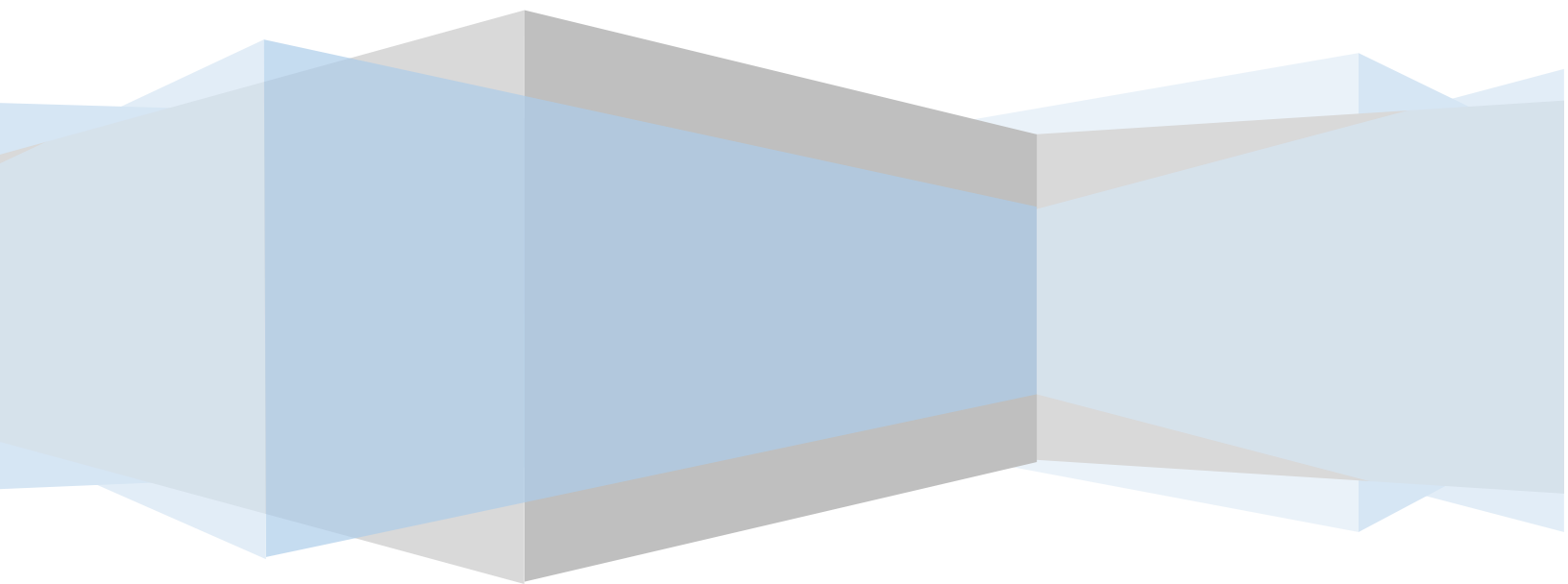


**ANNUAL REPORT**

**ATFM OPERATIONS**  
**(Jan 2019 to Dec 2019)**

**CENTRAL COMMAND CENTER, C-ATFM, DELHI**





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## Executive Summary

ATFM – India has completed two and half years of its Phase-I operation in India, wherein six (6) major airports i.e. Delhi, Mumbai, Chennai, Kolkata, Bengaluru and Hyderabad are consistently monitored for any demand capacity imbalance. In case of any imbalance, ATFM measures like Ground Stop or Ground Delay programs are implemented to regulate domestic arriving traffic to the constrained Airport with the support of 36 FMPs.

ATFM, in India, is now on the threshold of implementation of Phase II operations, where airspace flow programs such as Route balancing, Fix balancing, Sector balancing, Miles-in-Trail, Minutes-in-Trail will be available for application as needed. Since application of these measures requires proactive participation from ATC/FMPs and more widespread collaboration, it has been decided to introduce phase II features systematically in phased manner to ensure successful implementation in the operational environment. Initially, “Arrival Sequencing” and “Miles/Minutes in trail” will be implemented.

The C-ATFM system and ACDM system integration is successfully achieved for 3 major Airports i.e. Mumbai, Kolkata and Chennai. Operational trials are already in progress to integrate Delhi Airport CDM with ATFM. The integration facilitates better resource utilization at the Airports and updated demand information for ATFM System.

During the Year 2019, 20 (Twenty) times ATFM measures were applied for Delhi; 117 (One Hundred Seventeen) number of times ATFM measures were applied for Mumbai, 39 (Thirty-Nine) times for Bengaluru, 7 (Seven) times for Kolkata and 1 (Once) for Chennai. CCC had applied measures to address imbalances occurring due to various reasons like airspace closure, non-availability of airport infra-structures (Runway), NAV-AIDs (ILS etc.), Weather, VIP movement & inherent imbalance in flight scheduling etc. Major reason of application of ATFM measures for Mumbai and Bengaluru was planned Runway closure. Demand Capacity imbalance arising due to Republic Day Airspace closure was one of the major reasons for application of measures in Delhi.

The year 2019 was full of activities for C-ATFM. Some major milestones achieved are highlighted below:

Translocation of ATFM System from IGI Airport to Vasant Kunj was successfully carried out, without disrupting ATFM operations. C-ATFM started functioning from new location at Vasant Kunj from 1<sup>st</sup> May'2019. Honorable Minister of Civil Aviation, formally inaugurated the Central Command Centre for Air Traffic Flow Management(ATFM) facility on 22nd June'19.

4<sup>th</sup> and final Safety assessment workshop was conducted by DFS in collaboration with AAI and ATECH. Workshop was attended by all ATFM stakeholder. ATFM Operational environment was revised in view of Phase-II operation and Hazards of Phase-I operation were reviewed, taking into consideration forthcoming Phase-II operation.



VCCS (HARRIS) panel is available on the SKYFLOW workstations. CDM through teleconferencing has been introduced, initially with six major FMPs at a predetermined time and also on need basis. This practice will help CCC in collaborating actively with stakeholders in real time, in efficient manner.

ATFM Web Portal is operational and accessible through [URL: https://www.atfmaai.aero/portal](https://www.atfmaai.aero/portal) for situational awareness of all stakeholder's. ATFM Daily Plan(ADP), Notice of ATFM measure in force, Execution Report of CDM & revised CTOTs, Daily Post Operations Analysis and Monthly Post Operations Analysis are also disseminated through the portal. Study material regarding ATFM is also available in the resource section of the portal.

ICAO workshop on “*Airport Collaboration decision making integration with Air Traffic Flow Management*” was organized from 2<sup>nd</sup> to 4<sup>th</sup> December'19 by ATFM Directorate. The main objective of the workshop was to improve understanding by all stakeholders of the benefits of A-CDM integration with ATFM and how this combined implementation could be achieved. The workshop also offered opportunity to share the implementation experience of States and discuss implementation related issues.

In an endeavor to improve ATFM operational awareness, CCC has conducted twenty (20) training programs in 2019, a total of 521 stakeholders were trained during the year. In addition to Annual report and monthly ATFM post analysis, Daily ATFM post operation analysis is also carried out and shared with all concerned stakeholders'.

Some of the impending challenges faced by C-ATFM are:

- Developing Operating procedure for Phase-II airspace measures
- Defining change in role of all stakeholders in ATFM environment
- Training of all stakeholders for readiness on Phase-II implementation
- Trail operation for Phase-II

Correct Flight intent in SKYFLOW has been an ongoing challenge for ATFM unit India. Operational concept and design for an Integrated Initial Flight Plan Processing System (IFPS) is being developed in coordination with ATECH, Brazil to overcome this problem. An IFPS is a centralized service designed to rationalize the reception, initial processing and distribution of flight plan data & associated messages after validation within a region.

Active participation from all stakeholders in CDM process is still lacking. Sharing of information not only helps in building a common situation awareness but also helps in arriving at the most appropriate solution to address emerging situation at any airports or airspace sectors. In order to make the process more binding for all stakeholders, the approval of “*Common Business Rule (CBR)*” and *Signing of “Letter of Agreement (LoA)”* with the stakeholder is to be taken up on priority.



The CDM prepared to resolve Demand Capacity imbalance is not updated in real time. The lack of dynamic update of CDM in SKYFLOW is a major hurdle in assigning of revised CTOTs for flights missing their original CTOT.

Lack of ability of the ATFM system to adapt to a dynamically changing environment and a customized ATFM system as per Indian aviation scenario is a major hurdle in achieving an effective ATFM operational output and “buy in” from stakeholders.



# Annual ATFM Operations Report (Jan 2019 – Dec 2019)

## A. Introduction

### Back Ground

Airports Authority of India (AAI), in accordance with ICAO guidelines has implemented Central Air Traffic Flow Management (CATFM). The C-ATFM system network architecture consists of a Central Command Center (CCC), supported by 36 (thirty six) Flow Management Positions (FMP), located at 6 major Area Control Centers (ACC) and 30 (thirty) other major airports, which includes 8 (eight) Defense airports also.

C-ATFM in India is being implemented in phased manner, broadly in three phases. ATFM phase-I regular operation commenced from 27th April, 2017 vide AIP supplement 25/2017. During phase-I operation the Demand-Capacity scenario of six (6) major ACCs airports i.e. Delhi, Mumbai, Chennai, Kolkata, Bengaluru and Hyderabad, is regulated by applying appropriate ATFM measures available in phase I i.e. Ground Delay & Airport Stop programs. Presently, ATFM measures are applied only to Domestic arrivals to constrained Airports.

### ATFM Measures

During the Year 2019, 20 (Twenty) times ATFM measures were applied for Delhi; 117 (One Hundred Seventeen) number of times ATFM measures were applied for Mumbai, 39 (Thirty nine) times for Bengaluru, 7 (Seven) times for Kolkata and 1 (One) time for Chennai.

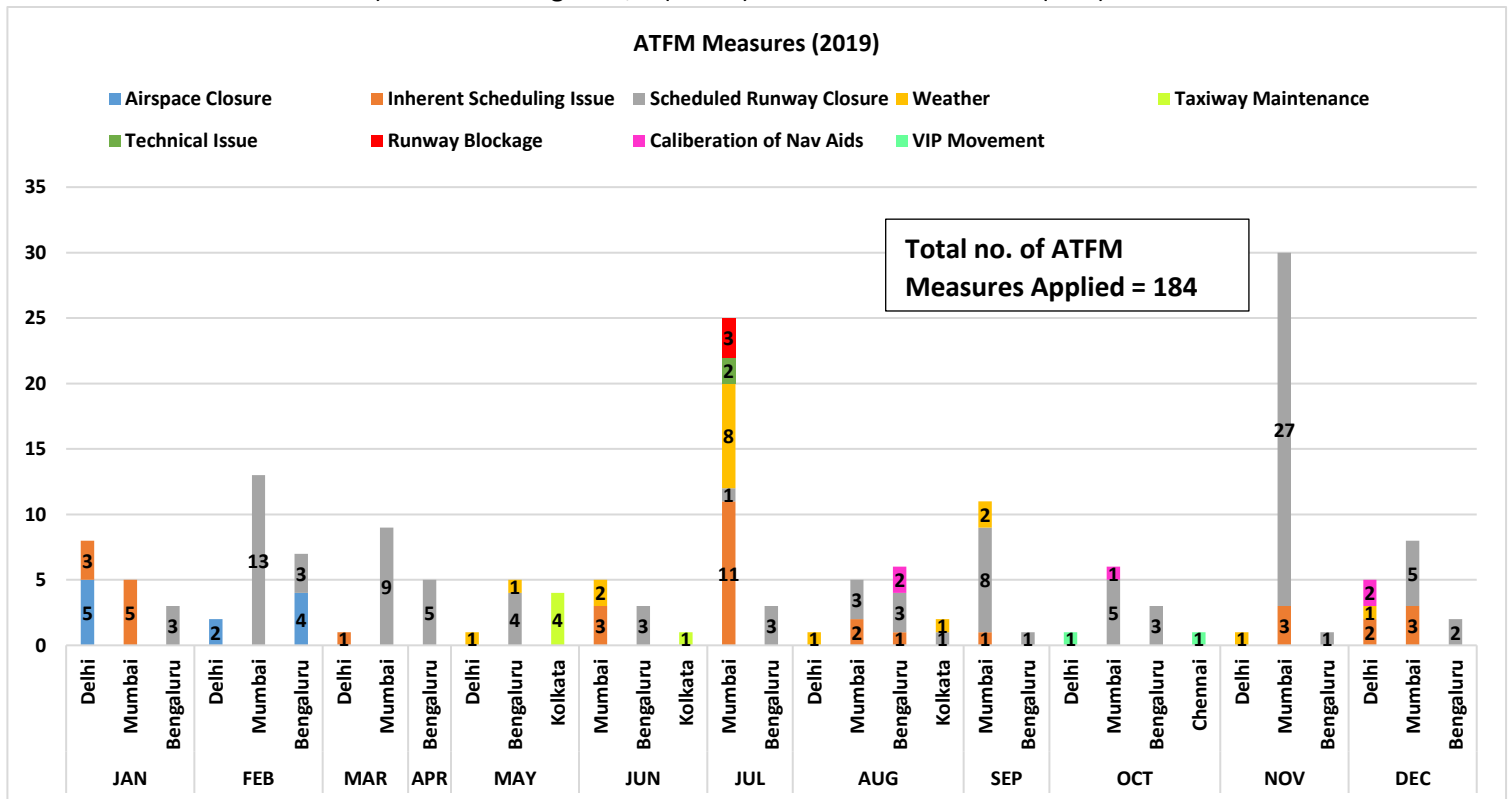


Figure 1: ATFM Measures - 2019



**Analysis Period** 1<sup>st</sup> Jan 2019 – 31<sup>st</sup> Dec 2019

**Data source** SKYFLOW, Automation system data from Delhi, Airport CDM data from Mumbai & Kolkata, AOCC data from Bengaluru and feedback from stakeholders.  
Flights with complete data i.e. ATOT(actual take off time), ALDT(actual landing time), etc. are only taken into consideration. Out of the total domestic arrivals for which CTOTs(calculated take off time) were issued, 92.3% data has been considered for Compliance measurement. Rest 7.7% data include domestic arrivals that did not operate and flights with incomplete required information.

