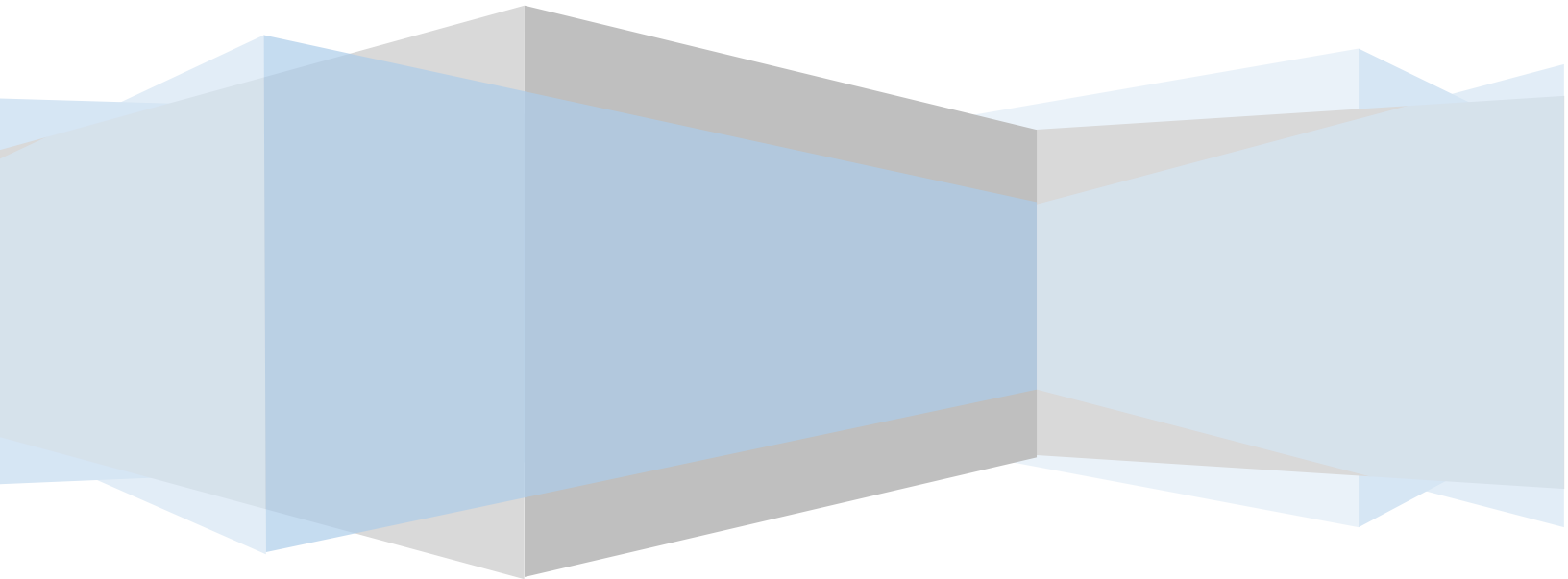


POST OPERATIONS ANALYSIS REPORT

December, 2020

CENTRAL COMMAND CENTER, C-ATFM, DELHI







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A. Executive Summary

Government of India has now allowed domestic airlines to resume their flight operations to 80 percent of pre-Covid approved capacity.

Scheduled international passenger flights were suspended in India on March 23, 2020 due to the pandemic-induced lockdown. The scheduled international flight movements remain suspended till 1829 UTC of 31st January'20. (NOTAM G1365 replacing NOTAM G1183/20). However, special international passenger flights have been operating in India under the Vande Bharat Mission since May and under air bubble arrangements formed with around 24 countries since July'20. Under a bilateral air bubble arrangement, airlines of the two countries can operate flights between their territories with certain restrictions. India has also suspended all passenger flights connecting India and U.K. from December 23 to January 7 as a new variant of coronavirus emerged in the UK.

ATFM measures were applied five times for Bengaluru Airport in the month of December'20 due to scheduled Runway maintenance. The average CTOT compliance rate was observed to be 80% and 51% of arrivals received an air delay of 10 minutes or less during the period when ATFM measures were in force.

B. Traffic Analysis

Experts believe that the key factors that will determine the pace of recovery in the domestic market are development and availability of vaccines, people's willingness to undertake leisure travel and recovery in macroeconomic growth.

The total number of ATMs at Indian Airports in **Dec'20 (during Covid pandemic) w.r.t. Dec'19(Pre -Covid) is 63.9%.**

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 and all other aircraft movements at six major Indian Airports namely Delhi, Mumbai, Bengaluru, Hyderabad, Kolkata and Chennai is plotted for each day of the month of Dec'20. The data used is the movement data received from Delhi, Mumbai, Bengaluru and Hyderabad Airport. AIMS data is used for Kolkata and Chennai Airport. Airline movement is also plotted for the month for major Scheduled Operators.



