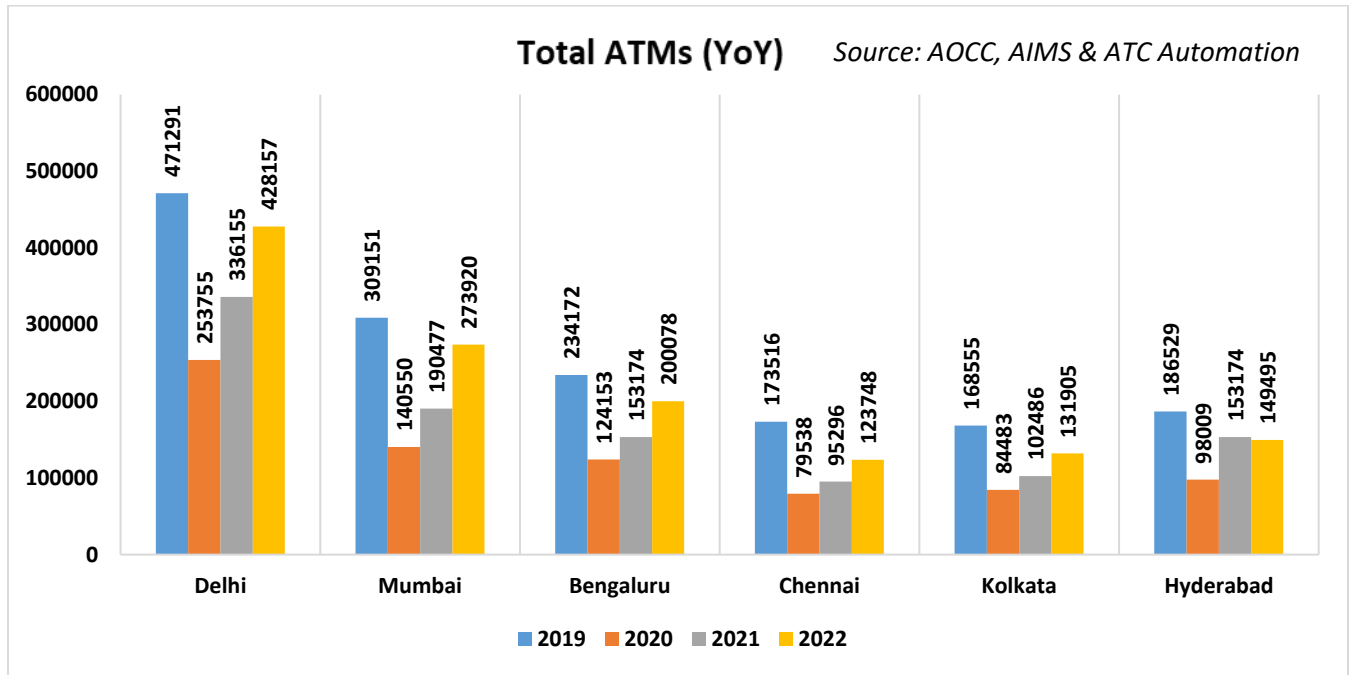


Figure 2: Traffic Variation (YoY)



III. Monthly Average Air Traffic Movement

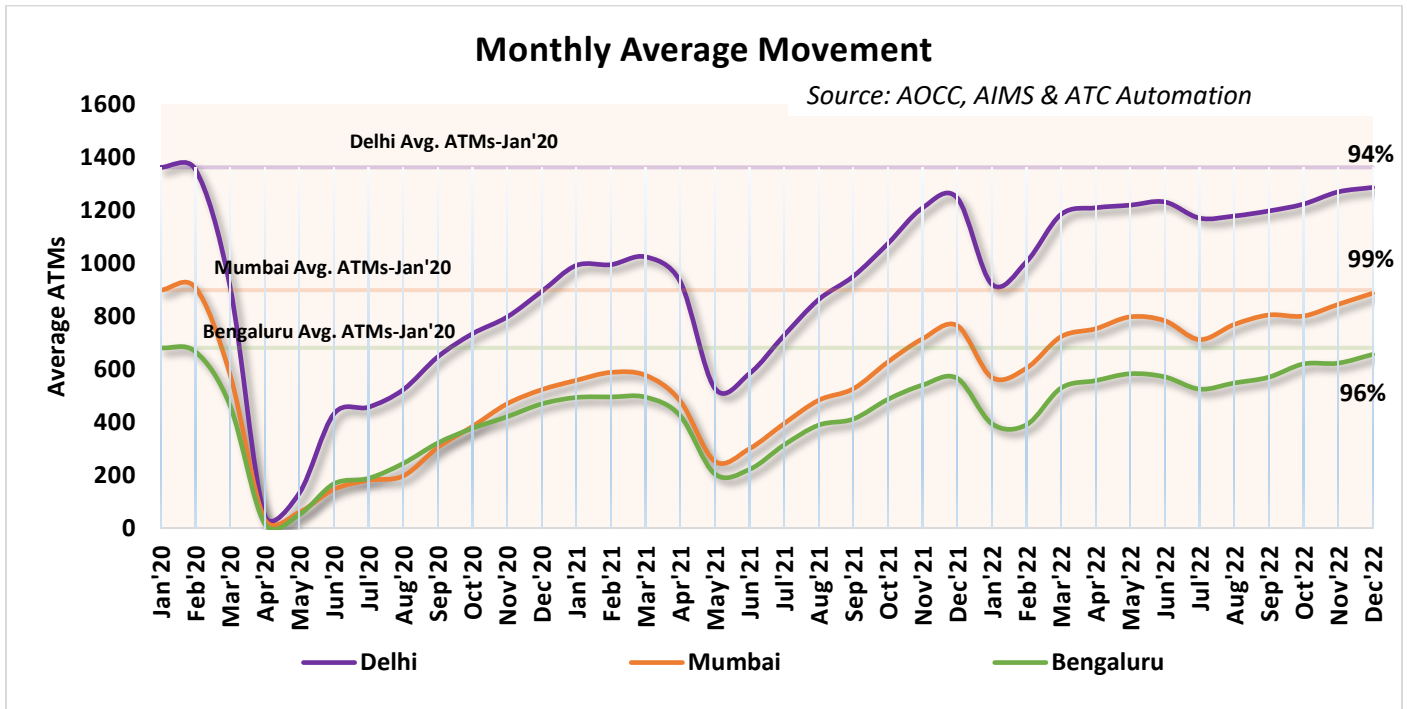


Figure 3: Monthly Average Air Traffic Movement For Three Major Airports

The above graph tracks the Monthly average Air Traffic Movements for three major Airports- Delhi, Mumbai and Bengaluru in India from January'20 to December'22. The Average Monthly ATMs in Delhi, Mumbai and Bengaluru stands at a deficit of 6, 1 and 4 percent respectively than the Average Monthly ATM recorded in January 2020 for the same Airports.