## ATFM Parameters

### ATFM Parameters

#### 1. ATFM Program Impact

- **ATFM Scenario**  
(An overview of traffic within the CDM scenarios for the year, representing ratio of International traffic & domestic traffic.).
- **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.]

#### 2. ATFM Ground delay

(ATFM ground delay defined as CTOT-ETOT)

Calculated take off time – Estimated take off time

- **Total monthly ATFM delay**  
(Value in minutes representing total ATFM delay in the year)
- **Total flights affected**  
(Flight count)
- **Average ATFM delay**  
[Total yearly ATFM delay (in minutes )/ total number of domestic arrivals]
- **Maximum ATFM delay**  
[Maximum ATFM delay (in minutes) assigned in the year]
- **ATFM delay distribution in the band**  
(No delay, 0-5, 6-10; 11-15; 16-20; 21-25; 26-30; >30 minutes)





(An overview of ground delay distribution in the different time bands constrained Airport wise)

### 3. ATFM Compliance Measurement

#### - **Overall compliance rate**

(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)

#### - **ATFM departure slot adherence distribution**

[An overview of regulated flight departures within an ATFM slot tolerance window (ASTW), before ASTW & after ASTW]

#### - **CTOT Compliance rate of Airline operators**

(An overview of CTOT compliance rate of various Airline operators)

#### - **CTOT Compliance rate of Regions**

(An overview of CTOT compliance rate of 4 FIRs)

#### - **CTOT Compliance rate of Airports within different Regions**

(An overview of CTOT compliance rate of Airports within 4 FIRs)

### 4. Air delay statistics

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**

#### - **Yearly Distribution of (AET-EET) in different time bands for various Constrained Airports**

(<=-10; -9 to -6; -5 to -1; 0 to 5; 6-10; 11-15; 16-20; 21-25; 25-30 & >30minutes)

(An overview of Air delay distribution in the different bands)

*CLDT: calculated landing time*

*CTOT: calculated take off time*

*ALDT: actual landing time*

*ATOT: actual take off time*

#### - **Average Air Delay for various constrained Airports**

Average Air Delay is calculated as:

$$\text{Average Air Delay} = \frac{\text{Total Air Delay to domestic arrivals (with values greater than zero)}}{\text{Total Domestic Arrivals}}$$



## B. Annual Overview

### 1. ATFM Program Impact

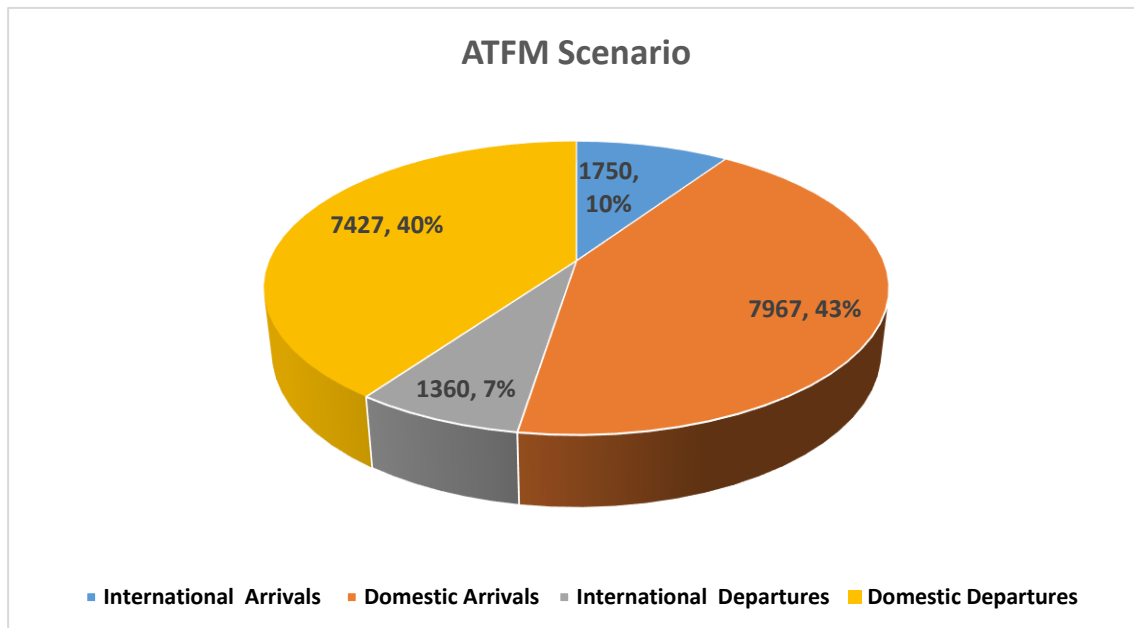
Data in this section helps to assess the impact of ATFM measure on overall flight operations in ATFM scenario & the extent of flights involved. Analysis provides:

- Picture of overall traffic mixture in the ATFM scenarios for twelve months and the percentage of participating flights to constrained airport.
- Percentage of participating flights assigned ATFM delay & its impact on overall flights in ATFM scenario.

#### 1.1 ATFM Scenario

<b>Total Flights</b>	<b>18504</b>
International arrivals	1750
International departures	1360
Domestic arrivals	7967
Domestic departures	7427

**Table-1**



**Figure 2: ATFM Scenario**

Within the CDM Scenario, domestic departures from the constrained Airport are regulated through Airport CDM. International Arrivals and Departures are exempted from ATFM measures. Only Domestic Arrivals to the constrained airport are participating.

## 1.2 Affected Flight Statistics

Total affected flights in scenario (Domestic Arrivals to constrained Airport)	7967
Total Domestic Arrivals with ATFM delay	6833
Total Domestic Arrivals with zero ATFM delay	1134

Table-2

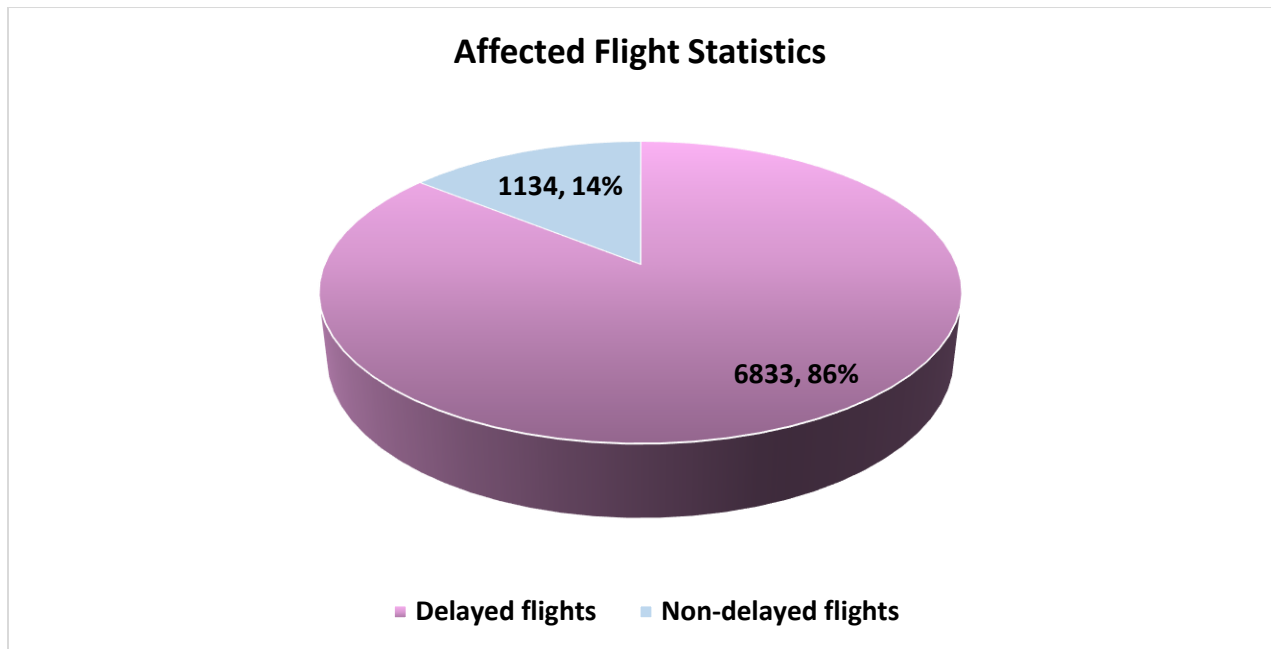


Figure 3: Affected Flight Statistics

## 1.3 Inference

1. Out of the total arrivals captured to the constrained Airport during the CDM scenario (Table-1), only 82% of flights i.e. Domestic arrivals are participating.
2. Out of these Domestic Arrivals, 86% of flights were assigned ATFM ground delay & 14% of flights were not assigned any ATFM delay (Figure-3).
3. Out of the total arrivals captured to the constrained Airport during the ATFM scenario, 70% of flights are assigned ATFM Ground Delay.



## 2. ATFM Ground Delay

Data analysis of this section provides insight into the impact of ATFM measure i.e. Ground delay. The study of delay distribution will provide seriousness of the capacity constraint.

### 2.1 ATFM Delay statistics

Total affected flights in scenario (Domestic Arrivals)	7967
Total ATFM Delay (CTOT-ETOT)	1,13,807 minutes (1896hrs:47mins)
Average ATFM Delay for affected flights	14 minutes
Maximum ATFM Delay	150 minutes

Table-3

Note:

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

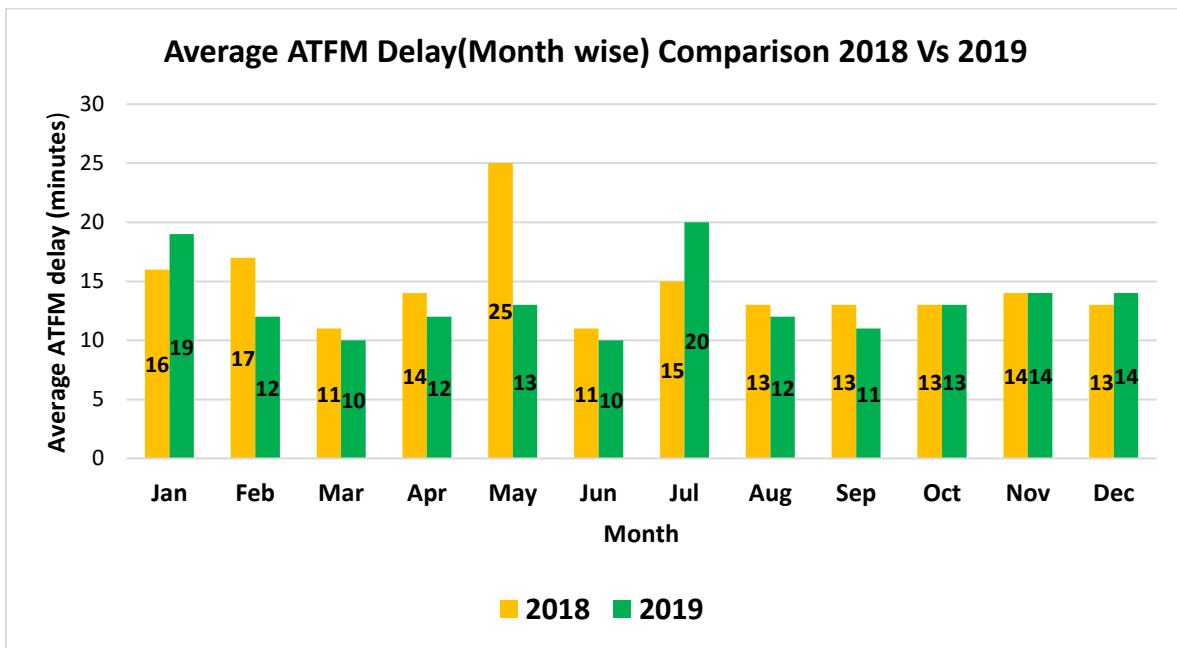


Figure 4: Month wise Average ATFM Delay

### 2.2 Inference

1. Average ATFM Delay was maximum in the month of May in 2018 and July in 2019.



### 3. ATFM Compliance Measurement

Data in this section helps to assess the actual situation achieved at the constrained airport.