I. Daily ATMs at six major airports

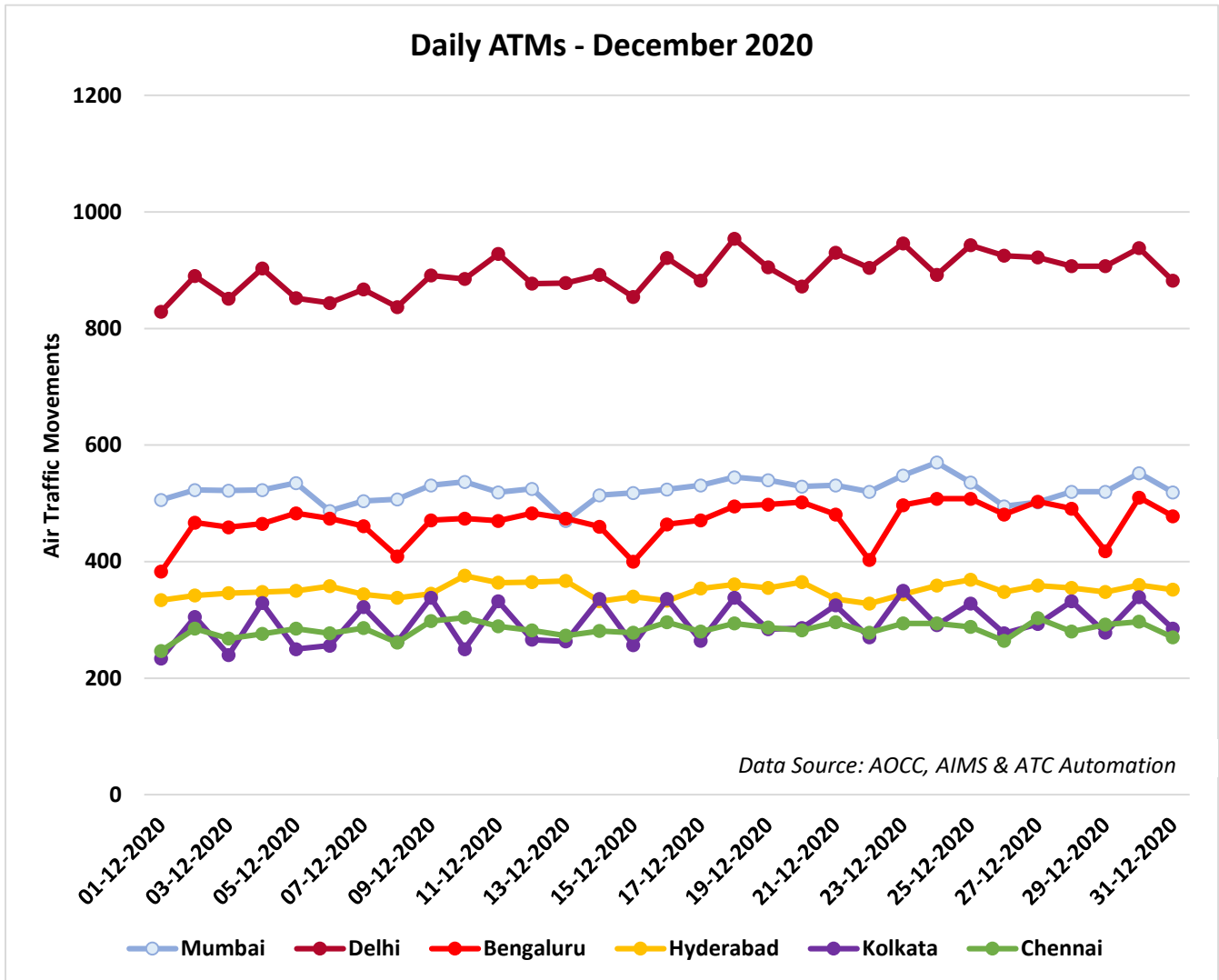


Figure 1: Daily ATMs at six major airports - Dec'20



II. Comparison of total ATMs (YoY) and Month wise

The graph below depicts the change in total ATMs in the month of Dec'20 in comparison to the total ATMs in Dec'19 for six major Airports in India. Bengaluru is showing the most recovery among the six airports i.e, the traffic in Dec'20 is 30% less than the Dec'19 whereas the traffic handled in Mumbai, Delhi, Hyderabad, Kolkata and Chennai are 42.4%, 34.8%, 36.9%, 41.5% and 43% respectively less than the traffic handled in Dec'19.

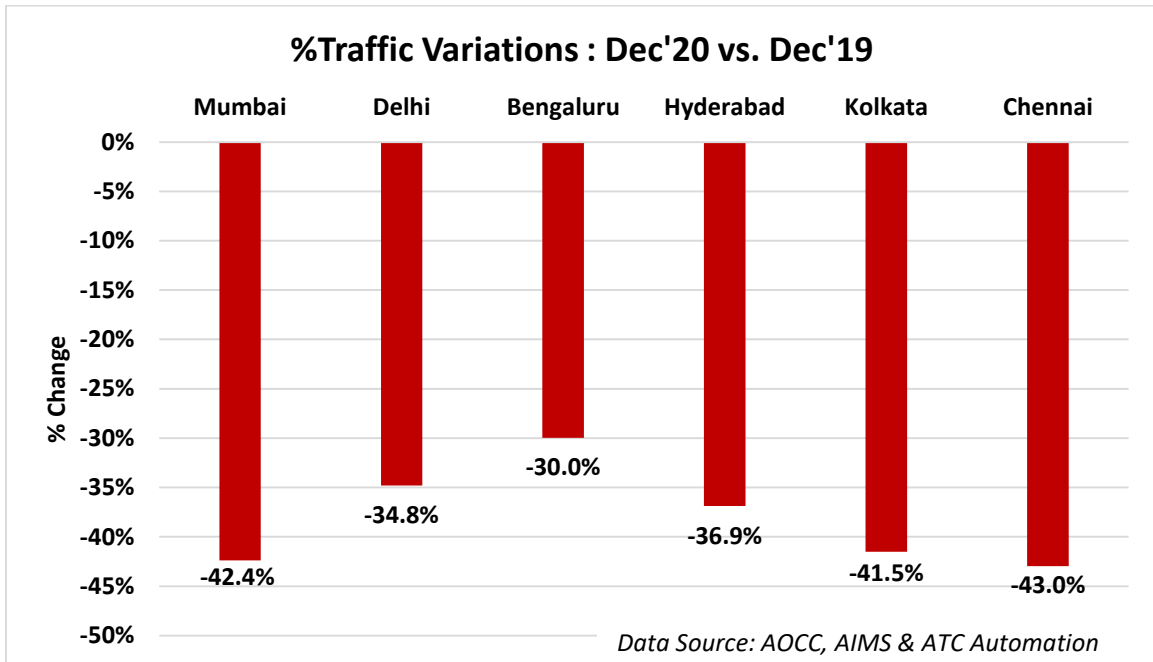


Figure 2: Percentage Traffic Variation (YoY)