IV. Top city pairs

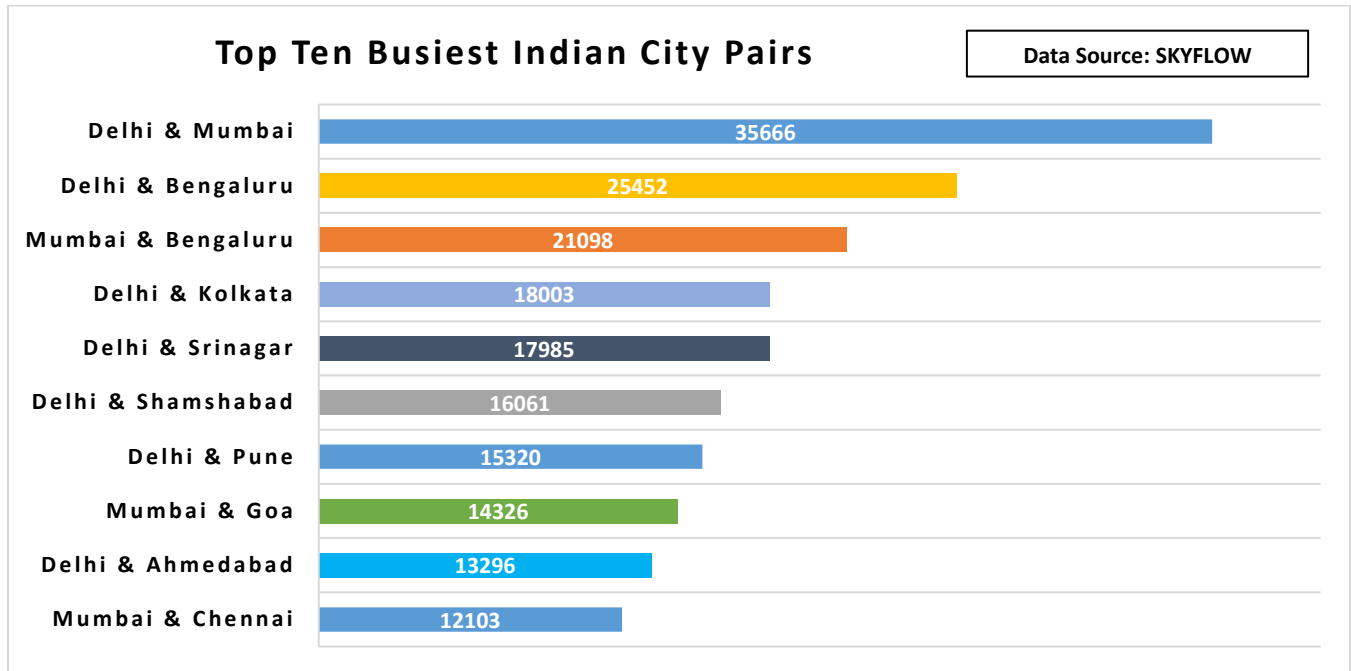


Figure 4: Busiest City Pairs

The above graph shows the top ten busiest Indian city pairs based on flight movement data.

Inference:

1. Delhi and Mumbai are the top most busiest city pair with a total of 35666 flights operating for the year 2022.
2. Delhi-Srinagar is the top most busiest major to non major city pair with 17985 flights operating for the year 2022.



V. Flight Operations – Airline-wise

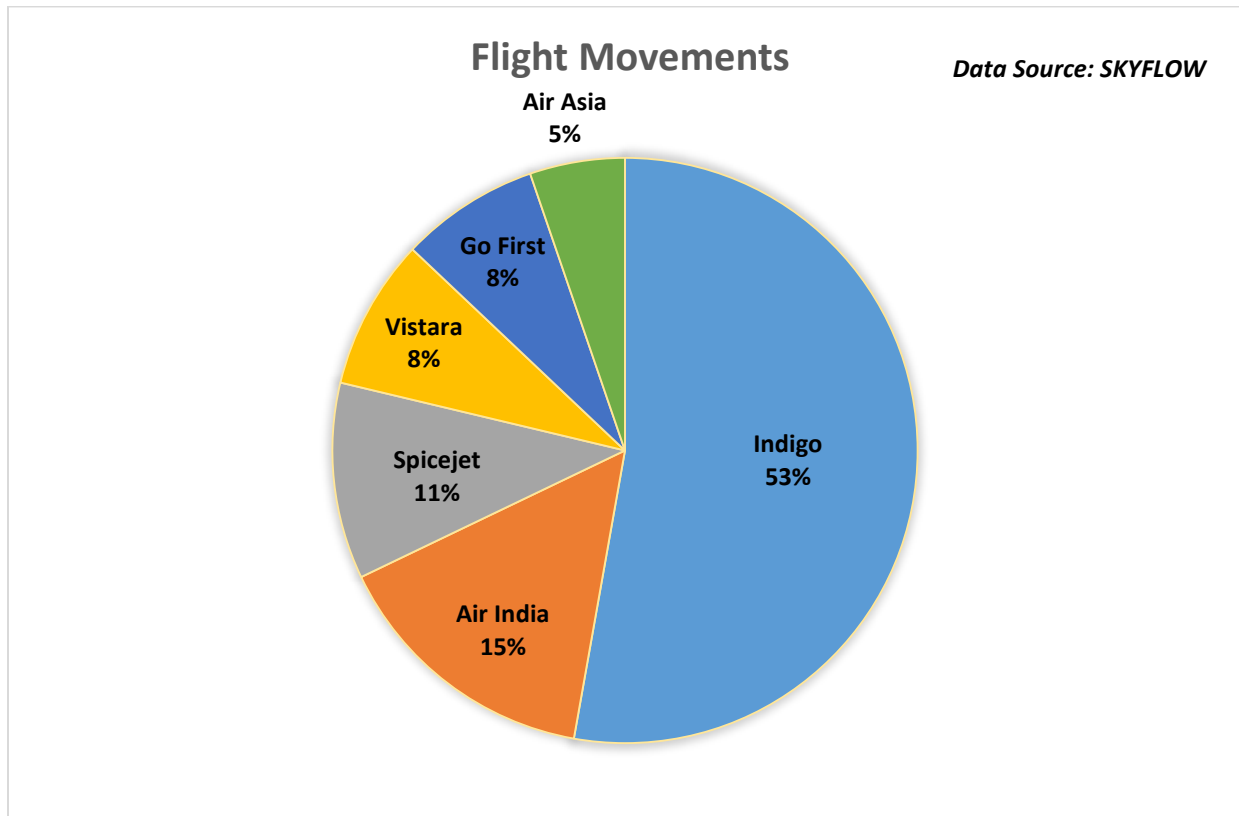


Figure 5: Flight Movements –Airline-wise

Inference

Indigo Airlines constitutes the maximum (53%) of the total scheduled aircraft movement for the Year 2022.