Analysis provides:

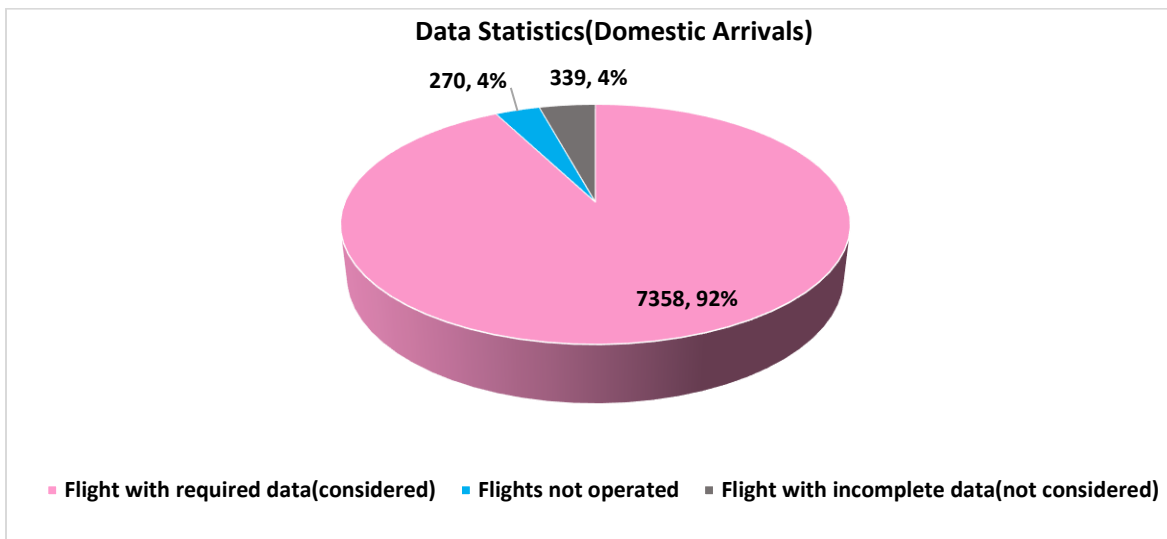
- Overall picture of flights operating within compliance window.
- Overview of regulated flight departures within ATFM slot tolerance window (ASTW), before ASTW & after ASTW
- Compliance rate Airline Operator wise , Region wise, Station wise within different Regions and Reasons for Non-Compliance

#### 3.1 Overall Compliance

Total Flights (Domestic arrivals)	7967
Flights with complete data (ATOT)	7358
Flights with incomplete data	339
Flights Not Operated	270
Compliant	4577
Non-Compliant	2781

**Table-4**

Total No. of Revised CTOTs issued = 448, compliance for flights issued revised CTOT is w.r.t. new CTOT issued.



**Figure 5: Data Statistics**

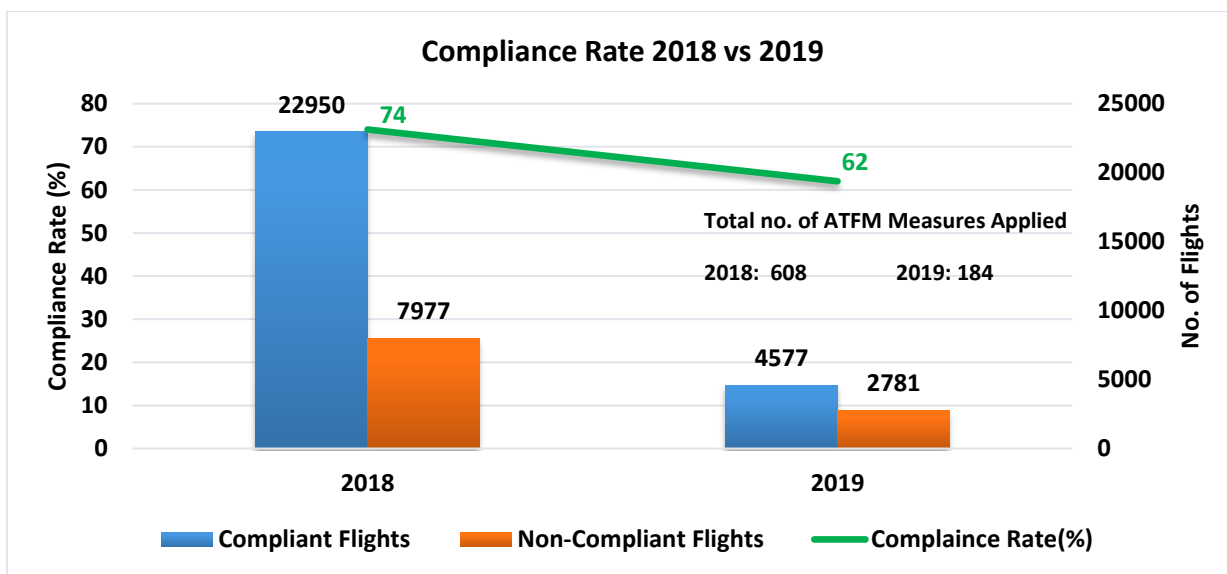


Figure 6: Overall Compliance

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

### 3.2 ATFM Slot Adherence distribution

ATFM Slot tolerance window (ASTW) is -5 to + 10 minutes of CTOT. The aircraft departing within this window shall be considered adhering to ATFM slots i.e. compliant flights.

Flight departing before 5 minutes & after 10 minutes of CTOT shall be considered out of ATFM slot tolerance window & accordingly termed as Non-Compliant i.e. before / after ASTW departures respectively.