Total ATMs (YoY) for six major airports		
Airports\Year	Dec'20	Dec'19
Mumbai	16203	28143
Delhi	27708	42494
Bengaluru	14541	20766
Hyderabad	10875	17232
Kolkata	9116	15585
Chennai	8785	15404



The graph below presents the month wise air traffic movement in the year 2020, at six major Airports.

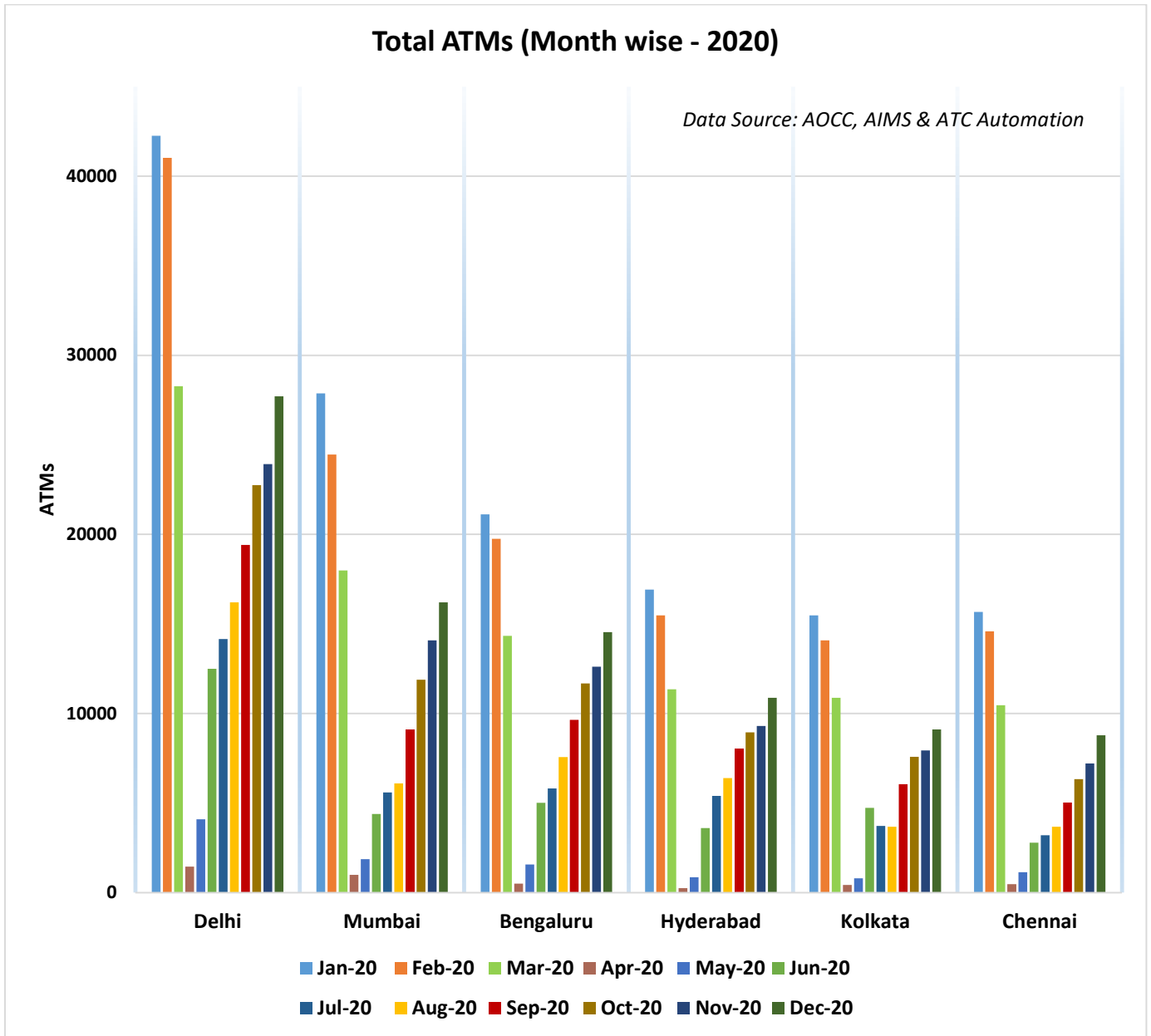


Figure 3: Month wise ATMs at six major airports



III. Air-Traffic Growth (Post COVID Lockdown period)

The graph below plots the percentage change per month in Air traffic (domestic and international) post Covid Lockdown and resumption of flight operations from May'20. The Indian aviation industry witnessed continued recovery in domestic passenger traffic in December'20, with a steady growth over November'20 by 15%.

The recovery to Precovid levels as per the data available with ATFM (Average monthly Air traffic movement for the year 2019) is by Feb'21 by an optimistic estimate and by April'21 by a conservative estimate.