D. ATFM Post Operations – CDM Analysis

I. Introduction

Analysis Period 1stJanuary'22– 31stDecember'22

Back Ground During the above mentioned period, ATFM measures were applied **Ninty Two(92)** times for **Delhi Airport**, **Twenty Eight (28)** times for **Mumbai Airport**, **Four (04)** times for Bengaluru Airport, **Three (03)** times for **Kolkata airport** and **Five(05)** times for **Bhopal Airport** due to the following reasons as illustrated in the bar chart below:–

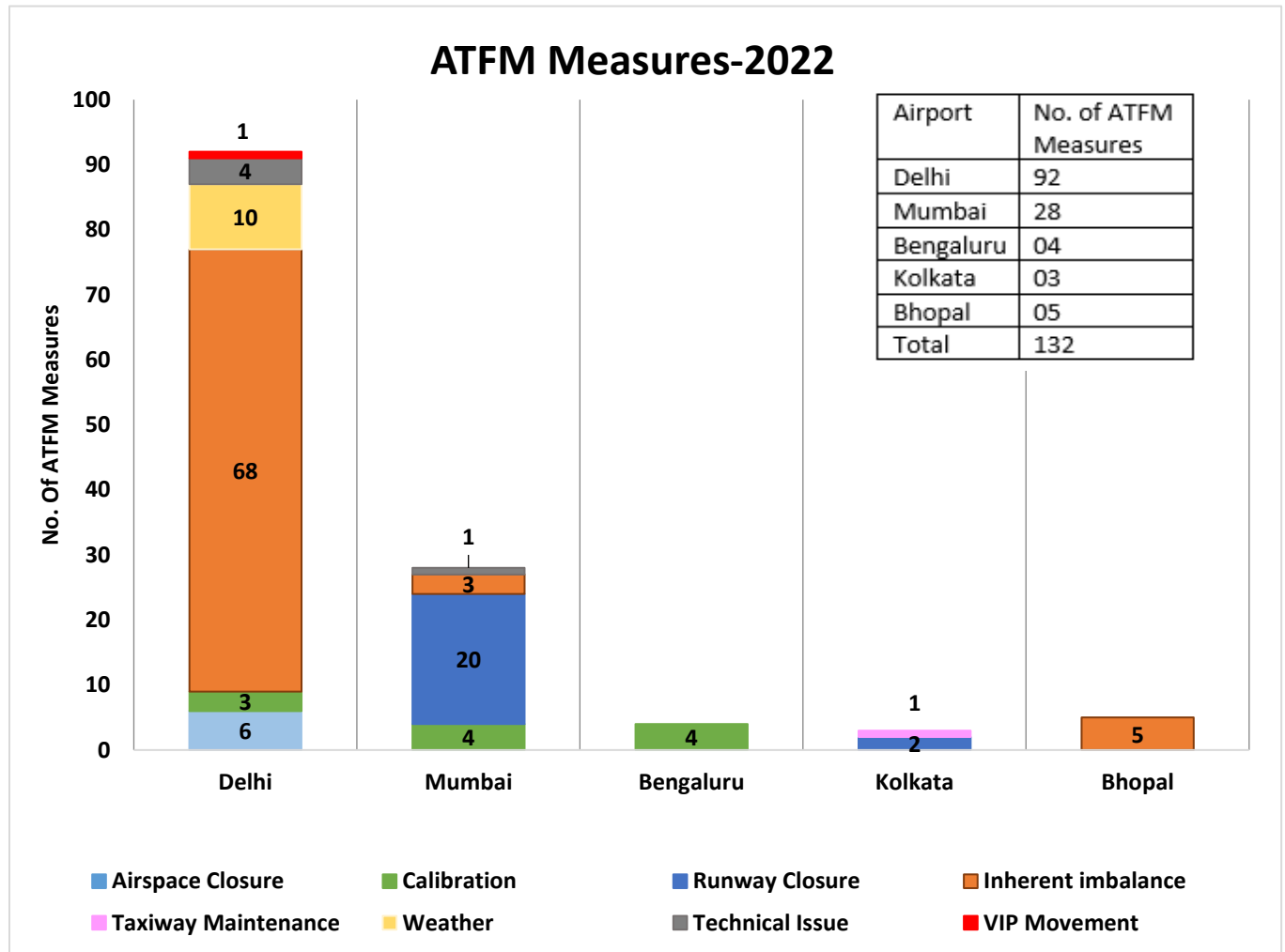


Figure 6: ATFM Measures – 2022



II. ATFM Measures Overview

	Delhi	Mumbai	Bengaluru	Kolkata	Bhopal
Number of ATFM measures applied	92	28	04	03	5
Average ATFM Ground delay due to measures	8.3 min	14.5 min	16 min	16.5 min	12 min
Maximum ATFM Ground delay due to measures	121 min	55 min	49 min	43 min	35 min
% Compliance	76.6%	82.4%	82%	80%	80%

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

Total affected flights in scenario (Domestic Arrivals)	6447
Total Domestic Arrivals with zero ATFM delay	1084
Total Domestic Arrivals with ATFM delay	5393

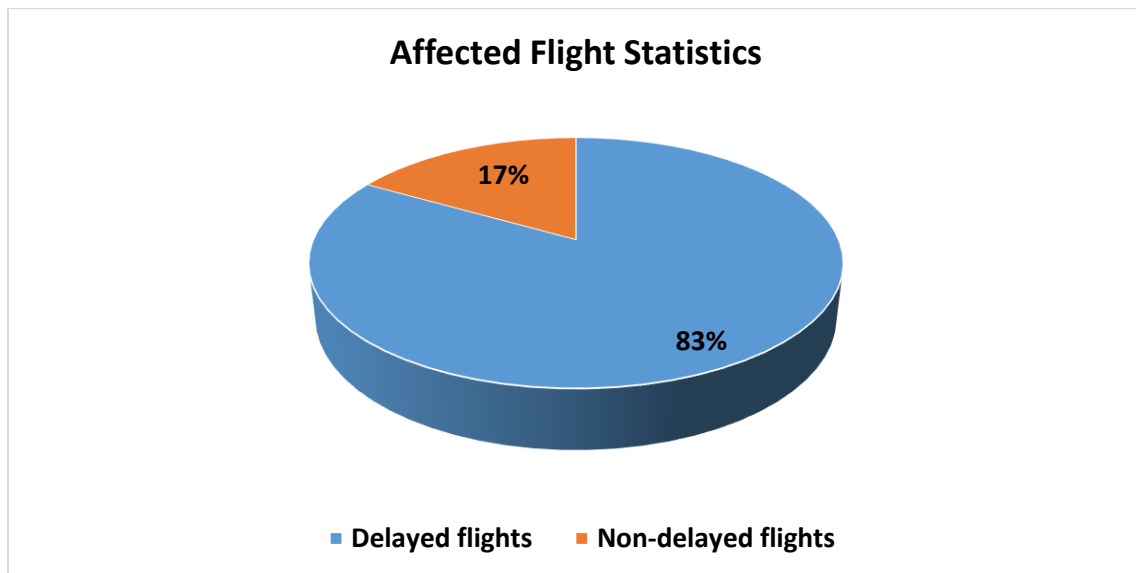


Figure 7: Affected Flight Statistics



III. Overall Compliance

Total Arrivals	7612
Domestic arrivals	6477
Flights with complete data (ATOT)	6066
Flights with incomplete data	302
Flights Not Operated	109
Compliant*	4890
Non-Compliant	1176