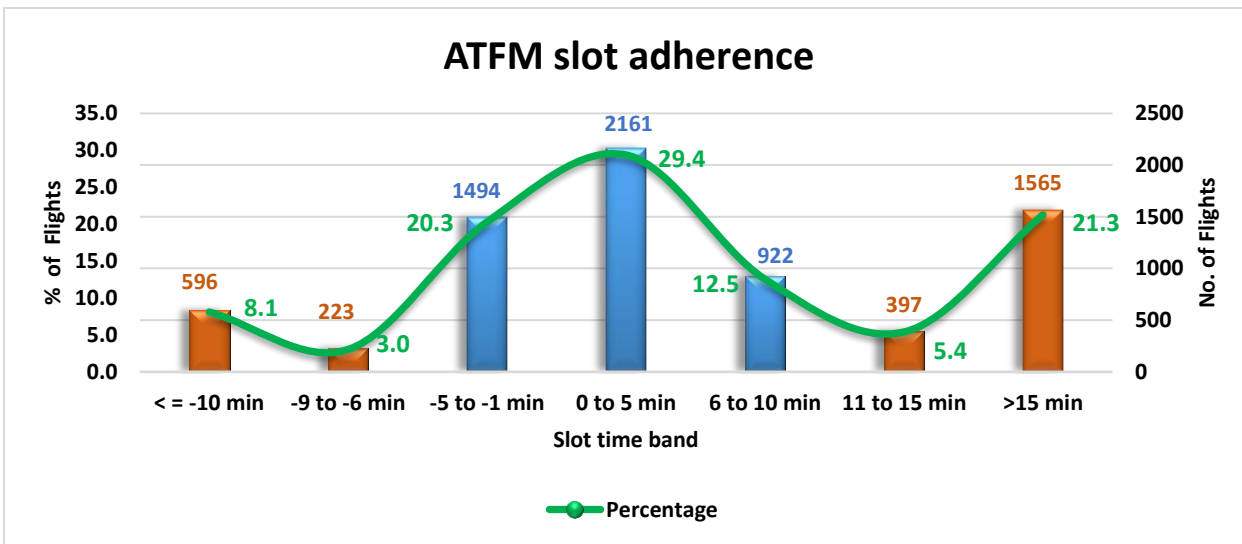


Figure 7: ATFM Slot Adherence

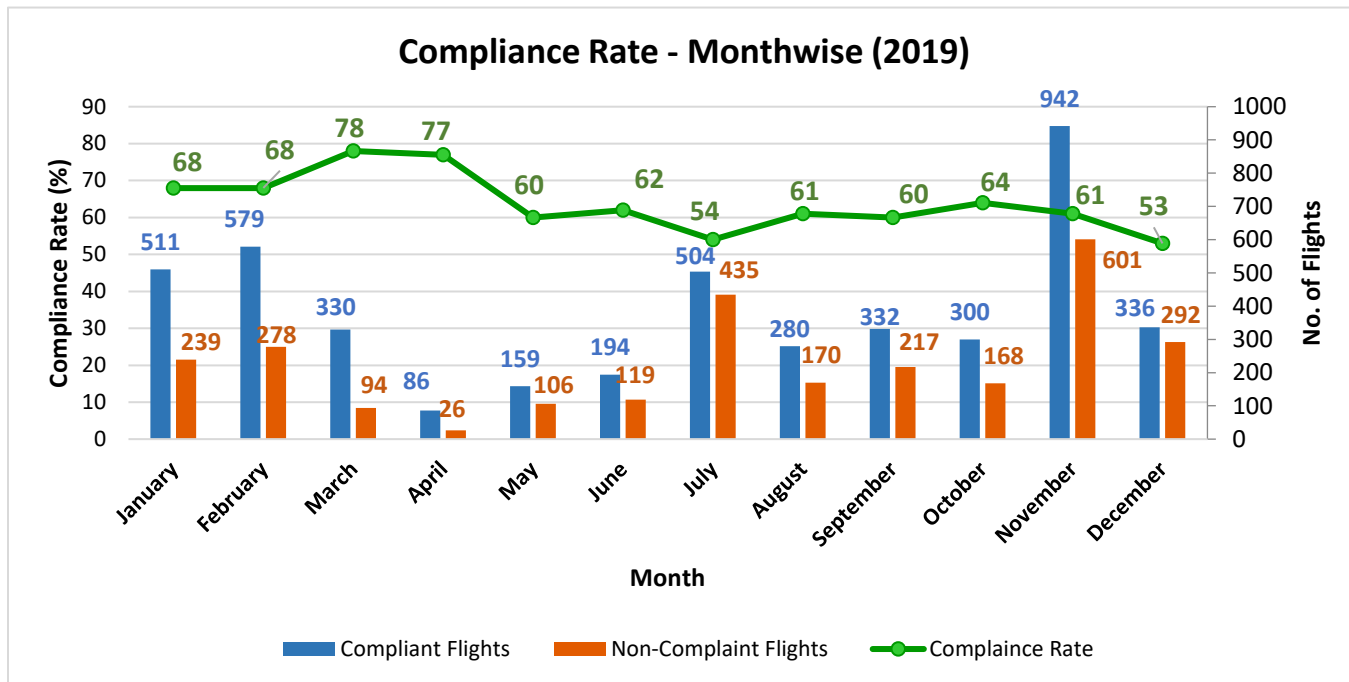


Figure 8: Compliance Rate – Month wise

3.3 CTOT Compliance rate by Airline Operators

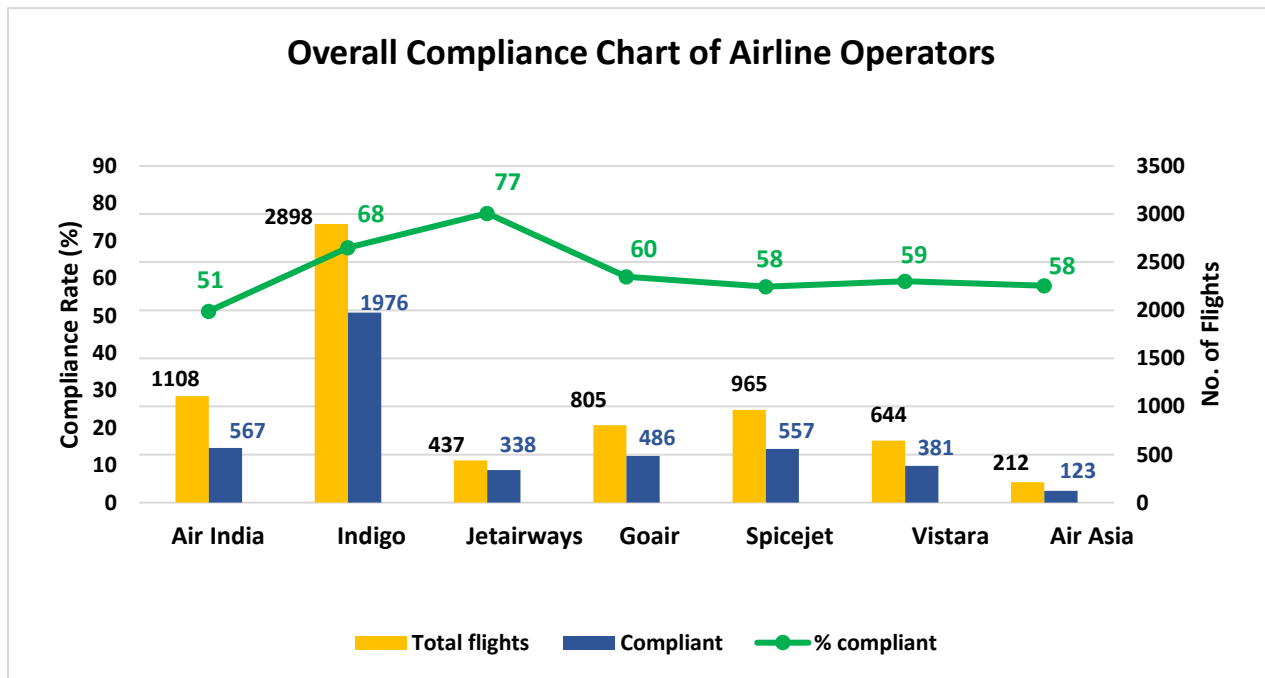


Figure 9: Overall Compliance Chart of Airline Operators



### 3.4 CTOT Compliance rate by FMPs (Region wise)

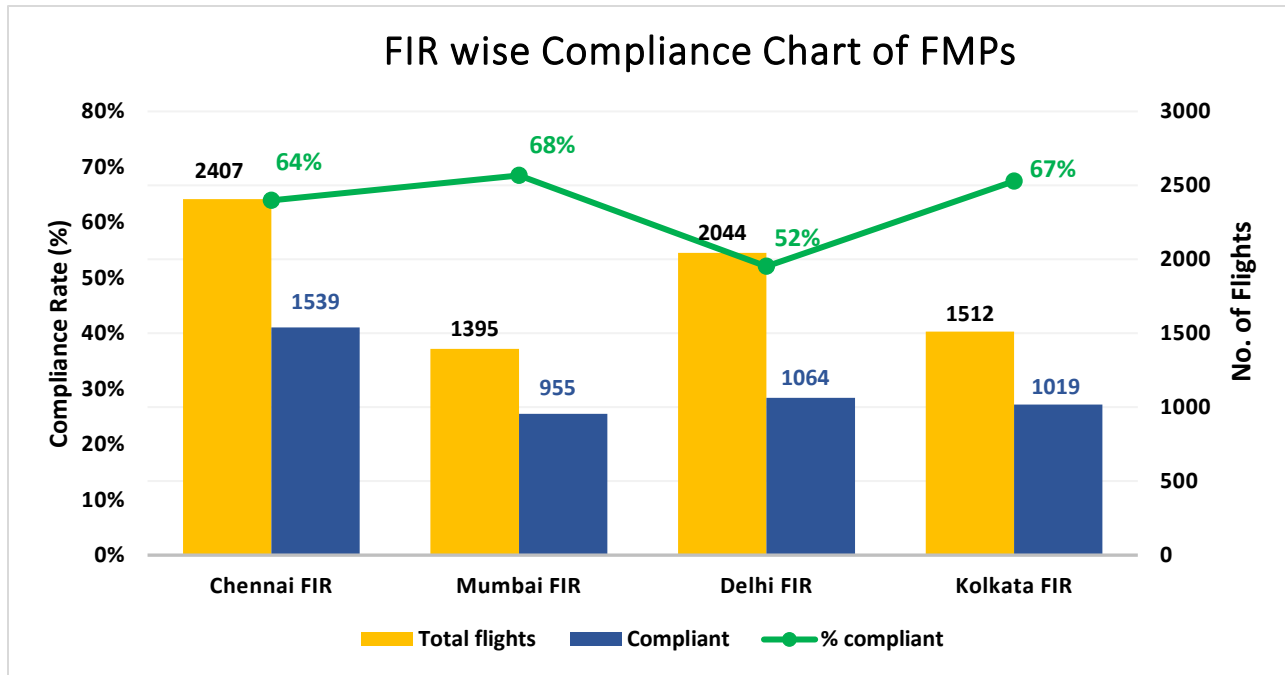


Figure 10: FIR wise Compliance Chart of FMPs

### 3.5 CTOT Compliance rate - Airport wise

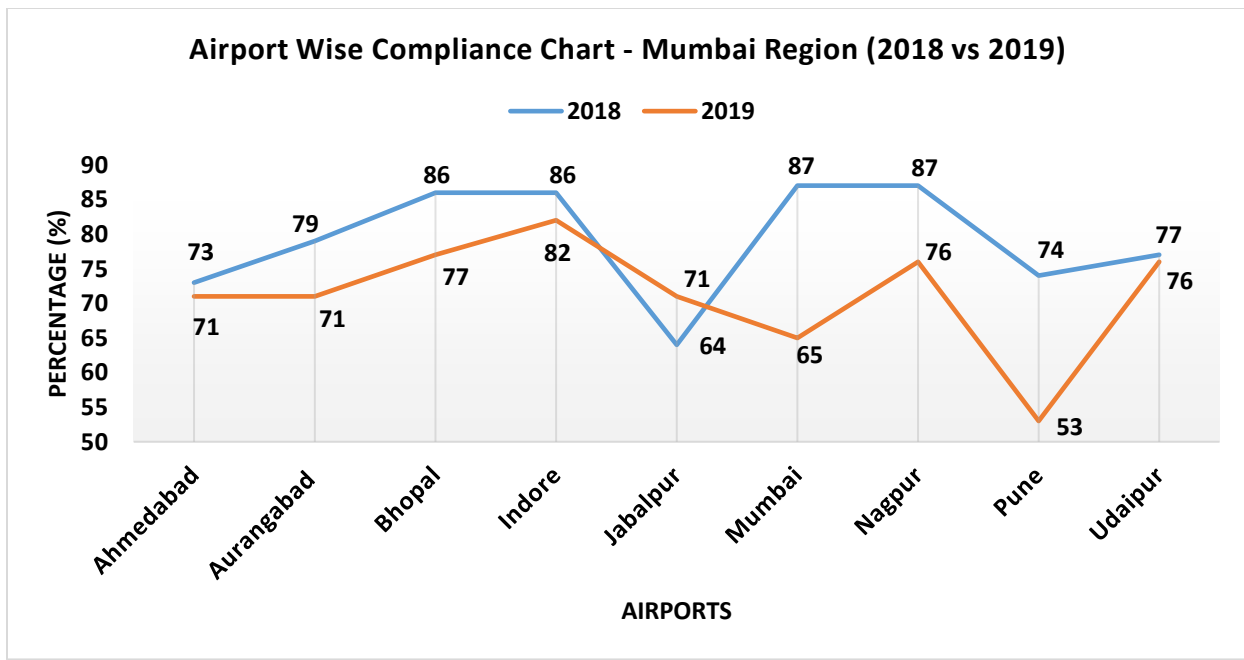


Figure 11: Airport Wise Compliance Chart - Mumbai Region



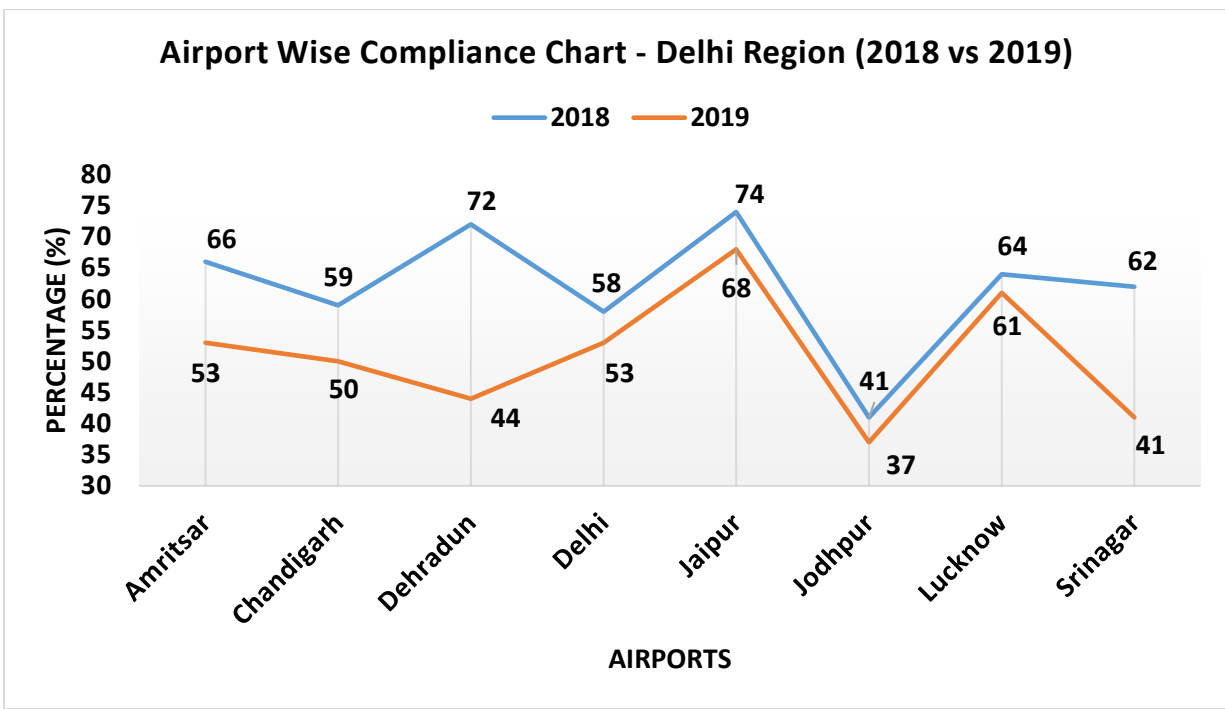


Figure 12: Airport Wise Compliance Chart - Delhi Region

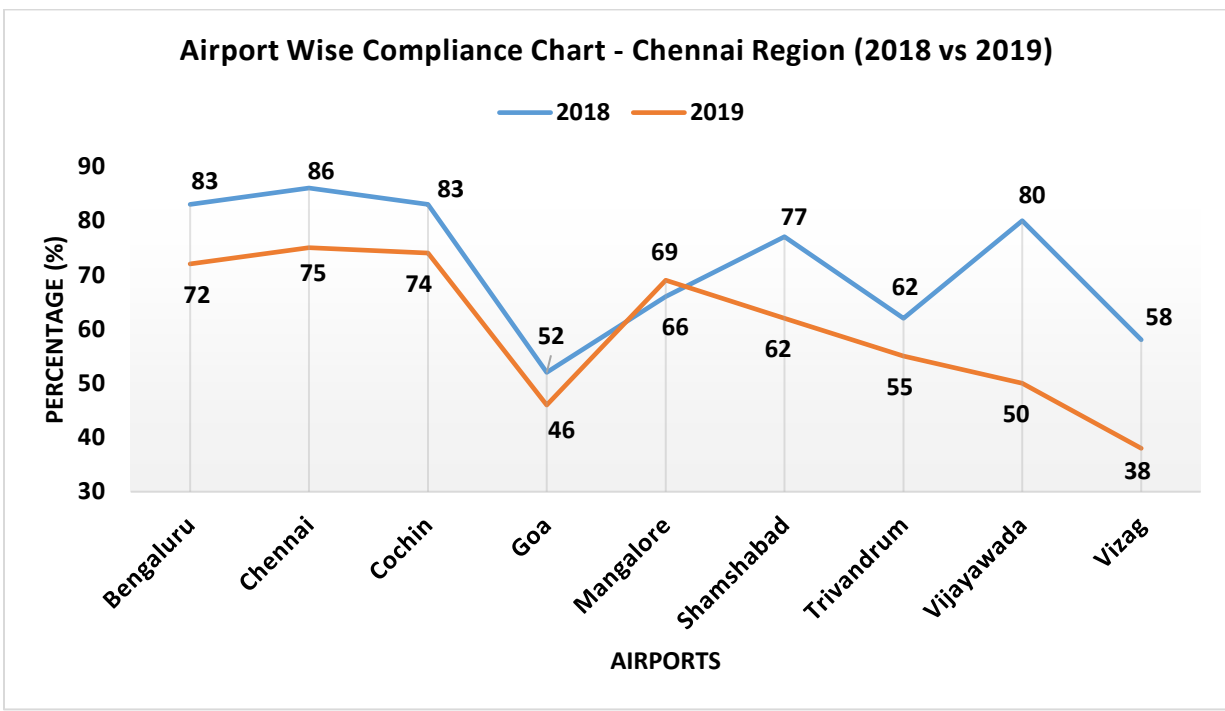
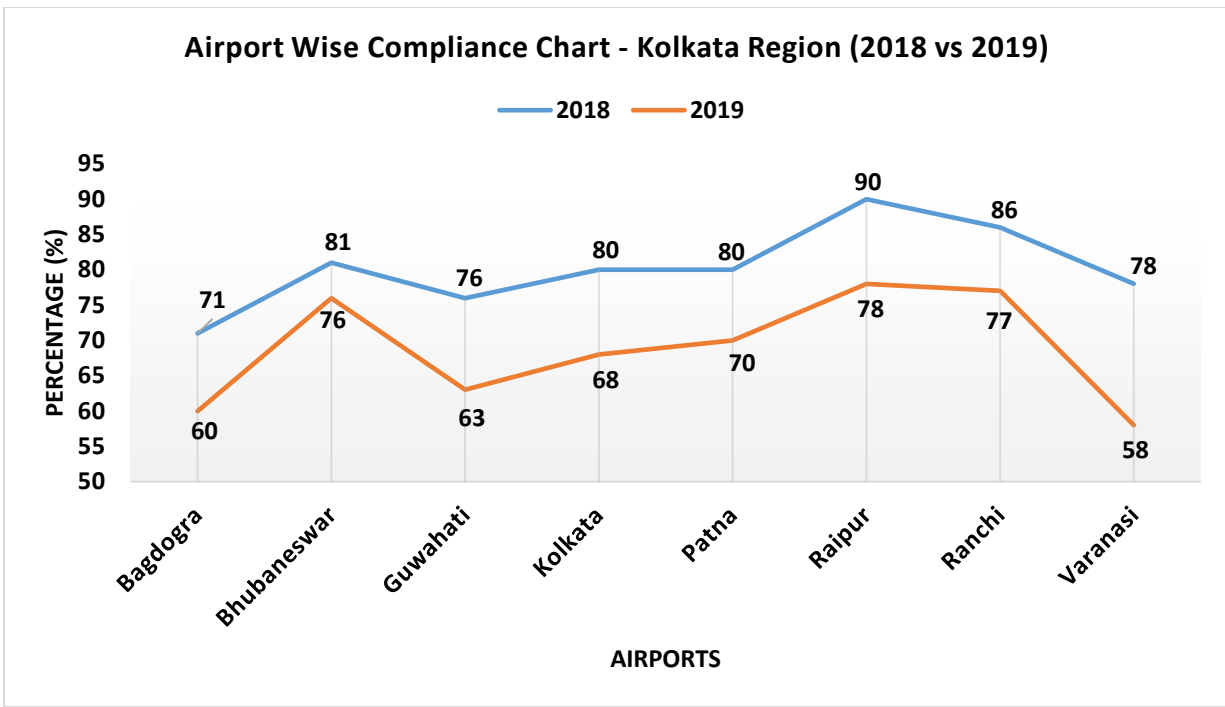