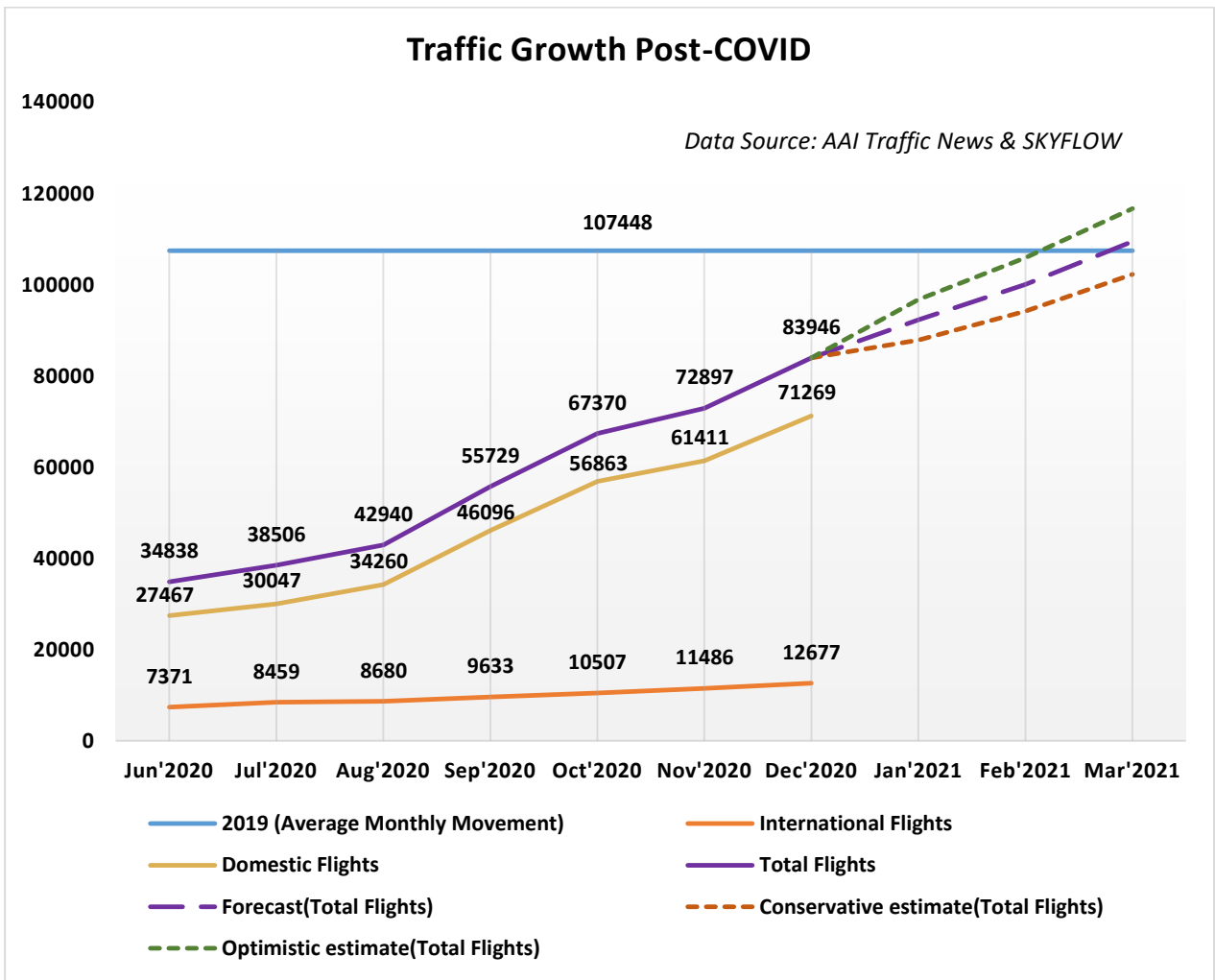


Figure 4: Traffic Growth - Post Covid



IV. Flight Operations – Airport wise

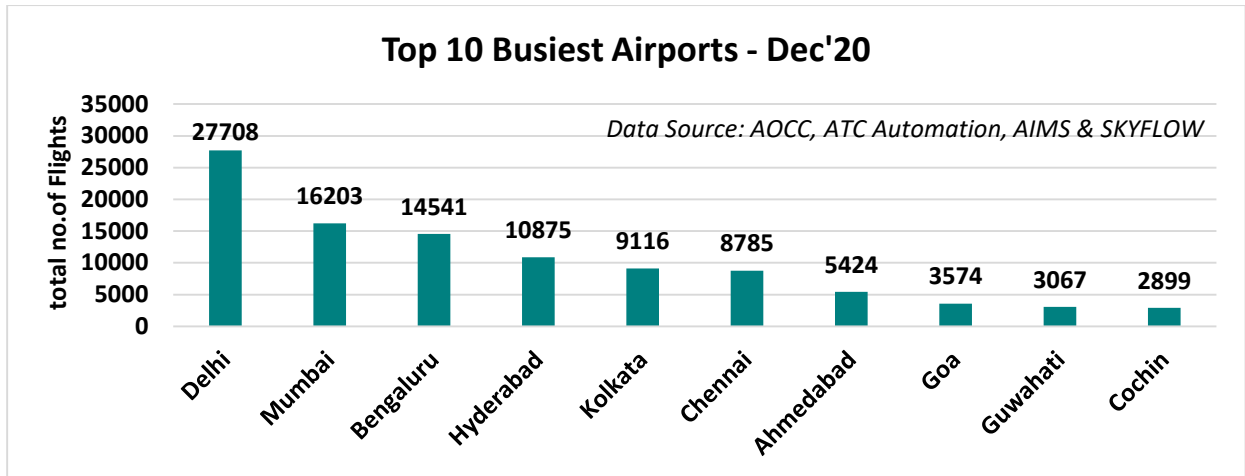


Figure 5: Busiest Airports in India - Dec'20

V. Flight Operations – Airline wise (Post COVID lockdown period)

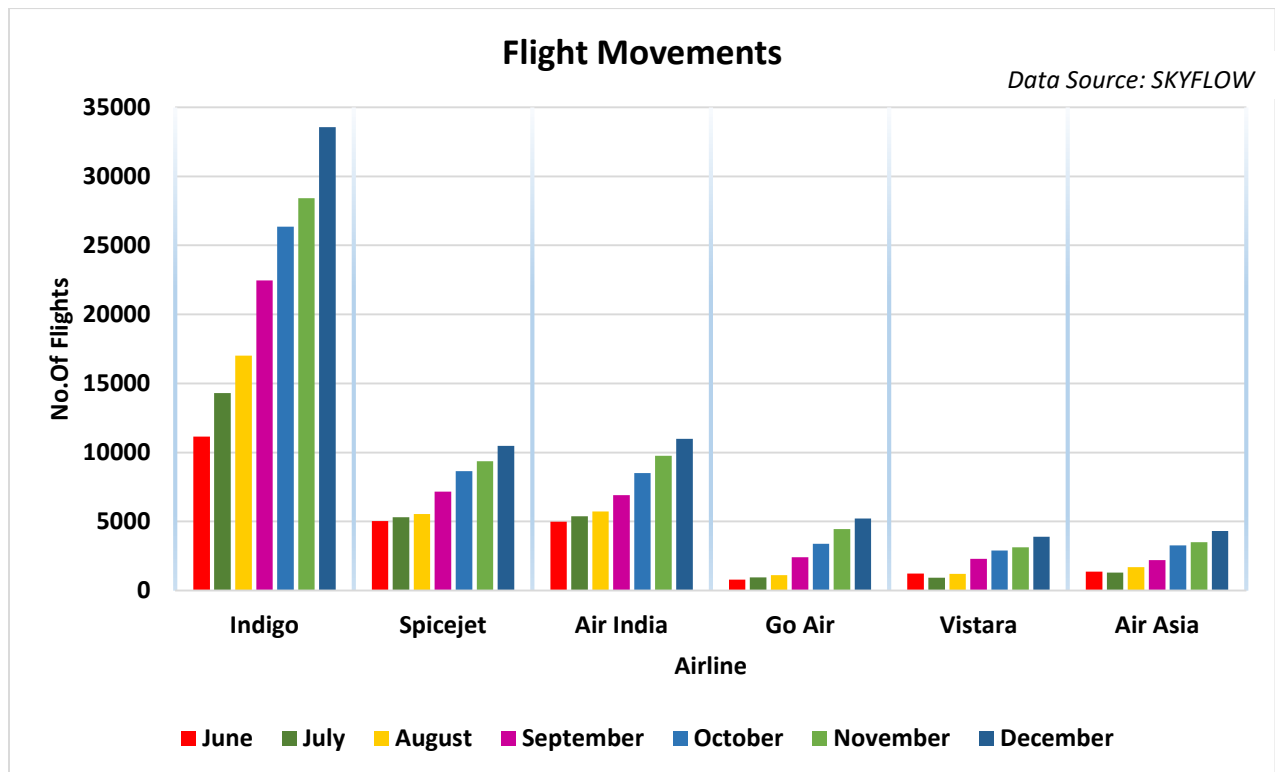


Figure 6: Flight Movements – Airline wise



C. ATFM Post Operations – CDM Analysis

I. Introduction

Analysis Period 1st – 31st December'20

Back Ground During the above mentioned period, ATFM measures were applied **five(5) times** for **Bengaluru Airport** due to the following reasons as illustrated in the bar chart below:–