Total No. of Revised CTOTs issued = 876 (Compliance of flights which were issued revised CTOT is measured w.r.t. new CTOT issued)

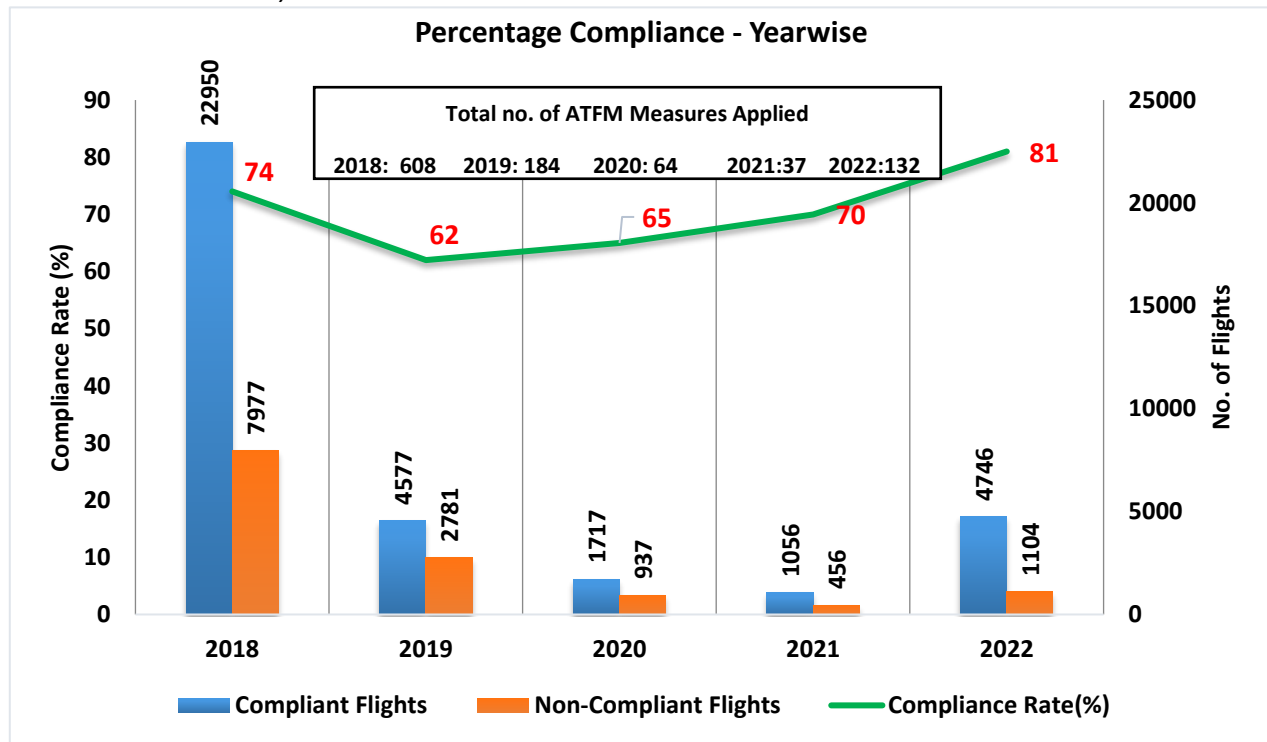


Figure 8: Overall Compliance

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

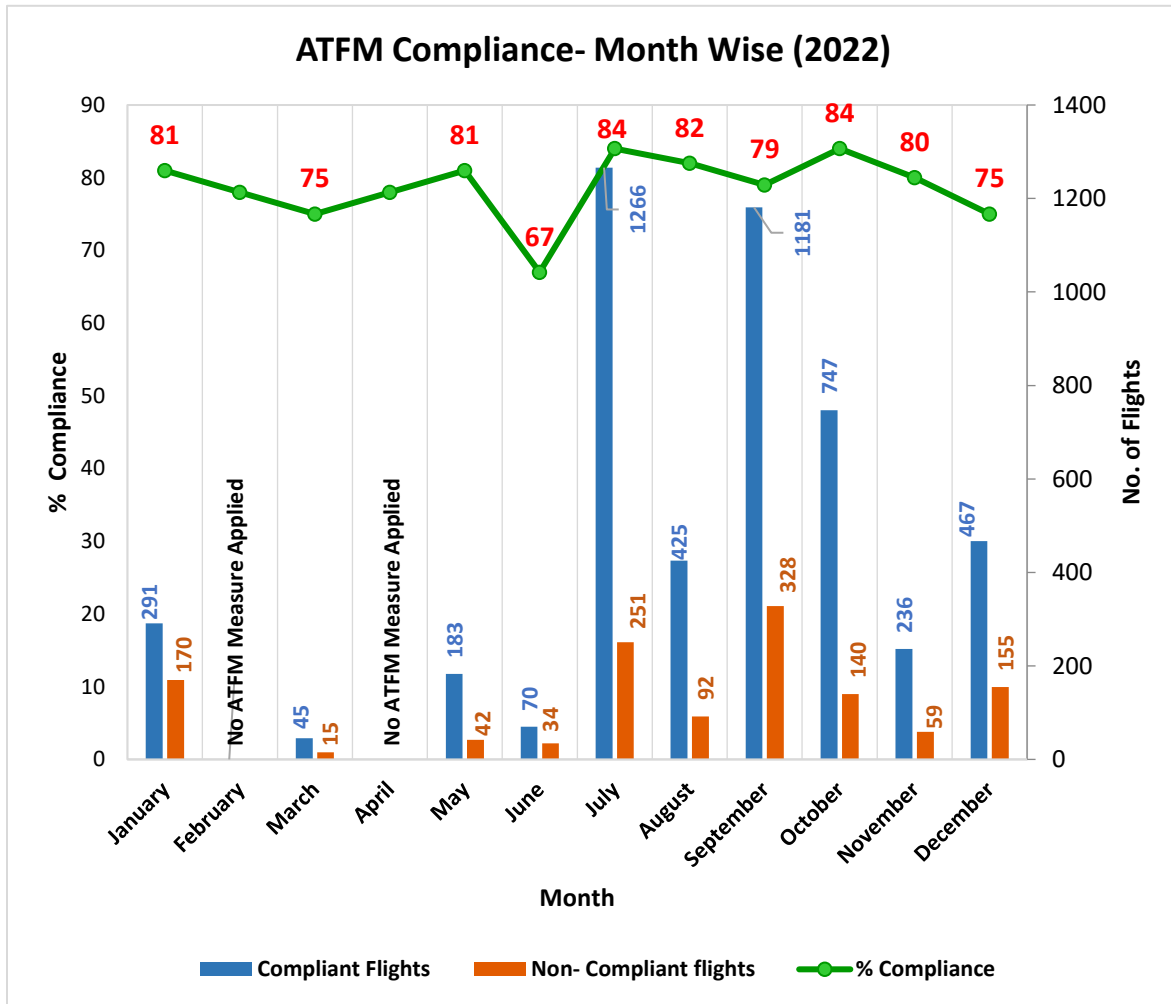




Figure 9: ATFM Compliance –Monthwise


Inference

1. Out of the total arrivals captured for the constrained Airports during the CDM scenario,85% of flights i.e. Domestic arrivals, are participating.
2. Out of these Domestic Arrivals, 84% of arrivals are assigned ATFM ground delay & 17% of flights are without any ATFM ground delay.
3. Out of the total arrivals captured to the constrained Airport during the ATFM scenario, 71% of flights are assigned ATFM Ground Delay.