Figure 13: Airport Wise Compliance Chart - Chennai Region



**Figure 14: Airport Wise Compliance Chart - Kolkata Region**

### 3.6 Inference

1. Out of the total domestic arrivals with complete data in ATFM scenario, 62% flights are compliant in 2019 as compared to 74% in 2018. (Figure-6)
2. Only Indigo Airlines is having a compliance rate of more than average recorded 62% compliance. (Figure-9)
3. Within the Indian FIRs, Mumbai region is having highest compliance rate of 68% whereas Delhi region is the lowest with compliance rate of 52%. (Figure-10)
4. On an average almost 11% of flights are departing ahead of the CTOT compliance window whereas 27% are departing after the tolerance window.(Figure-7)
5. In Mumbai Region, all Airport's compliance rate has gone down in year 2019 as compared to 2018 except Jabalpur.(Figure-11)
6. In Delhi and Kolkata Region, all Airport's compliance rate has gone down in the year 2019 as compared to 2018.(Figure-12 and Figure -14 )
7. In Chennai Region, all Airport's compliance rate has gone down in year 2019 as compared to 2018 except Mangalore.(Figure-13)

## C. Airport wise Analysis

### 1. Delhi Airport

#### 1.1 Traffic Trend

Delhi was the busiest Airport in India with total annual movement reduced to 4,71,278 in 2019 as compared to 4,86,563 in 2018. The year 2019 recorded a maximum of 1402 average ATMs per day in the month of November while in 2018 the maximum of 1357 average ATMs per day was observed in the month of October.

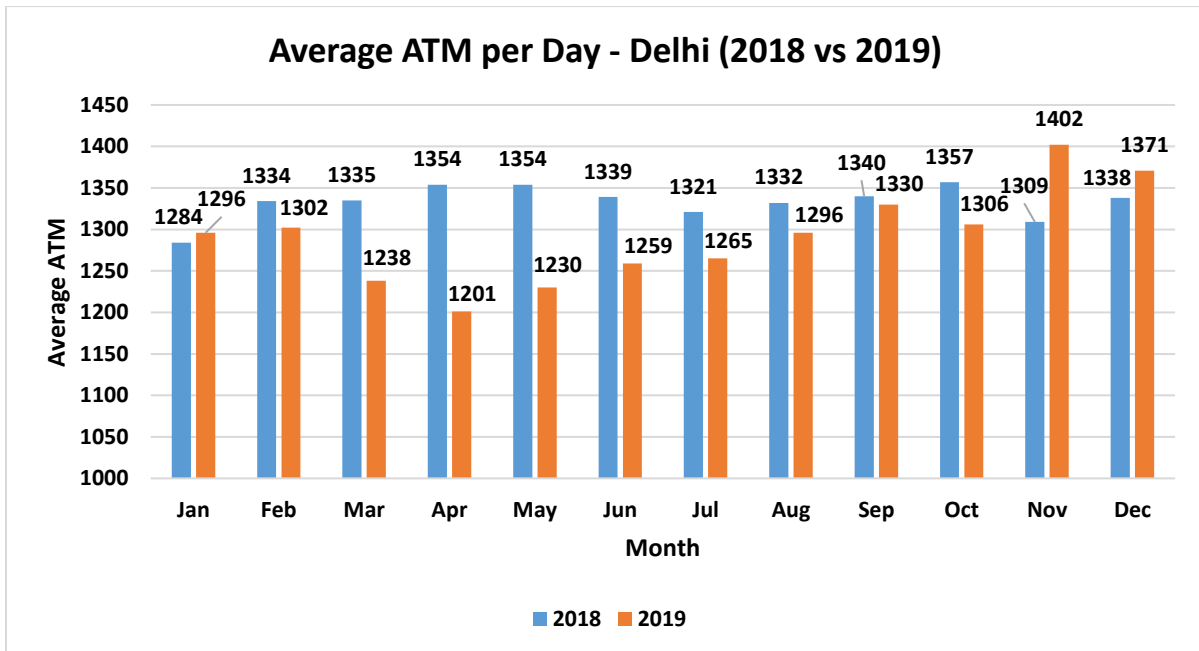


Figure 15: Average ATM per Day(Delhi)

#### 1.2 Details of ATFM Measures:

Number of ATFM measures applied due to constraint at Delhi : 20

Major reason for application of measures : Airspace closure

Average ATFM Ground delay due to measures at Delhi : 16 min

Maximum ATFM Ground delay due to measures at Delhi : 132 min

% Compliance for Delhi CDM : 58%

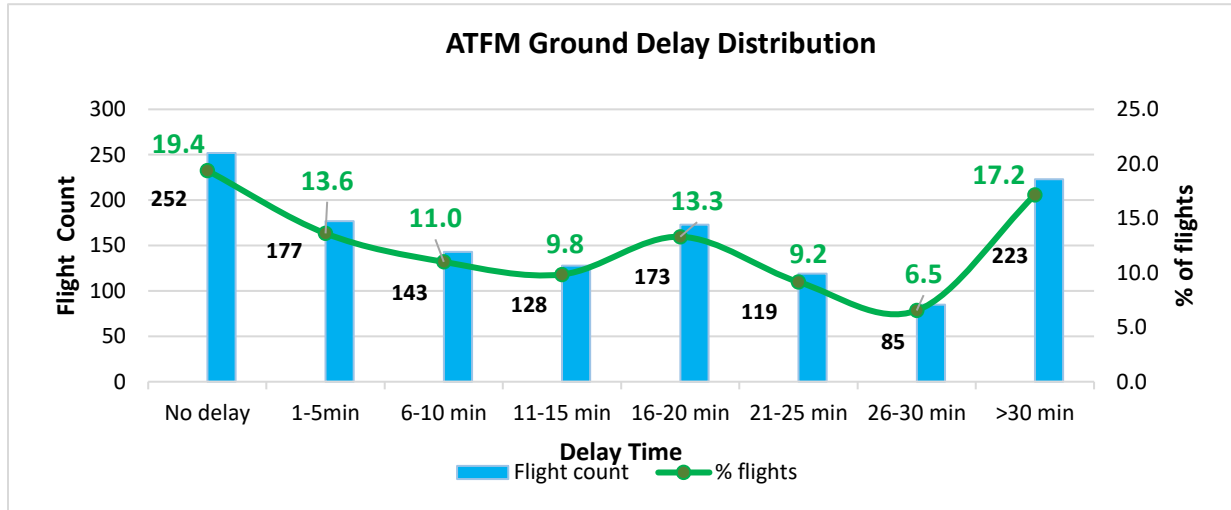


Figure 16: ATFM Ground Delay Distribution (Delhi Airport)

**Inference**

- 19.4% of flights for Delhi had no ATFM ground delay assigned by the system.
- 34.4% of flights for Delhi had an ATFM ground delay of up to 15 minutes.
- 29% of flights for Delhi had an ATFM ground delay in the range of 16 to 30 minutes.
- 17.2% of flights for Delhi had an ATFM ground delay of more than 30 minutes.

**1.3 Air Delay during the CDM Scenario period:**

**Average Air Delay to domestic arrivals\* within the CDM Scenario period for Delhi is 10 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
Delhi	Flt. Count	42	40	126	279	235	149	104	50	27	88
	% flight	4	4	11	24	21	13	9	4	2	8

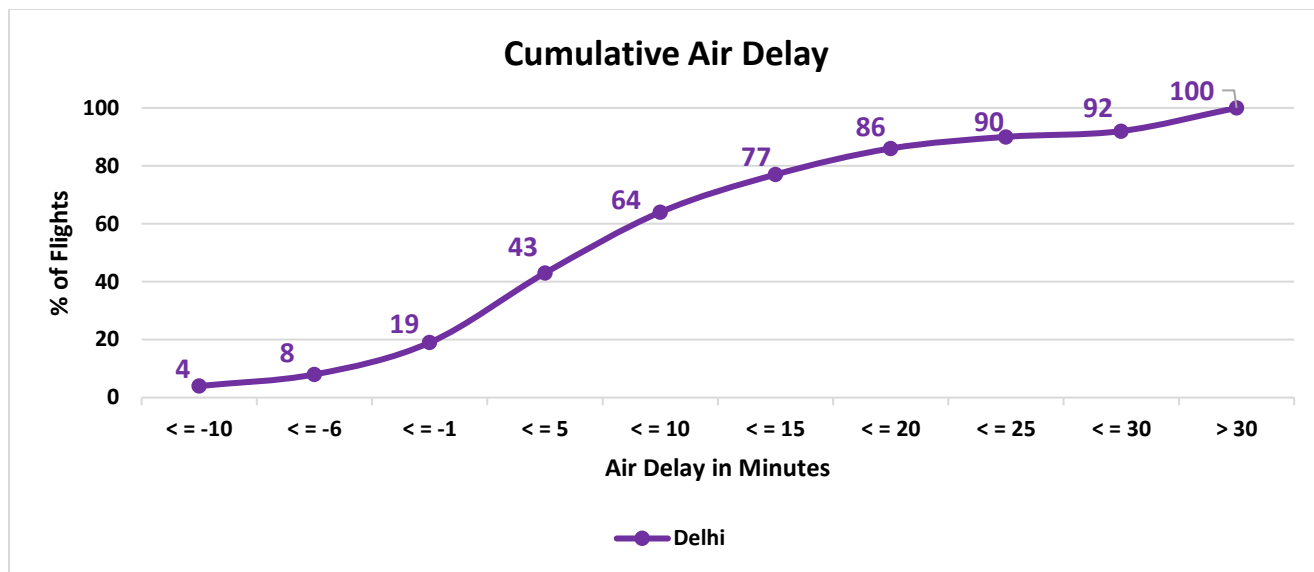


Figure 17: Cumulative Air Delay during CDM period(Delhi Airport)

**Inference**

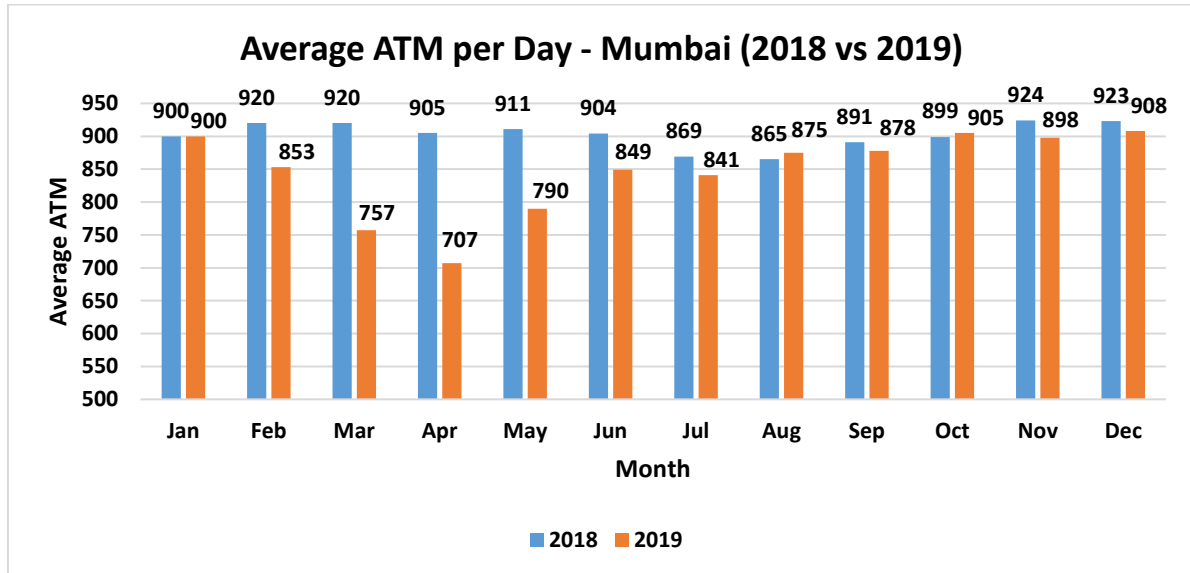
1. 77% of flights for Delhi had an Air delay of equal to or less than 15 minutes within the CDM period.



## 2. Mumbai Airport

### 2.1 Traffic Trend:

Mumbai was the 2<sup>nd</sup> busiest Airport in India with total annual movement reduced to 3,09,100 in 2019 as compared to 3,29,377 in 2018. The year 2019 recorded a maximum of 908 average ATMs per day in the month of December while in 2018 the maximum of 924 average ATMs per day was observed in the month of November.