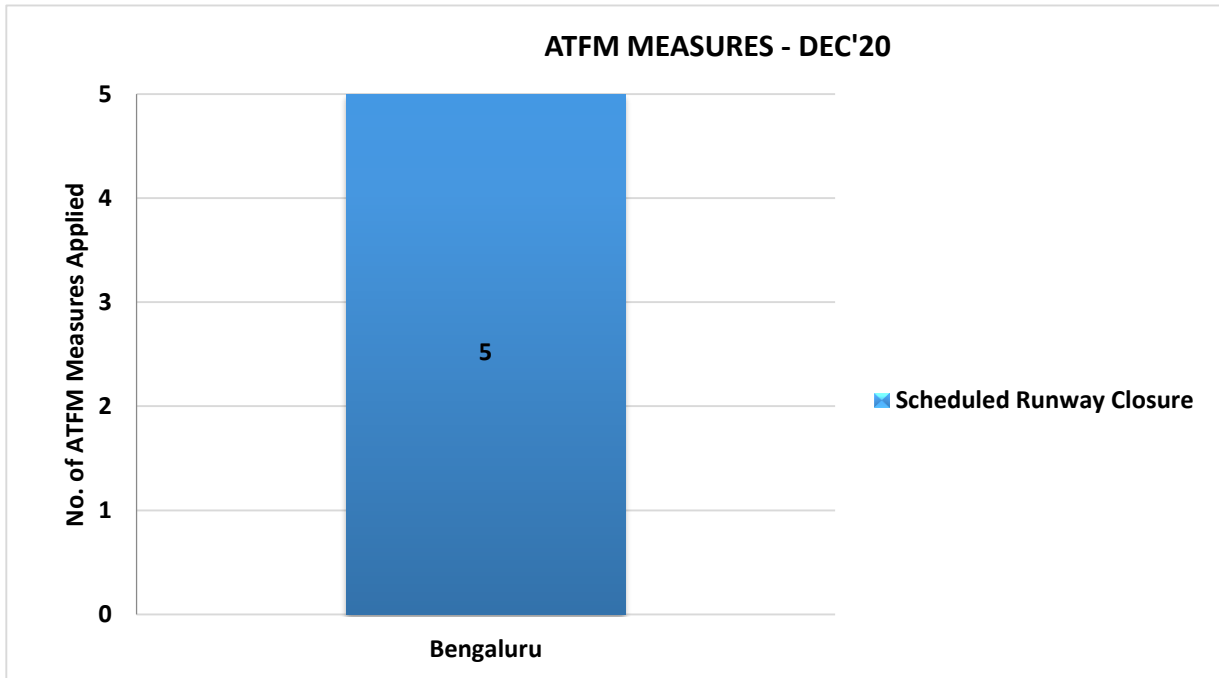


Figure 7: ATFM Measures - Dec'20



II. ATFM Measures Overview

	Bengaluru Airport
Number of ATFM measures applied	5
Average ATFM Ground delay due to measures	13 min
Maximum ATFM Ground delay due to measures	28 min
% Compliance	80

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

Total affected flights in scenario (Domestic Arrivals)	104
Total Domestic Arrivals with zero ATFM delay	16
Total Domestic Arrivals with ATFM delay	88

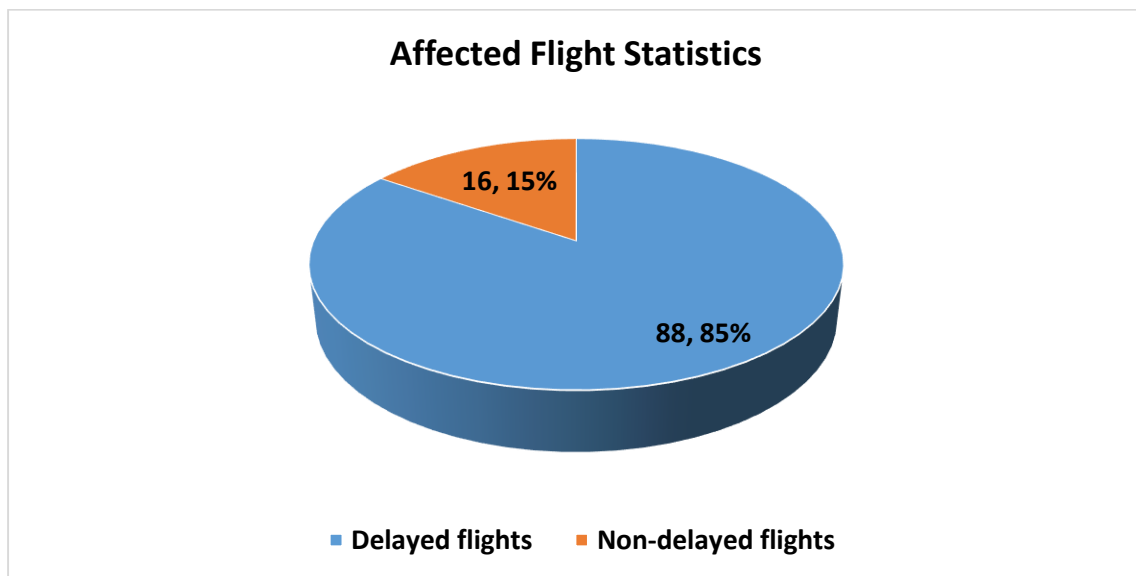


Figure 8: Affected Flight Statistics – Dec'20



III. Overall Compliance

Total Arrivals	113
Domestic arrivals	104
Flights with complete data (ATOT)	102
Flights with incomplete data	1
Flights Not Operated	1
Compliant*	82
Non-Compliant	20

Total No. of Revised CTOTs issued = 5 (Compliance calculation for flights which were issued revised CTOT is w.r.t. new CTOT issued)

