



WORKING PAPER

ASSEMBLY — 39TH SESSION

TECHNICAL COMMISSION

Agenda Item 37: Other issues to be considered by the Technical Commission

TO DEFINE THE VALIDATION PARAMETER FOR DEPARTURE VARIABLE TAXI TIME (VTT) TO MEET THE REQUIREMENT OF MODERN AIRPORT INFRASTRUCTURE

(Presented by India)

EXECUTIVE SUMMARY

This working paper is prepared to analyse the traditional fixed VTT calculation method of Airport Collaborative Decision Making(ACDM) to propose dynamic VTT calculation method .This dynamic method will help in optimizing Airside infrastructure utilization & Slot availability.

Action: The Assembly is invited to:

- a) note the contents of this Paper; and
- b) consider mandating Dynamic VTT based on local factors to reduce the deviation from TTOT in Airports

<i>Strategic Objectives:</i>	This working paper relates to the Safety and Air Navigation Capacity and Efficiency Strategic Objectives.
<i>Financial implications:</i>	Not Applicable
<i>References:</i>	Doc 9971, <i>Manual on Collaborative Air Traffic Flow Management</i>

1. INTRODUCTION

1.1 With increase in global air traffic density and limitations of infrastructural upgrades, it is very important to develop new concepts and new technologies to cope up and effectively cater to the ever increasing global air traffic demands. ACDM is one of the critical tools for enhancing predictability and provides a better level of information exchange platform.

1.2 Most of the airports across the globe have been working on ACDM application to derive benefits by specifying the various events and values which if monitored in a synchronised manner can lead to dynamic capacity planning, improved passenger experience and on time performance. As a by-product, it also helps in reducing operating cost of airlines and deferment of capex for the airport operator.

1.3 Implementation of ACDM is becoming a necessity for aviation fraternity to meet the future air traffic demand.

1.4 Agencies throughout the world like Euro-control, Next-Gen, CNAS, CARATS are already working on ACDM. ICAO is also considering regulating ACDM through its documents like ICAO Doc 9971 and making it part of Aviation System Block Upgrades.

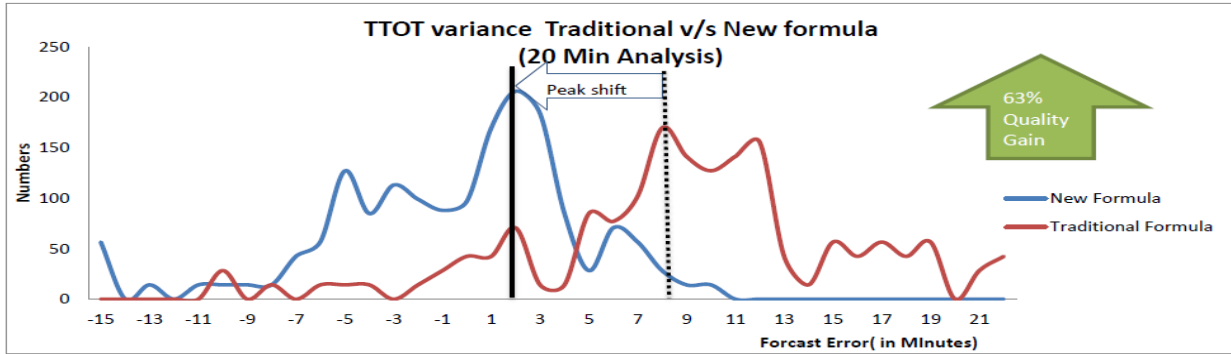
1.5 This paper focuses on further improving the predictability of TTOT and TSAT through effective VTT calculation considering individual airport layout. Some additional benefits which can be harnessed with deployment of this tool would be; creation of additional slots, reduction in fuel usage during ground which would eventually contribute towards “green initiative”.

2. SCOPE OF ENHANCEMENT

2.1 All existing ACDM models throughout the world are based on existing airport infrastructure since years. With development of new large aircrafts (Code F) and associated changes in airside as well as navigational infrastructure, there is a lot of scope of enhancement in calculation method of various ACDM values for departures like Target Off Block Time (TOBT), Target Take off time (TTOT) etc. Continuous improvisation of these values will result in improved capacity.