**Figure 18: Average ATM per Day(Mumbai)**

### 2.2 Details of ATFM Measures:

Number of ATFM measures applied due to constraint at Mumbai : 117

Major reason for application of measures : Schedule Runway closure

Average ATFM Ground delay due to measures at Mumbai : 14 min

Maximum ATFM Ground delay due to measures at Mumbai : 150 min

% Compliance for Mumbai CDM : 62%

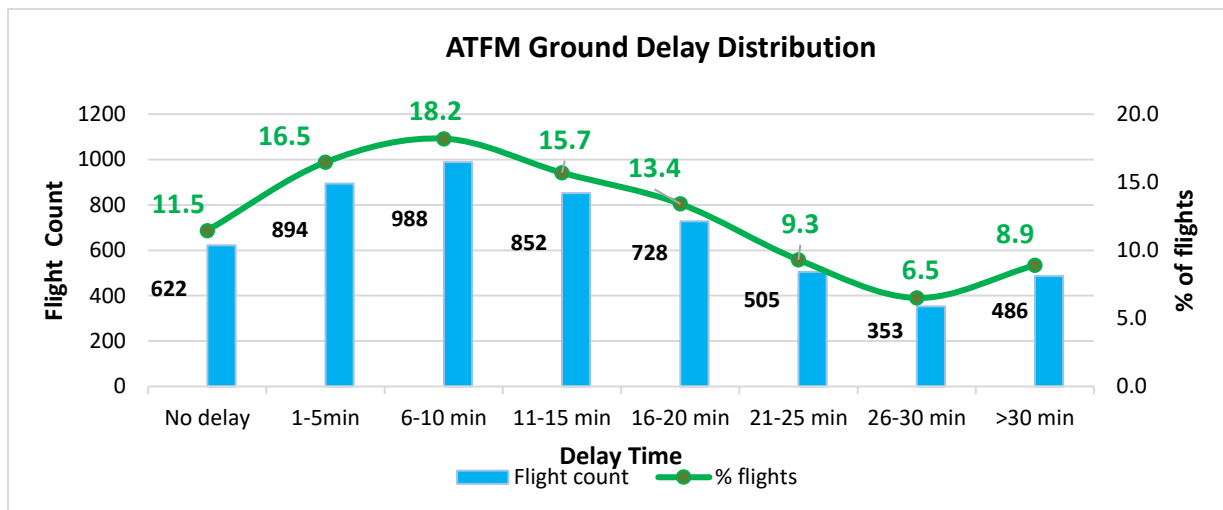


Figure 19: ATFM Ground Delay Distribution (Mumbai Airport)

**Inference**

- 5. 11.5% of flights for Mumbai had no ATFM ground delay assigned by the system.
- 6. 50.4% of flights for Mumbai had an ATFM ground delay of up to 15 minutes.
- 7. 29.2% of flights for Mumbai had an ATFM ground delay in the range of 16 to 30 minutes.
- 8. 8.9% of flights for Mumbai had an ATFM ground delay of more than 30 minutes.

**2.3 Air Delay during the CDM Scenario period:**

**Average Air Delay to domestic arrivals\* within the CDM Scenario period for Mumbai is 10 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
Mumbai	Flt. Count	153	178	469	1030	941	792	610	395	213	246
	% flight	3	4	9	20	19	16	12	8	4	5

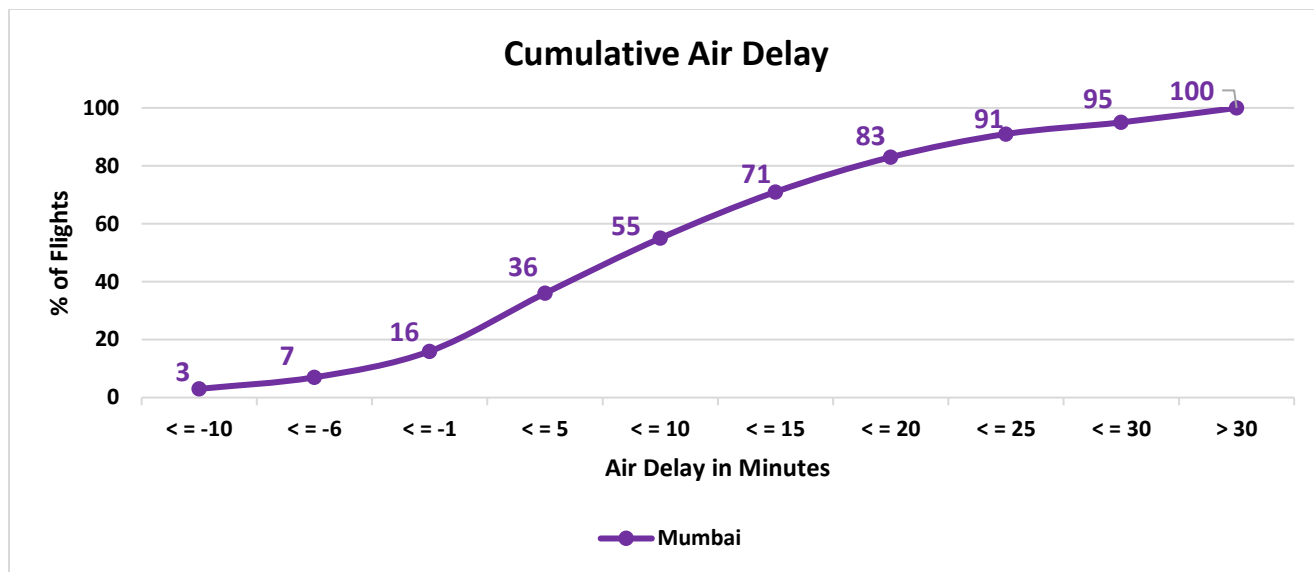


Figure 20: Cumulative Air Delay during CDM period(Mumbai Airport)

**Inference**

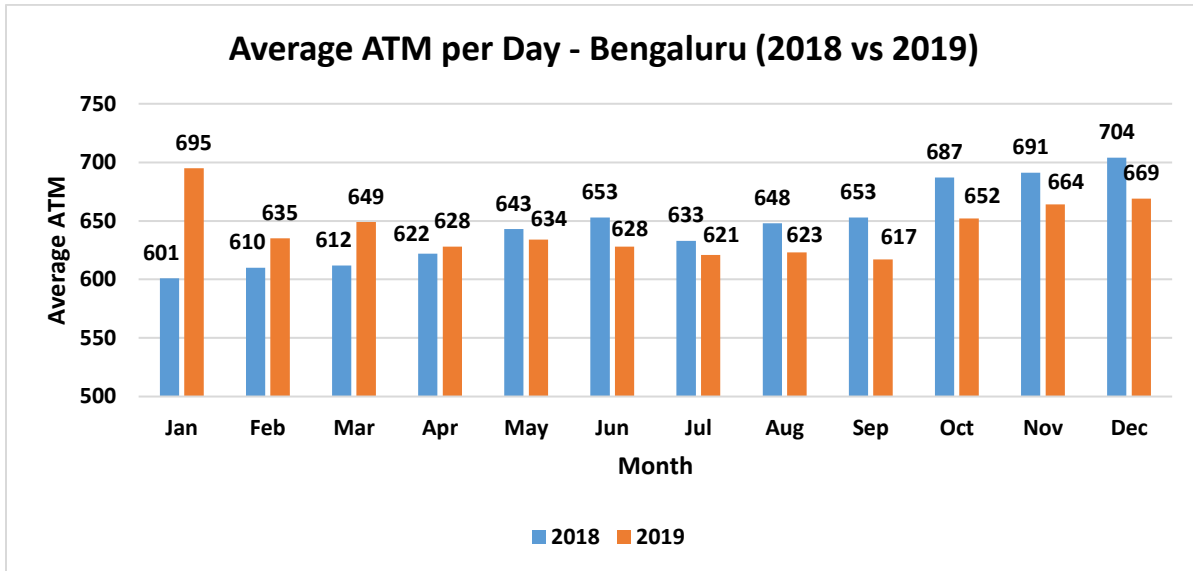
- 2. 71% of flights for Mumbai had an Air delay of equal to or less than 15 minutes within the CDM period.



### 3. Bengaluru Airport

#### 3.1 Traffic Trend :

Bengaluru recorded a total annual movement of 2,36,018 in 2019 as compared to 2,34,723 in 2018. The year 2019 recorded a maximum of 695 average ATMs per day in the month of January while in 2018 the maximum of 704 average ATMs per day was observed in the month of December.



**Figure 21: Average ATM per Day(Bengaluru)**

#### 3.2 Details of ATFM Measures:

- Number of ATFM measures applied due to constraint at Bengaluru : 39
- Major reason for application of measures : Schedule Runway closure
- Average ATFM Ground delay due to measures at Bengaluru : 10 min
- Maximum ATFM Ground delay due to measures at Bengaluru : 44 min
- % Compliance for Bengaluru CDM : 69%

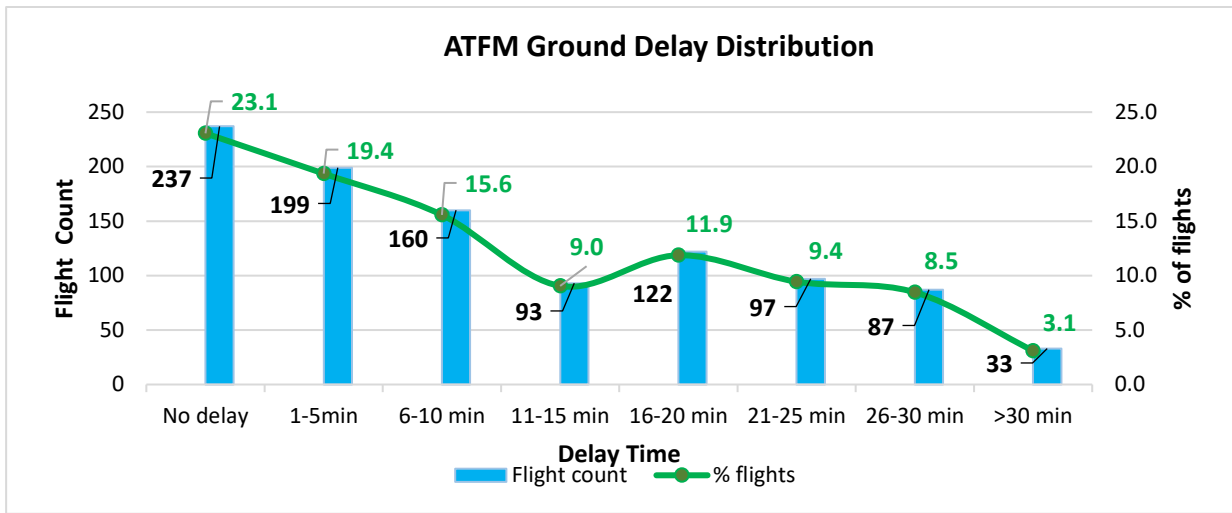


Figure 22: ATFM Ground Delay Distribution (Bengaluru Airport)

**Inference**

1. 23.1% of flights for Bengaluru had no ATFM ground delay assigned by the system.
2. 44% of flights for Bengaluru had a ATFM ground delay of up to 15 minutes.
3. 29.8% of flights for Bengaluru had an ATFM ground delay in the range of 16 to 30 minutes.
4. 3.1% of flights for Bengaluru had an ATFM ground delay of more than 30 minutes.

**3.3 Air Delay during the CDM Scenario period:**

**Average Air Delay to domestic arrivals\* within the CDM Scenario period for Bengaluru is 5 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	60	48	171	291	136	96	60	30	16	4
	% flight	7	5	19	32	15	11	7	3	1	0

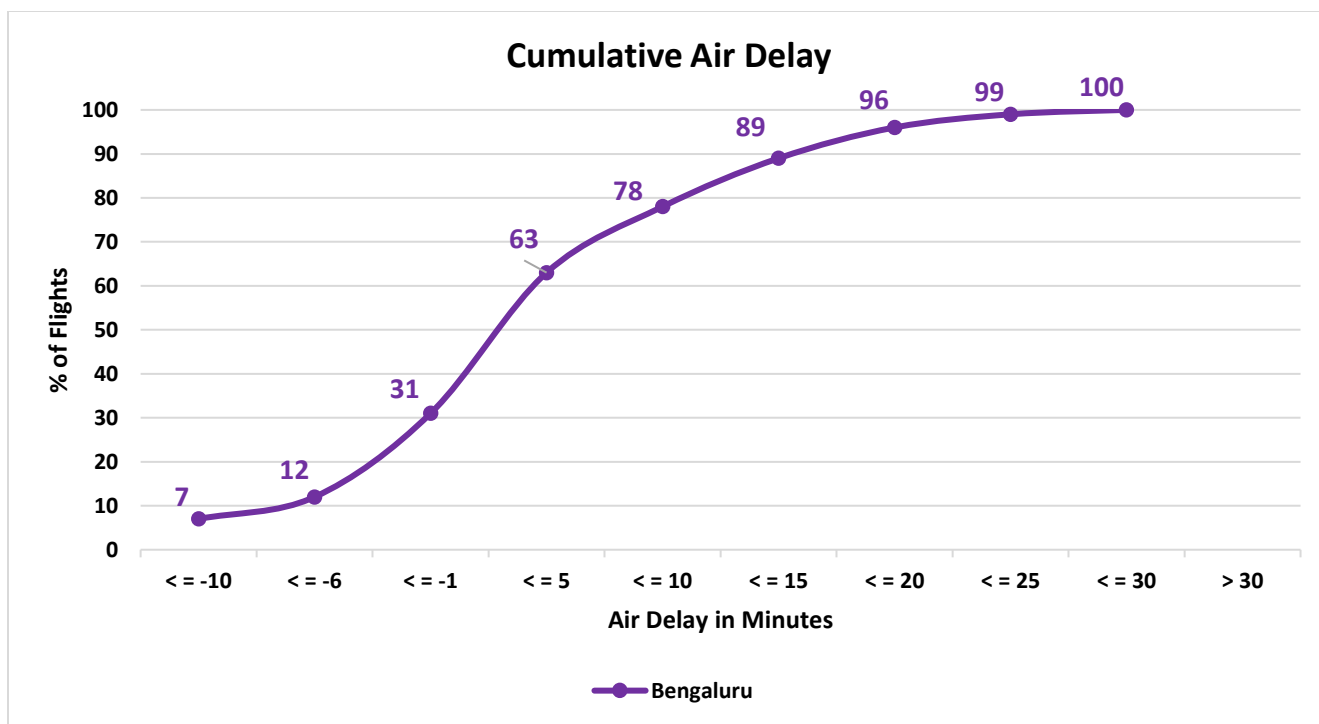


Figure 23: Cumulative Air Delay during CDM period(Bengaluru Airport)

**Inference**

1. 89% of flights for Bengaluru had an Air delay of equal to or less than 15 minutes within the CDM period.