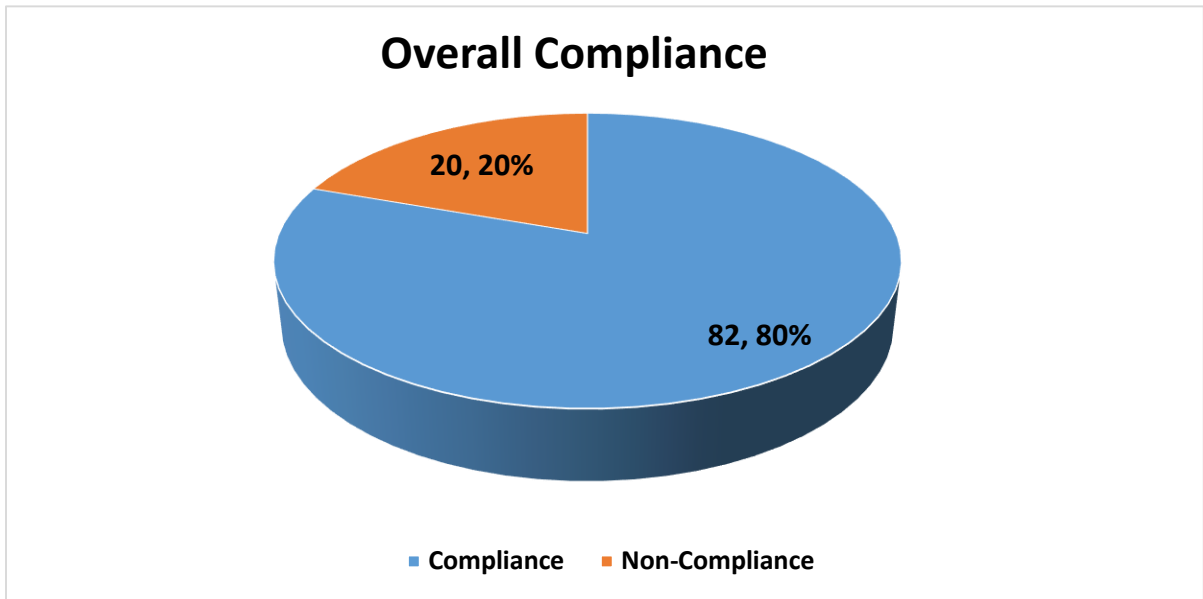


Figure 9: Overall Compliance – Dec'20

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

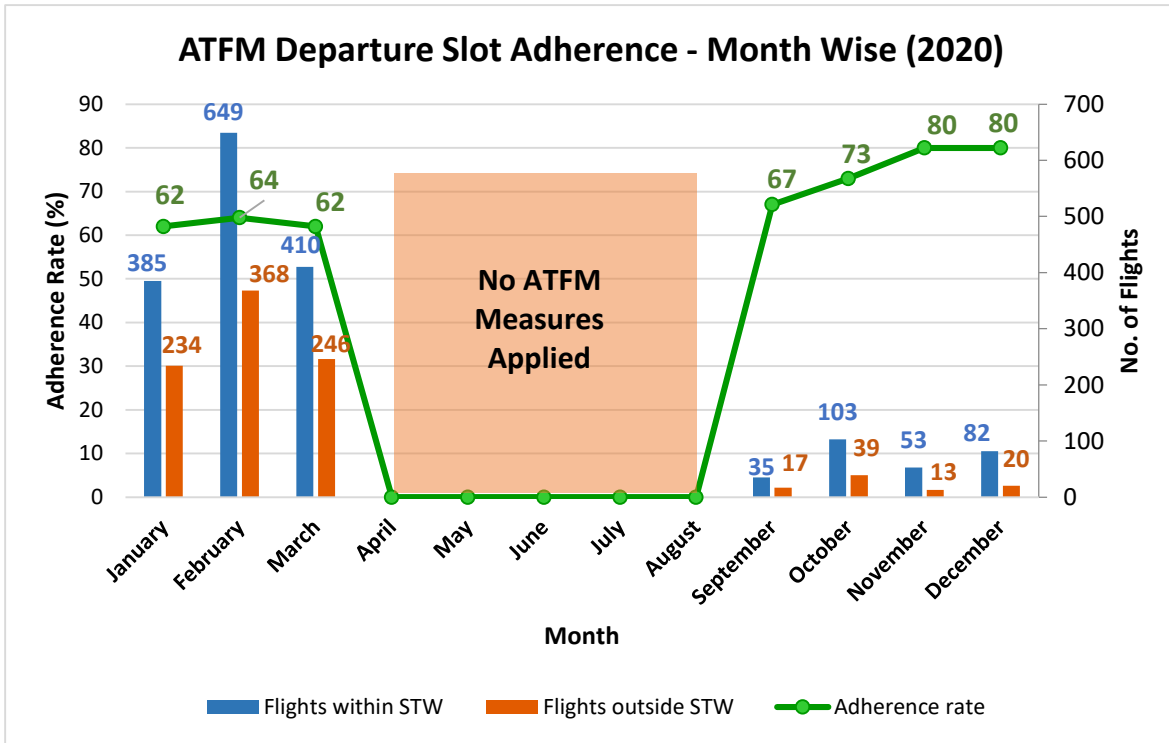


Figure 10: ATFM Compliance – Month wise

Inference

1. Out of the total arrivals captured for the constrained Airports during the CDM scenario , 92% of flights i.e. Domestic arrivals, are participating.
2. Out of these Domestic Arrivals, 85% of arrivals are assigned ATFM ground delay & 15% of flights are without any ATFM ground delay.
3. Out of the total arrivals captured to the constrained Airport during the ATFM scenario, 78% of flights are assigned ATFM Ground Delay.



IV. CTOT Compliance rate – Airport wise

MUMBAI FMP (67%)*	Compliant	Non Compliant	%Compliant
Kolhapur	2	2	50
Bhopal	4	0	100
Ahmedabad	2	2	50
KOLKATA FMP (81%)*			
Bagdogra	8	0	100
Guwahati	4	1	80
Kolkata	12	3	80
Patna	4	1	80
Varanasi	4	1	80
DELHI FMP (83%)*			
Delhi	11	0	100
Chandigarh	1	3	25
Jaipur	4	0	100
Lucknow	3	1	75
CHENNAI FMP (84%)*			
Chennai	3	1	75
Goa	1	0	100
Hyderabad	9	0	100
Belgaum	3	2	60
Madurai	4	0	100