**CTOT Compliance –Airportwise**

MUMBAI FIR	2021 (73%)*	2022 (84%)* 
Ahmedabad	75	85
Aurangabad	80	92
Bhavnagar	0	0
Bhopal	96	94
Diu	-	50
Indore	70	87
Jabalpur	82	80
Jamnagar	-	81
Kandla	88	78
Kolhapur	50	0
Mumbai	66	86
Nagpur	86	91
Nasik	-	0
Ozar	-	50
Porbandar	-	100
Pune	70	73
Rajkot	100	84
Shirdi	77	67
Surat	-	86
Udaipur	86	86
Vadodara	-	88
KOLKATA FIR	(74%)*	(84%)* 
Agartala	85	67
Aizawl	-	100
Allahabad	67	67
Bagdogra	74	79
Bhubhneswar	80	95
Bilaspur	-	100
Chakeri	-	40
Darbangha	63	89
Deoghar	-	100



Dibrugarh	100	78
Dimapur	80	91
Durgapur	67	69
Gaya	100	83
Gorakhpur	-	68
Guwahati	72	82
Imphal	100	84
Jharsuguda	80	89
Jorhat	100	67
Kalaikunda	-	100
Khajuraho	-	0
Kushinagar	-	0
Kolkata	81	86
Lengpui	100	100
Niranjanpur	-	0
Pakyong	67	100
Patna	73	89
Prayagraj	-	90
Raipur	-	95
Ranchi	-	88
Silchar	56	50
Siliguri	-	66
Varanasi	78	84
DELHI FIR	(54%)*	(70%)* 
Adampur	-	0
Agra	100	50
Ajmer	-	0
Aligarh	-	0
Amritsar	-	79
Bareilly	100	30
Barmer Airforce Station	-	0
Bathinda	-	0
Bhuntar	-	67
Bikaner	0	25
Chandigarh	49	56



Dehradun	63	81
Delhi	71	76
Gaggal	-	56
Gwalior	29	63
Halwara Air Force Station	-	0
Hindon	100	0
Jaipur	76	85
Jaisalmer	-	50
Jammu	52	66
Jodhpur	79	61
Kangra	-	100
Kishangarh	67	43
Kolhapur	-	67
Leh	52	66
Lucknow	47	82
Pantnagar	-	75
Pathankot	50	100
Shimla	-	86
Sirsa	-	100
Srinagar	-	66
Thoise	-	0
CHENNAI FIR	(76%)*	(83%)* 
Bengaluru	80	90
Begumpet, Hyderabad	-	67
Belgaum	100	100
Calicut	-	57
Chennai	79	87
Cochin	88	91
Coimbatore	89	84
Cuddapah	-	100
Goa	-	63
Hakimpet, Hyderabad	-	100
HAL Bangalore	-	50
Hubli	0	60
Shamshabad, Hyderabad	75	87



Kalaburagi	86	100
Kannur	67	40
Kochi	-	86
Kurnool	-	100
Madurai	100	79
Mangalore	100	87
Mysore	100	0
Port Blair	-	100
Rajahmundry	-	100
Sindhudurg	-	50
Sulur	-	100
Thiruvananthapuram	-	92
Tiruchirappally	-	100
Tirupati	50	100
Trivandrum	67	89
Tuticorin	100	50
Vijaynagar	-	67
Vijaywada	63	83
Vishakhapatnam	77	80
Yelahanka Air Force	-	0

**FIR wise compliance.*



IV. CTOT Compliance – Airlinewise

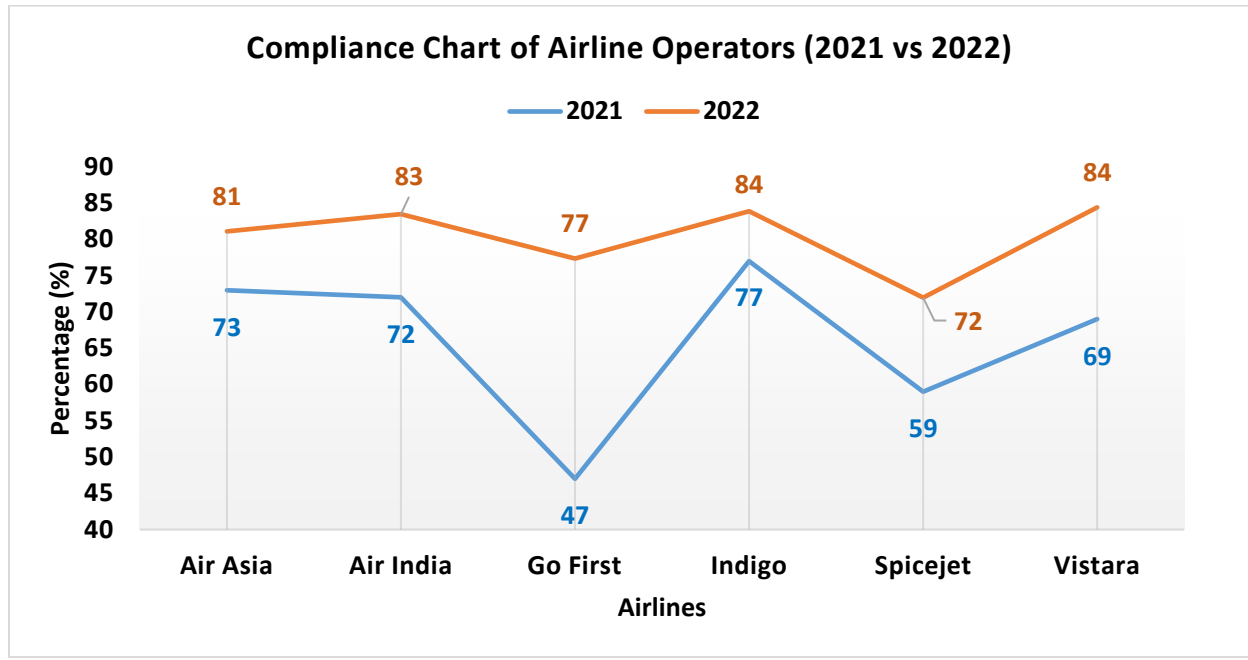


Figure 10: CTOT Compliance-Airlinewise

Inference

1. Out of the total domestic arrivals with complete data in the CDM scenario, 81% arrivals are compliant.
2. For the year 2022, Kolkata and Mumbai region have the highest compliance of 84% where as Delhi region has the lowest compliance of 70%.
3. Indigo, Air India and Vistara Airlines have a percentage compliance above the average recorded 81% compliance for the year.
4. Percentage Compliance of all airlines has increased in the year 2022 as compared to year 2021. This is a good indication of 'buy in' by stakeholders.