## 4. Kolkata Airport

### 4.1 Traffic Trend :

Total annual Air Traffic Movement in Kolkata has increased to 1,68,624 in 2019 as compared to 1,61,522 in 2018. The year 2019 recorded a maximum of 504 average ATMs per day in the month of November while in 2018 the maximum of 465 average ATMs per day was observed in the same month.

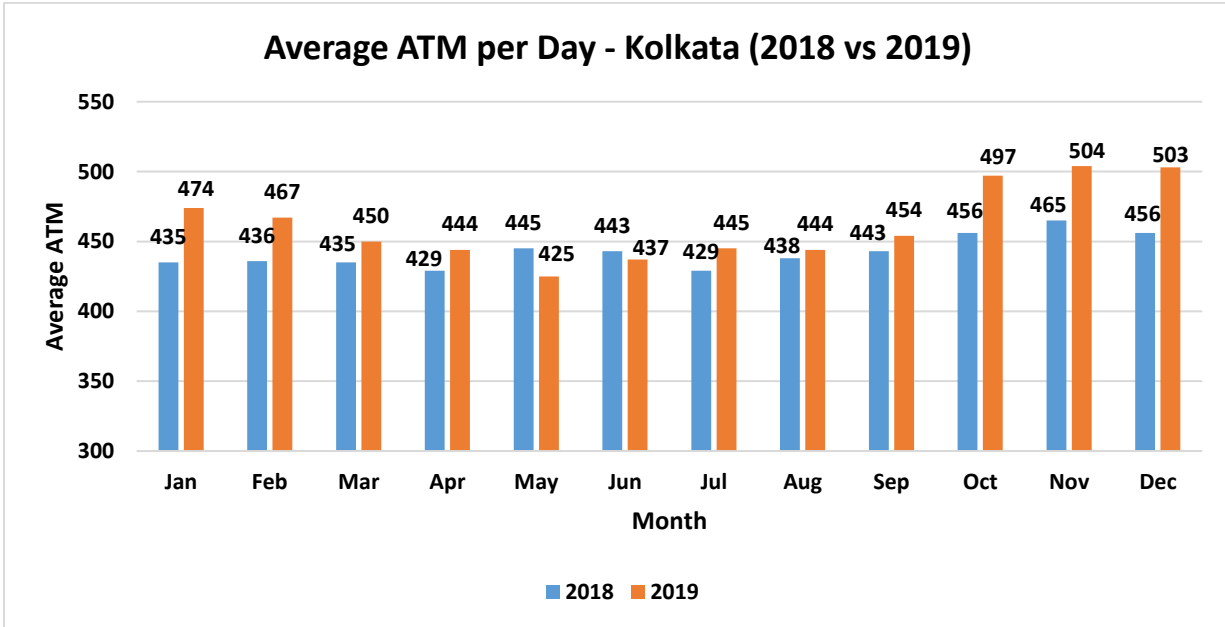


Figure 24: Average ATM per Day(Kolkata)

### 4.2 Details of ATFM Measures:

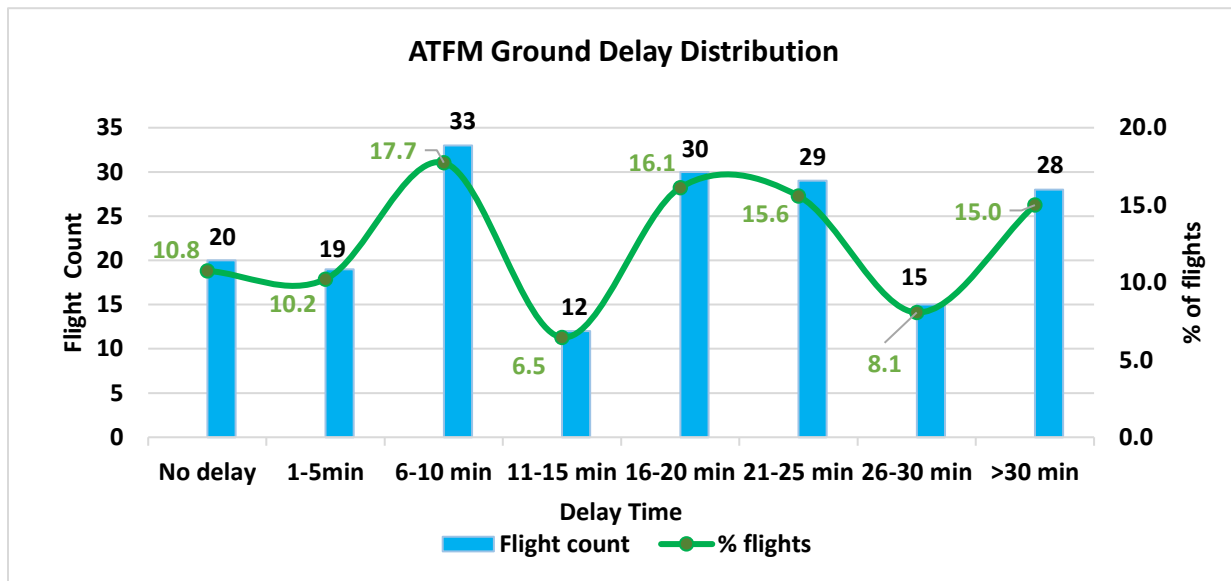
Number of ATFM measures applied due to constraint at Kolkata : 7

Major reason for application of measures : Schedule Taxiway closure

Average ATFM Ground delay due to measures at Kolkata : 16 min

Maximum ATFM Ground delay due to measures at Kolkata : 45 min

% Compliance for Kolkata CDM : 63%



**Figure 25: ATFM Ground Delay Distribution (Kolkata Airport)**

**Inference**

1. 10.8% of flights for Kolkata had no ATFM ground delay assigned by the system.
2. 34.4% of flights for Kolkata had an ATFM ground delay of up to 15 minutes.
3. 39.8% of flights for Kolkata had an ATFM ground delay in the range of 16 to 30 minutes.
4. 15% of flights for Kolkata had an ATFM ground delay of more than 30 minutes.

**4.3 Air Delay during the CDM Scenario period:**

**Average Air Delay to domestic arrivals\* within the CDM Scenario period for Kolkata is 4 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
Kolkata	Flt. Count	9	15	27	69	27	14	7	2	2	1
	% flight	5	9	16	40	16	8	4	1	1	0

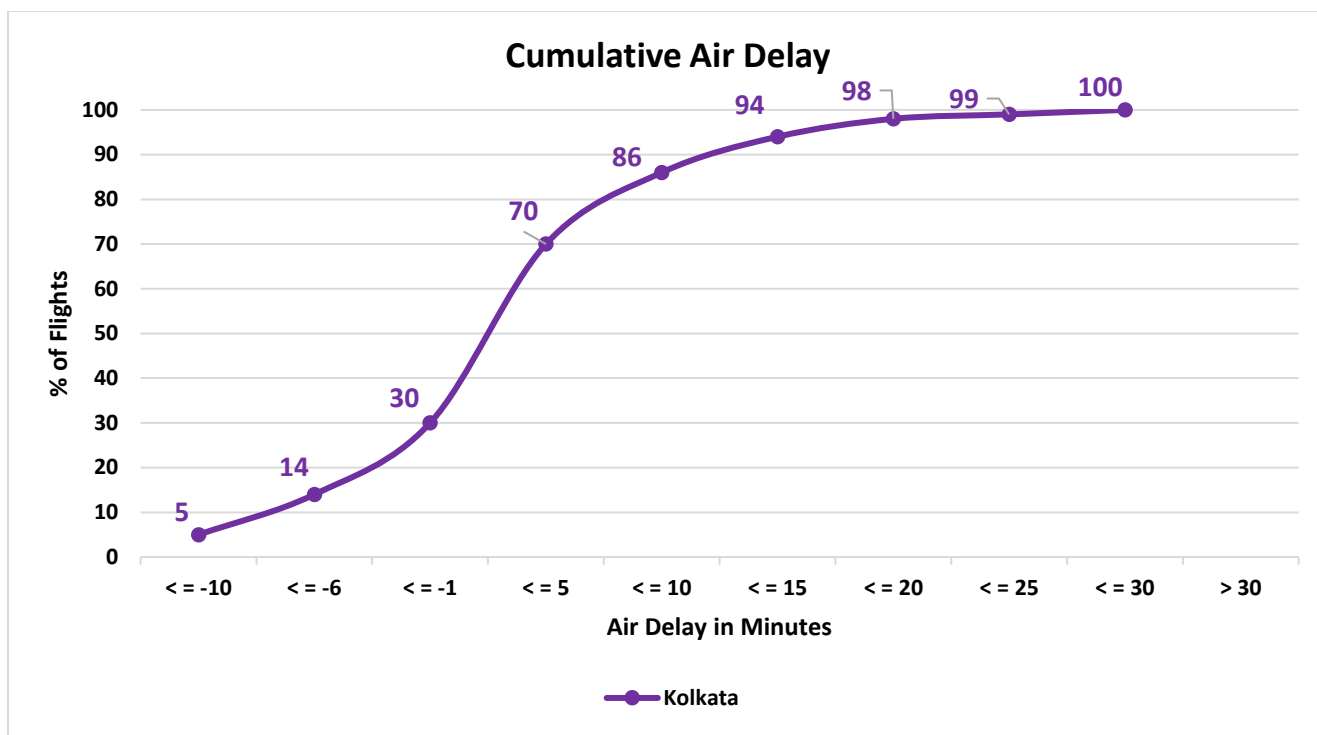


Figure 26: Cumulative Air Delay (Kolkata Airport)

**Inference**

1. 94% of flights for Kolkata had an Air delay of equal to or less than 15 minutes.



## D. Challenges

### 1. System related issues

1. "Watch Hours" of all the Airports is entered in the system. However, the system does not consider these watch hours while issuing CTOTs and issues CTOTs beyond the watch hours of the Airport.
2. "Partial Update" feature of updating the demand in tactical environment leads to large delays to a new FPL or any "CHG" message received for any FPL (irrespective of the change , e.g. an aircraft type, route, EOBT change etc. is likely to affect the profile of the aircraft, whereas a change in navigation capability, squawk change does not have any influence on the profile)
3. SKYFLOW is configured to capture the first "Dep" message received. In cases when multiple "Dep" messages are received, the system continues to depict the wrong ATOT (issue already raised to ATECH).
4. After using "APPLY" feature to a CDM scenario, Delay messages (DLA) are being sent by SKYFLOW system resulting in revision of EOBT of the delayed flight in ATS automation system .This is incorrect, as the initiation of a DLA message is the prerogative of the originator. The issue is already taken up with ATECH.
5. The system does not have any feature to put independently Airport Arrival rate (AAR) and Airport Departure rate (ADR) to regulate the demand against the practiced capacity.
6. The Arrival message for Delhi Arrivals isn't interpreted correctly by SKYFLOW because of format inconsistency, resulting in large error queues. This leads to inaccurate demand in the tactical environment for Delhi.
7. System functionalities are limited to balancing demand against capacity of an individual Aerodrome. **In case of two constrained Airports with overlapping timings, the SKYFLOW system Algorithm may not be able to give an acceptable solution. (refer ATECH e-mail dated 28<sup>th</sup> April, 2017).**
8. Once the CDM is applied , the system does not update the CDM Scenario. Lack of dynamic update presents stale demand information through the CDM.