*FIR wise compliance rate



V. CTOT Compliance rate – Airline wise

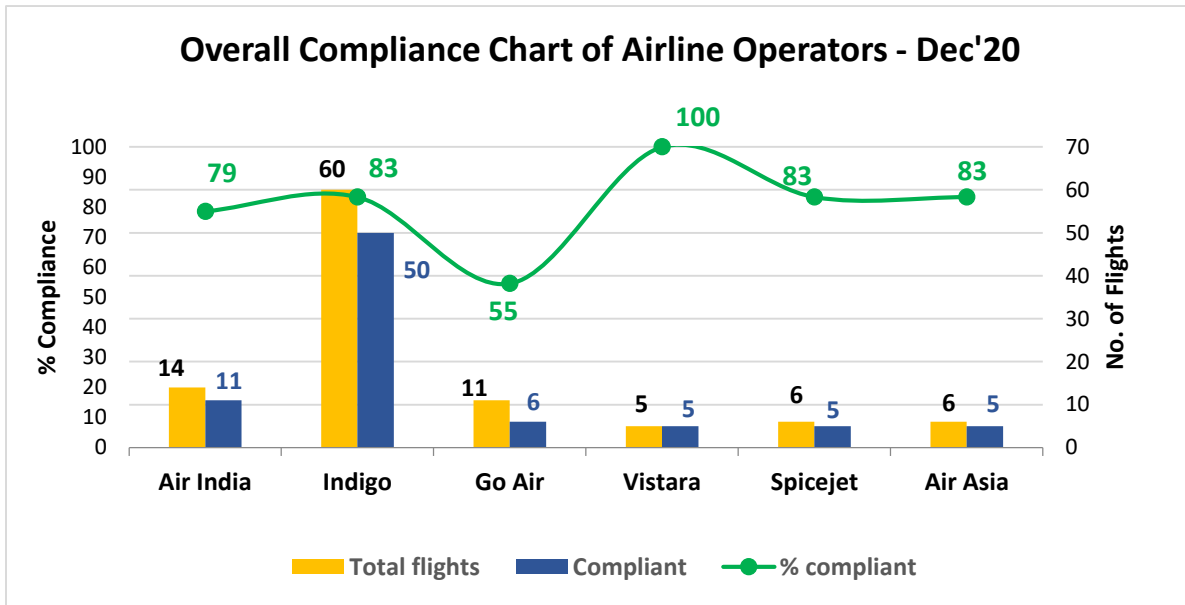


Figure 11: Airlines Overall Compliance - Dec'20

Inference

1. Out of the total domestic arrivals with complete data in the CDM scenario, 80% arrivals are compliant.
2. Chennai region has the highest compliance rate of 84% whereas Mumbai region has the lowest compliance rate of 67%.
3. Indigo, Vistara, Spicejet and Air Asia have a compliance rate above the average recorded 80% compliance.



VI. Air Delay during the CDM Scenario period

Average Air Delay to domestic arrivals* within the CDM Scenario period for Bengaluru is 12 minutes

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

Distribution of difference between AET & filed EET

AET-EET min (time band)		<= -10	-9 to -6	-5 to -1	0 to 5	6 to 10	11 to 15	16 to 20	21 to 25	26 to 30	>30
Bengaluru	Flt. Count	4	5	10	17	15	17	11	8	7	6
	% flight	4	5	10	17	15	17	11	8	7	6

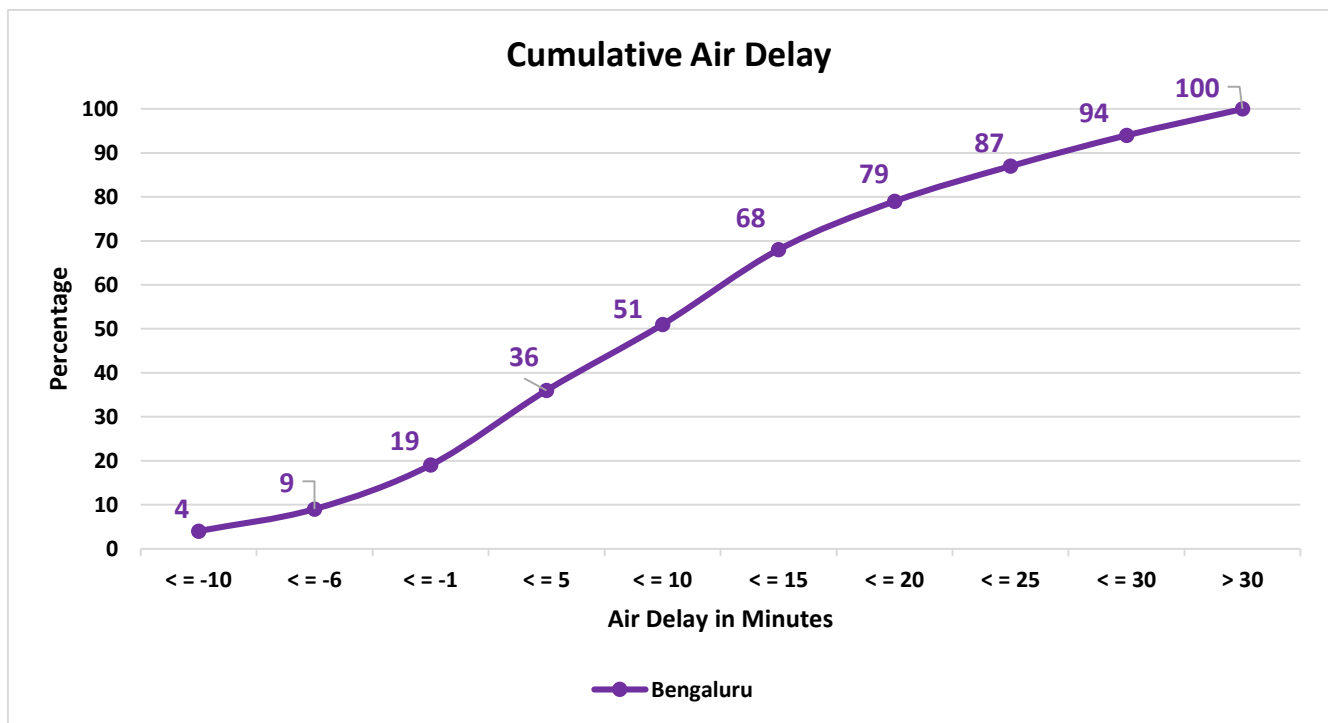


Figure 12: Cumulative Air Delay during CDM period

Inference

1. 51% of arriving flights to Bengaluru had an Air delay of equal to or less than 10 minutes during the CDM period.



D. 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>