V. Reason For Non-Compliance (2022)

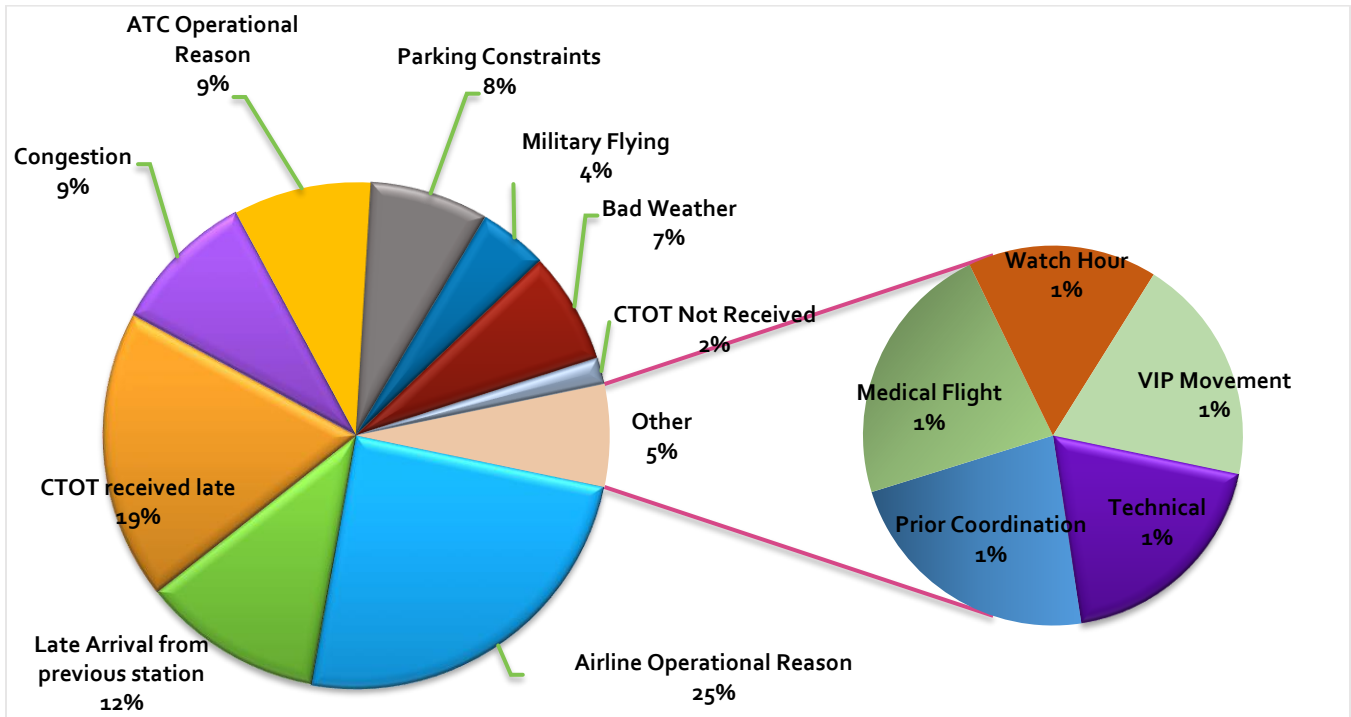


Figure 11: Reason for Non-Compliance

Inference:

1. 25 percent of the Non- Compliance reported by concerned FMP is due to Airline operational reason. The airline revise their EOBT very close to the time of operation resulting in wastage of unused slots.
2. 19 percent of the Non-Compliance is reported to be due to late receipt of CTOTs at the departure airport. This might happen when the ATFM measures are initiated at short notice or when there is delay in dissemination of CTOT to the field stations by FMPs and to the flight crew by the OCC of the Airlines.

VI. Air Delay during the CDM Scenario period

Average Air Delay to domestic arrivals* within the CDM Scenario period for Delhi, Mumbai, Bhopal, Kolkata and Bengaluru are 6 min, 9 min, 11 min, 11 min and 10 minutes respectively.