## 2. Operational Issues

1. The present means of communicating the application of ATFM measures is through instant messaging followed by an email addressed to all stations. This has proved to be an inefficient means of information broadcast as many stations are unaware of the measures till CTOTs are actually passed to them from the main FMP units. Many stations are not manning the FMP position.
2. The existing means of CTOT dissemination by FMPs to different ATS units and ATCs within their jurisdiction leads to delays in timely dissemination of CTOTs for ensuring compliance. The Airline operators are also falling short in their responsibility of sharing the CTOTs received with their Air crew.
3. FMPs installed at Defense and few satellite Airports have been trained on ATFM “SKYFLOW” but still have CTOT accessibility issues. Information sharing regarding commencement of ATFM measures and ADP is still an issue with these stations.
4. A lead in time of at least 3 hours is required for preparation of CDM, in order to disseminate CTOTs at least 2 hours prior to EOBT. Airports with flying time of more than 2 and half hours face the difficulty in dissemination of the CTOT information to Airlines in time for CTOT compliance. This leads to non-compliance of CTOT timings, as with passengers on board the flights, it becomes difficult for Airlines to comply with the CTOT restriction.
5. The RPLs received from Airlines on fortnightly basis does help CCC in strategic decision making. Very few domestic airlines share their “No ops” information or send an associated AFTN CNL or CHG message. As SKYFLOW utilizes, RPL for Demand projection, absence of correct information leads to wrong demand prediction.  
In some cases, the EOBT shared in RPLs with CCC and FPL filed on the ‘D’ day does not match leading to long error queues. These FPLs with different EOBT get stuck in error queues because of a duplicate plan already available in the system.  
Such flights have to be manually allocated a revised CTOT after application of ATFM measures or at times they take off without a valid CTOT.
6. The RPLs and FPLs in SKLYFLOW get annulled after 120 minutes of their EOBT in absence of timely origination of “DLA” messages by airlines, This leads to display of wrong demand in the System, specially any CDM prepared for post disruption period will reflect wrong demand until and unless the Airlines amend their flight intentions by generating appropriate AFTN message addressed to VIDPCTFM.
7. SKYFLOW system is not receiving DEP messages from many domestic and international Airports. In such cases, the demand update is not correctly reflected for a constrained Airport.
8. At times, additional tactical flow measures are applied by ATC of constrained Airport during the period when ATFM measures are in force. leading to confusion and conflicting instructions for Airline operators. Tactical flow measures initiated by constrained Airport cannot be incorporated in the SKYFLOW system which causes wrong representation of demand in the system.





9. Requests for revised CTOT has increased but the airlines are still not updating their flight intent in SKYFLOW by originating an appropriate AFTN message addressed to VIDPCTFM. Genuine requests for revision of slot allocation are handled manually by CCC as there is no provision of revision of CTOT in SKYFLOW system after the use of " APPLY " feature. This leads to over delivery of flights to a constrained Airport during such hours. The slots vacated cannot be assigned to others through the system. This leads to under delivery during that period. SKYFLOW system does not have facility of dynamic CTOT allocations. (refer ATECH e-mail dated 28th July, 2017) [This procedure sometime leads to over or under delivery of flights to the constrained airport, as revised CTOTs and vacant slots cannot be assigned through SKYFLOW system.]
10. Due to lack of understanding at many Airports, flights following ATFM Ground delay for a constrained Airport are held on ground and made to depart within their CTOT tolerance window whereas flights which are actually planned to operate after the ATFM Scenario period to the same constrained Airport are not restricted at all.
11. Many operators, mostly non-scheduled operators and Military flights, are not filing their FPLs three (03) hours prior to their EOBTs leading to wrong demand prediction.
12. The flights given exemption (accommodated in the CDM with no delay) on operational grounds are at times not following the allotted CTOT (which is same as filed EOBT plus default taxi time). It is essential for all stakeholders to note that these exempted flights are accorded priority over others but even these flights need to adhere to the issued CTOT, within the permissible tolerance window of minus 5 to plus 10 minutes.
13. Increasing number of exemption requests on various reasons like VIPs on board, watch hour restrictions, Sunset restrictions , operational Constraints etc. leads to undue delays to other flights. This problem becomes grave when the constrained Airport has a grid lock lasting for more than an hour.
14. The CDMs prepared to cater to demand capacity imbalance towards the end of a day usually reflects wrong demand as the Flight intentions are not timely updated by Airlines in the SKYFLOW i.e. by originating appropriate ATS messages through AFTN.
15. CTOT compliant flights are not receiving any preference over non-compliant flights while arriving at constrained airport, therefore getting substantial ground as well as airborne delay.
16. **CDMs prepared to cater to post Weather disruption or post exigency period**, even with few hours prior notice might not capture actual scenario, as for a correct demand prediction updated information on delayed and diverted flights in the SKYFLOW system is essential. Airport operators are also unable to provide advance flight information due to uncertainty in such situation.

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## Annexure A- Flight Plan Analysis (1st Nov'19 to 31st Dec'19)

### 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 November and December'19, wherein flight plans were studied for the time they were received by the ATFM unit against their filed EOBT.

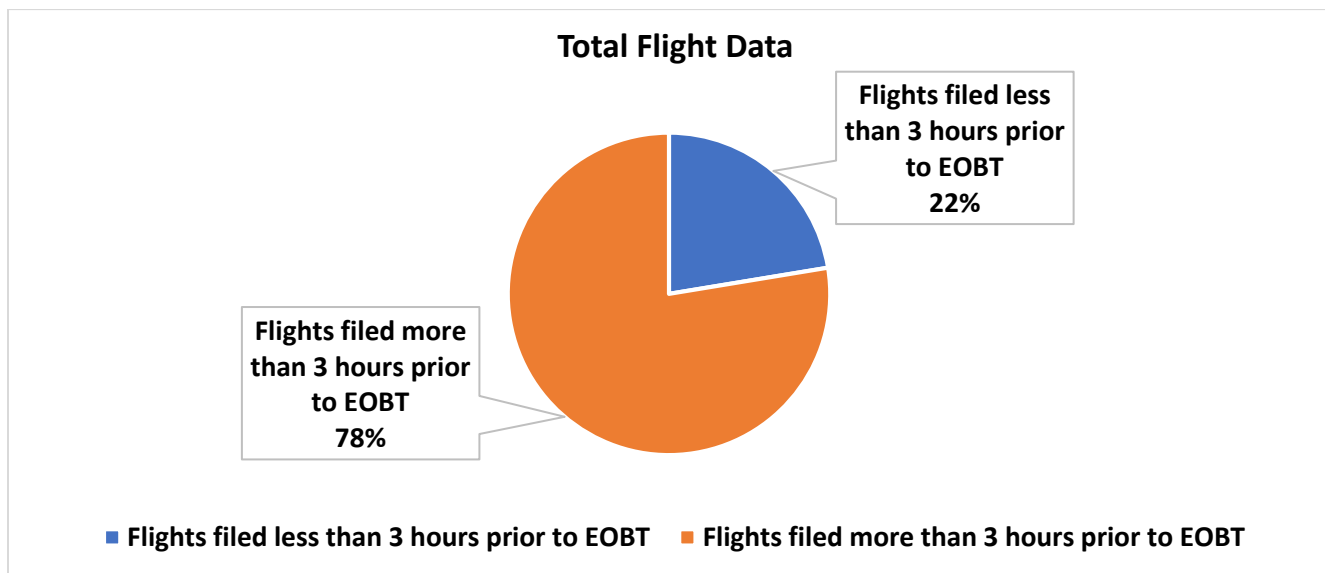
### II. Data Analysis

Total **206099** correct Flight plans were received by SKYFLOW system and analyzed

Following observations are made: -

#### 1. Total Flight Data for Entire Month (Including Domestic and International Flights)

Flight Plan Filing time	Number of Flights	Total Flights	Percentage
Flights Filed less than 1 hour prior to EOBT	6776	206099	3.3
Flights Filed less than 2 hours prior to EOBT	19741	206099	9.6
<b>Flights Filed less than 3 hours prior to EOBT</b>	<b>46170</b>	206099	<b>22.4</b>
Flights Filed more than 3 hours prior to EOBT	159929	206099	77.6



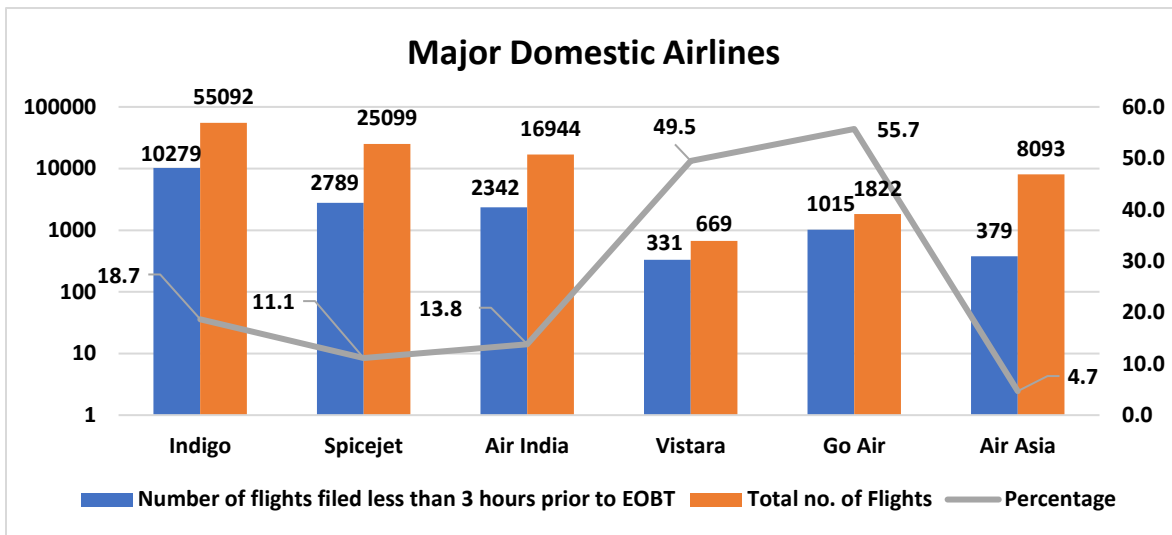
#### Inference

1. 3.3% of flight plans are filed as late as one hour prior to the EOBT.
2. 9.6% of flight plans are filed 2 hours prior to the EOBT.
3. 22.4% of Total Flights are filing Flight plans 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	10279	55092	18.66
Spicejet	2789	25099	11.11
Air India	2342	16944	13.82
Vistara	331	669	<b>49.48</b>
Go Air	1015	1822	<b>55.71</b>
Air Asia	379	8093	4.68



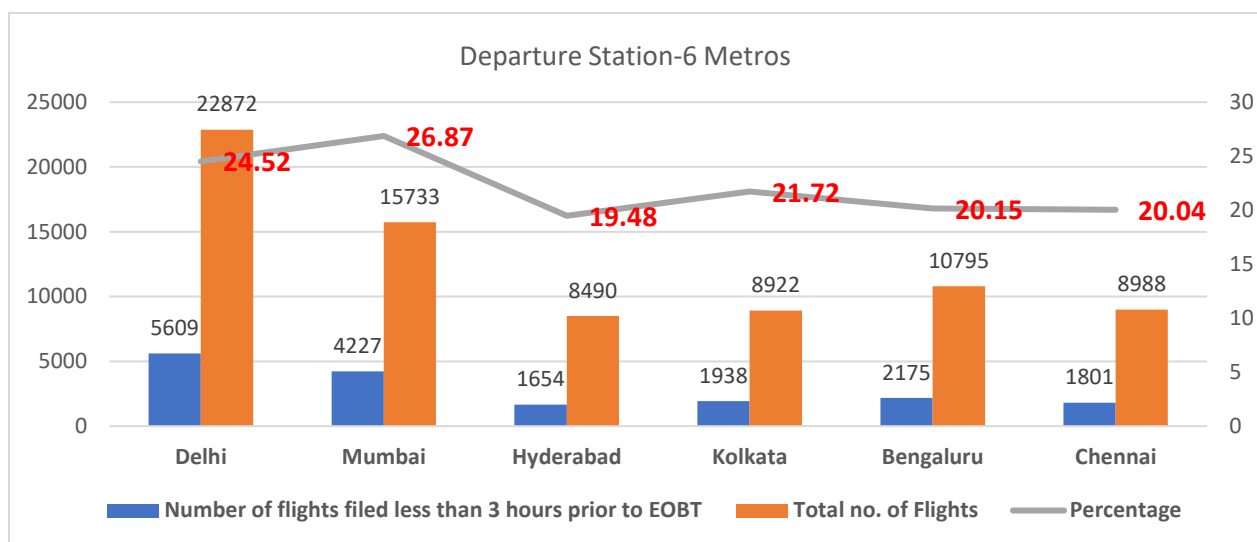
### Inference

- Go Air Airlines submitted around 55.7% of Flight Plans less than 3 hours prior to EOBT.
- Air Vistara submitted almost 49.5% of flight plans less than 3 hours prior to EOBT.  
These Airlines share fortnightly flight intent with CCC for most of their movements which is not analysed here.
- Indigo Airlines submitted around 18.7% whereas Spice jet filed 11.1% of Flight plans less than 3 hours prior to EOBT.
- Air Asia filed 4.7% of Flight Plans less than 3 hours prior to EOBT.



### 3. Departure Station Wise (6 Major Metro Airports)

Departure Station	Number of Flight Plans filed Less than 3 hours prior to EOBT	Total No. of filed Flight plans	Percentage
Delhi	5609	22872	24.52
Mumbai	4227	15733	26.87
Hyderabad	1654	8490	19.48
Kolkata	1938	8922	21.72
Bengaluru	2175	10795	20.15
Chennai	1801	8988	20.04



#### Inference

1. Around 25% of Departures from Delhi and 27% of Departures from Mumbai have submitted Flight plans less than 3 hours prior to EOBT.

### III. Conclusion:

As can be observed from the analysis, 22.4% 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.