3. PROPOSAL

3.1 A hypothesis of improvement in airport capacity through calculation of various departure ACDM values based on aircraft runway length requirements for associated aircraft mix and consideration of intersection departures is proposed. Hypothesis considers runway length availability from each entry point and a method of sequential usage of runway entry points for departures. Benefits of these calculations are expected to be derived even in peak traffic on simple as well complex airside infrastructure, as represented graphically below:



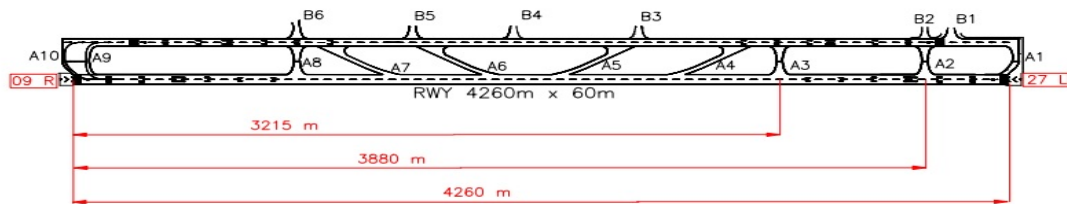
4. ASSUMPTIONS

4.1 Morden runways are constructed as per the requirements of most demanding aircraft, which gives ample opportunities to reduce VTT as per the Aircraft mix. Taking e.g. of Hyderabad airport of India:

DEPARTURE RUNWAY 27L

TAKE-OFF RUN AVAILABLE FROM DIFFERENT RUNWAY INTERSECTIONS

RUNWAY 27L			
ENTRY TAXIWAY	A1	A2	A3
TORA (M)	4260	3880	3215
ANGLE OF ENTRY TWY WITH THE RWY IN USE	90°	90°	90°
LENGTH OF TWY (M)	427	225	225



4.2 Comparison of various runway lengths of airports

Airport	Number of Runways	Length (meters)	Availability of Intersection points
FRA	07C/25C	4000	Yes
	07R/25L	4000	Yes
	07L/25R	2800	
	18	4000	
JFK	13R/31L	4423	Yes
	13L/31R	3048	Yes
	4R/22L	2560	
	4L/22R	3682	Yes
HYD	09R/27L	4260	Yes
BLR	09/27	4000	Yes

4.3 Mix of runway length requirement of various aircrafts as show in table below:

Aircraft	Aeroplane reference field length (in Meters)
AN225	3500
AN124	3000
A388	2674
B748	2871
B744	2971
A346	2821
A332	2070
B738	2070
A321	1989
A320	1971
AT72	1350
Q400	1170

4.4 Fleet mix traffic at Airport will also play an important role in Dynamic ACDM Calculations. Fleet mix for some of the Airport are given below:

Airport	Wide body A/Cs	Narrow body A/Cs
Delhi	14%	86%
Hyderabad	8%	92%
Bangalore	9%	91%
Mumbai	26%	74%
Chennai	12%	88%

5. **FACTORS TO BE CONSIDERED FOR DYNAMIC VTT :**

5.1 Variance calculation:

- a) Peak hours considerations
- b) Weather related coefficients
- c) Departure queue
- d) Arrival queue
- e) Runway Segment
- f) Fleet mix
- g) Local Factors

6. **ALGORITHM OF DYNAMIC VTT:**

6.1 $TTOT=TOBT+ VTT$; (Traditional TTOT calculation)

$T(r)= TOBT+ VTT(d)$ (New Proposed calculation)

Where $VTT (d)= VTT+R1*R1f+R2* R2f+ Sf*Sv+ Pf*Pv+Af*Av+Df*Dv$;

Legends : $T(r)$ = Revised TTOT; **$VTT(d)$ =Dynamic VTT**, $R1$ = Runway Entry Second point Deviation; $R1f$ = If Second entry; $R2$ = Runway Entry Second point Deviation ; $R2f$ = If Second entry; Sf = Seasonal Factor; Sv = Seasonal Variance; Pf =Pushback factor, Pv =pushback variance, Af =Arrival queue factor, Av = Arrival queue variance, Df =Departure Queue factor, Dv = Departure Queue variance

7. **BENEFITS OF APPLYING ALGORITHM**

- a) ACDM Airports are expected to add further capacity during their current peak.
- b) Reduction in ATF wastage
- c) Predictability of departure slots on runway will improve.
- d) Holding of aircrafts near runway will reduce.
- e) Will also help in creating additional slots and reduction in carbon footprints

— END —