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

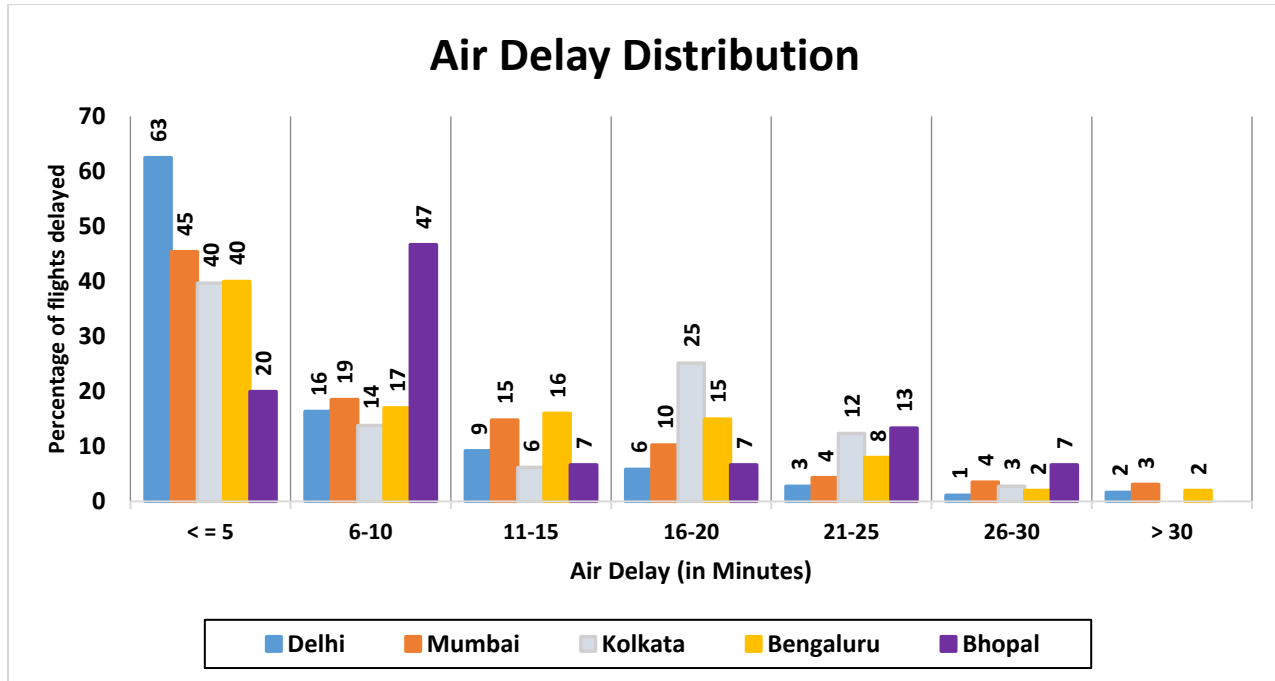


Figure 12: Air Delay during CDM Period

Inference

- 88% of arriving flights to Delhi had an Air delay equal to or less than 15 minutes during the CDM period.
- 79% of arriving flights to Mumbai had an Air delay equal to or less than 15 minutes during the CDM period.
- 60% of arriving flights to Kolkata had an Air delay equal to or less than 15 minutes during the CDM period.
- 73% of arriving flights to Bengaluru had an Air delay equal to or less than 15 minutes during the CDM period.
- 74% of arriving flights to Bhopal had an Air delay equal to or less than 15 minutes during the CDM period.



VII. Fuel Saving & Reduction in Emissions per flight during the CDM Scenario period

The chart below shows fuel saved per flight and reduction in CO₂ emissions per flight due to ATFM measures on monthly basis.

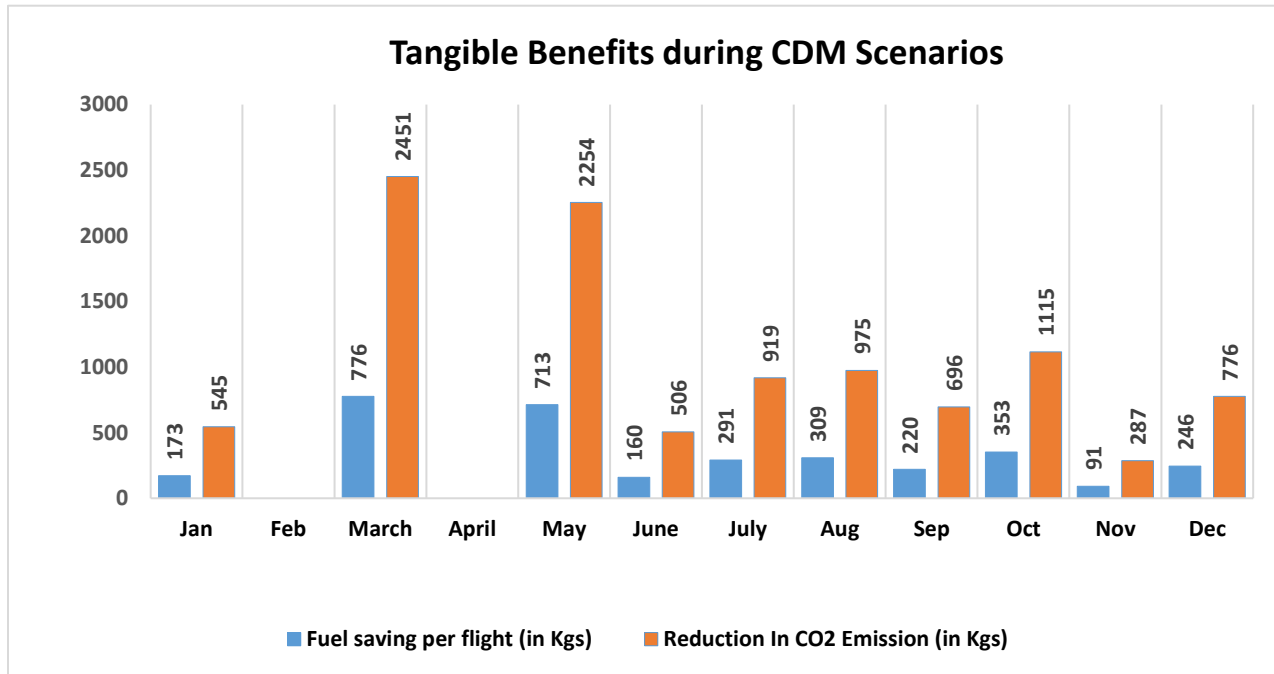


Figure 13: Fuel Savings & CO₂ Emissions reduction

No ATFM measures were applied for the the month of February & April for the year 2022. Total 1616.92 tonnes of fuel was saved during the period when ATFM measures were in force ,which translated into 6373.46 tonnes of reduction in Co₂ emission in the calendar year 2022.

Inference

1. March 2022 recorded maximum Fuel savings per flight of 776 Kg of ATF during an ATFM measure initiated for Delhi Airport where demand capacity imbalance was observed due to a VIP movement.
2. Each ATFM measure saved on an average 16000 Kg of fuel in the year 2022 with total 132 ATFM measures applied.
3. March 2022 recorded maximum reduction in emissions of 2451 Kg of CO₂.
4. With total 132 number of ATFM measures this year, the average reduction in CO₂ emission was calculated to be 51000 Kg.



E. Glossary

ATFM Parameters	Definition
<i>Affected Flight statistics</i>	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)
<i>Average ATFM delay</i>	$\frac{\text{Total monthly ATFM delay (in minutes)}}{\text{Total Domestic Arrivals}}$
<i>Maximum ATFM delay</i>	Maximum ATFM delay (in minutes) assigned in the month
<i>Overall compliance rate</i>	Defined as monthly ATFM departure slot adherence rate of regulated flights. Flights having ATOT within the ATFM Slot Tolerance Window (STW) of minus 5 to plus 10 minutes of CTOTs, are considered as compliant flights
<i>CTOT Compliance rate of Airline operators</i>	An overview of CTOT compliance rate of various Airline operators
<i>CTOT Compliance rate of Airports within different Regions</i>	An overview of CTOT compliance rate of Airports within 4 FIRs
Air delay statistics	<p>Air delay defined as difference between AET & EET, where AET (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</p> <p>Average Air Delay is calculated as:</p> $\text{Average Air Delay} = \frac{\text{Total Air Delay to domestic arrivals (with values greater than zero)}}{\text{Total Domestic Arrivals}}$ <p>CLDT: Calculated Landing Time CTOT: Calculated Take off Time ALDT: Actual Landing Time ATOT: Actual Take off Time</p>



Annexure A- Flight Plan Analysis (1st Oct'22 to 31st Dec'22)

I. Introduction

Correct and timely flight intent in SKYFLOW is important for correct demand prediction and eventually effective ATFM measures'. A sample study was carried out at Central Command Centre for the Month of October, November and December'22, wherein flight plans were studied for the time they were received by the ATFM unit against their filed EOBT.

II. Data Analysis

During the period of analysis, total **156340** correct Flight plans were received by SKYFLOW system and analyzed

Following observations are made: -

1. Total Flight Data for the sample period (Including Domestic and International Flights)

Flight plan filing time (Hours Before the EOBT)	Number of FPL	Percent
Less than 1	16704	3%
More than 1- less than 2	22948	4%
More than 2- less than 3	46662	9%
More than 3- less than 4	61534	12%
More than 4- less than 5	55801	11%
More than 5 less than -6	71999	14%
More than 6- less than 7	43658	8%
More than 7- less than 8	37173	7%
More than 8- less than 9	32627	6%
More than 9- less than 10	32982	6%
More than 10- less than 11	20405	4%
More than 11- less than 12	15557	3%
More than 12- less than 13	11458	2%
More than 13- less than 14	9315	2%
More than 14- less than 15	7474	1%
More than 15- less than 16	6467	1%
More than 16- less than 17	5802	1%
More than 17- less than 18	5225	1%
More than 18- less than 19	4126	1%
More than 19- less than 20	3734	1%
20 or more	9638	2%

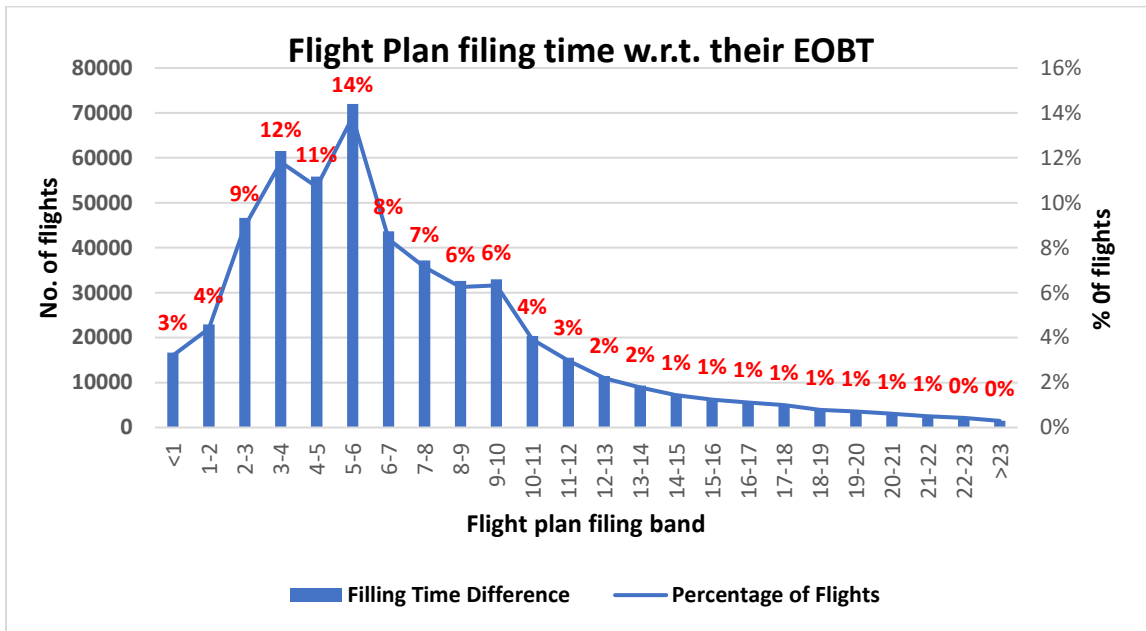


Figure 14: Flight Plan Filing Time against EOBT

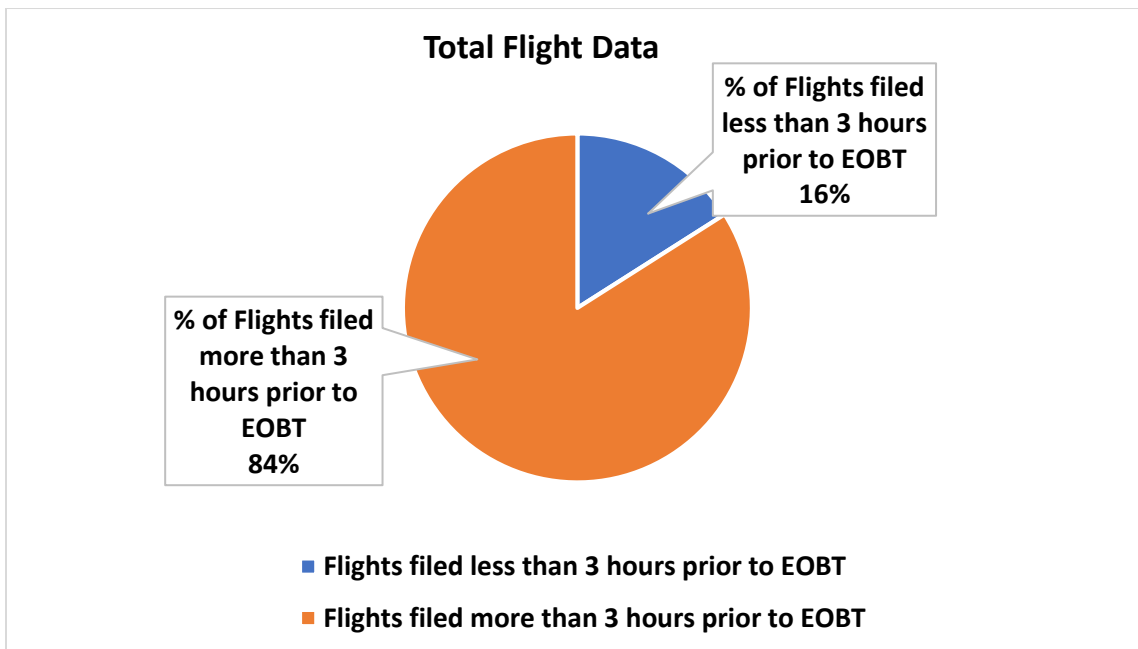


Figure 15: Percentage of total flights filling within 3 Hrs of EOBT

**Inference**

1. 3.2% of the flight plans filed are as late as one hour prior to the EOBT.
2. 7.6% of flight plans are filed 2 hours prior to the EOBT.
3. 16% of flight plans are filed less than 3 hours prior to EOBT

2. Major Domestic Airlines Wise Analysis

Airlines	Number of Flight plans filed less than 3 Hours prior to EOBT	Total no. of filed Flight Plans	Percentage
Indigo	5256	47035	11
Spicejet	934	7753	12
Air India	787	13455	6
Vistara	586	7635	8
Go First	446	5636	8
Air Asia	166	5525	3

Inference

1. Spicejet Airlines submitted around 12% of Flight Plans less than 3 hours prior to EOBT.
2. Indigo Airlines submitted almost 11% of flight plans less than 3 hours prior to EOBT.

Both of these Airlines share fortnightly flight intent with CCC for most of their movements which is not considered in the sample study.

III. Conclusion:

As can be observed from the analysis, 16% of flight plans are still filed less than 3 hours prior to EOBT. It is a violation of the basic flight plan requirements as mandated by AIP India. It is therefore reiterated that all airlines follow the eAIP regarding submission and addressing of Flight Plan.