International Civil Aviation Organization

Fourteenth Meeting of the Air Traffic Management Sub-Group (ATM/SG/14) of APANPIRG

Bangkok, Thailand, 3 – 7 August 2026

Agenda Item 6: ATM Coordination and Implementation

6.0: Reports on Relevant ATM Coordination and Ad Hoc Group Meetings

PROGRESS OF THE APAC DATA ANALYTICS GROUP

(Presented by Singapore, on behalf of Australia, China, Hong Kong China, India, Indonesia, Japan, Papua New Guinea, Philippines, Republic of Korea, Singapore, Sri Lanka, Thailand, United States and Viet Nam)

SUMMARY

This paper informs the ATM/SG of the progress made by the Data Analytics Group (DAG). To date, the DAG had commenced data sharing and analysis for 11 Key Performance Indicators (KPIs) under the Global Air Navigation Plan (GANP). In this third report, the DAG has progressed from a one-year to a two-year analysis, increased participation from States and improved data quality. A *Regional Data Management Guidance Document* has been developed to facilitate and govern data sharing within the DAG and is available as a reference for other groups within the region to adapt for their own data sharing use cases. Together, these developments demonstrate the region's growing capabilities in performance measurement and data analytics, underpinned by a strengthening foundation in data management, and its commitment to implement more advanced performance measures to have better insight on ATM performance to support management and operational decisions.

1. INTRODUCTION

1.1 The Global ATM Operational Concept (Doc 9854) envisaged a performance-based global air navigation system. Based on this, ICAO published the *Manual on Air Traffic Management System Requirements* (Doc 9882) and the *Manual on Global Performance of the Air Navigation System* (Doc 9883). To complement the guidance in Doc 9883 on performance-based approach (PBA) to ATM, the *Global Air Navigation Plan* (GANP, Doc 9750) included a segment on key performance indicators (KPIs). These were developed for consideration by States to facilitate the PBA.

1.2 Using PBA in the prioritisation and implementation of ATM initiatives provides States/Administrations a data-driven and scientific approach to achieve their performance objectives. To advance the adoption of PBA in the Asia and Pacific (APAC) region, the Regional ATM Performance Measurement Framework Small Working Group (RAPMF/SWG) was established at the Third Meeting of the ATM Sub-group (ATM/SG/3) in 2015 to develop the APAC Air Traffic Management Performance Measurement Framework (ATM/PMF). In 2019, the Thirtieth Meeting of the Asia/Pacific Air Navigation Planning and Implementation Regional Group (APANPIRG/30) endorsed the ATM/PMF. The ATM/PMF provides the stages of implementation for KPIs identified under the KPAs in the GANP and prescribes a step-by-step PBA to ensure that the region will develop data and performance management capabilities in a harmonised manner.

1.3 The Data Analytics Group (DAG) was officially formed at ATM/SG/11 to continue building on this foundation to expand harmonised reporting across the region that each State can contribute according to their own capabilities. The DAG had since convened eight times through five online and three physical meetings, to agree on key matters to kickstart performance benchmarking and improve ATM performance in the region.

2. DISCUSSION

Comprehensive Year-on-Year Performance Review of 11 KPIs

2.1 Building on the analysis of performance data for year 2024 conducted in 2025, DAG members have expanded the analysis to include full-year data for 2024 and 2025, enabling a year-on-year comparison of performance. The comprehensive performance review is provided in **Appendix A**.

2.2 The analysis focused on 11 Key Performance Indicators (KPIs), aligned up to Stage 2 of the APANPIRG-endorsed ATM/PMF, as listed in **Table 1**. A comprehensive data collection guide detailing definitions and calculation methodologies for each KPI is provided in **Appendix B** to ensure consistency and reproducibility across member States.

Table 1. 11 KPIs reported by DAG

KPA	KPI	Variant	GANP KPI Code	ATM/PMF KPIs
Capacity	Airport peak capacity	Departure	KPI09-D	Stage 1
		Arrival	KPI09-A	Stage 1
Capacity	Airport peak throughput	Departure	KPI10-1D	Stage 1
		Arrival	KPI10-1A	Stage 1
Capacity	Airport throughput efficiency	Departure	KPI11-D	Stage 2
		Arrival	KPI11-A	Stage 2
Efficiency	Additional taxi-out time	Advanced	KPI02-2	Stage 1
Efficiency	Additional taxi-in time	Advanced	KPI13-2	Stage 1
Efficiency	Additional time in terminal airspace	Basic, Advanced; 40NM, 100NM	KPI08	Stage 2
Predictability	Departure punctuality	± 15 mins	KPI01-2A	Stage 1
Predictability	Arrival punctuality	± 15 mins	KPI14-2A	Stage 1

2.3 For States/Administrations with multiple airports, the analysis only included major airports based on traffic volume. This approach improves understanding of performance trends and reduces distortions arising from low-traffic variability. The participating airports in this exercise are presented in **Table 2**.

Table 2. Participating Airports in the Data Analysis Exercise

State/Administrations	Participating Aerodromes
Australia	Brisbane Airport (**YBBN**) Melbourne Airport (**YMML**) Perth Airport (**YPPH**) Sydney Kingsford Smith Airport (**YSSY**)
China	Guangzhou Baiyun International Airport (**ZGGG**) Shanghai Pudong International Airport (**ZSPD**)
Hong Kong China	Hong Kong International Airport (**VHHH**)
Indonesia	Jakarta Soekarno–Hatta International Airport (**WIII**) Ngurah Rai International Airport (**WADD**)
Japan	Haneda Airport (**RJTT**)
Philippines	Ninoy Aquino International Airport (**RPLL**)
Singapore	Singapore Changi Airport (**WSSS**)
Thailand	Bangkok Suvarnabhumi International Airport (**VTBS**)
United States	New York JFK Airport (**KJFK**) Chicago O'Hare International Airport (**KORD**) Dallas Fort Worth International Airport (**KDFW**) Houston George Bush Intercontinental Airport (**KIAH**) San Francisco International Airport (**KSFO**) Los Angeles International Airport (**KLAX**)
Viet Nam	Noi Bai International Airport (**VVNB**) Tan Son Nhat International Airport (**VVTS**)

2.4 The analysis revealed notable regional patterns and interdependencies across the reported KPIs. Most airports continued to operate below declared capacity while maintaining high throughput efficiency, suggesting that prevailing demand was generally accommodated and that operations were largely demand-limited. Departure punctuality consistently exceeded arrival punctuality, reflecting the greater control that airports and airlines have over departure processes, compared with arrivals which are more susceptible to upstream variability. Additional taxi-out times also remained generally longer than additional taxi-in times across airports, possibly linked to common practices in runway sequencing and departure queue management.

2.5 Year-on-year, the comparison showed improvements in departure punctuality, while arrival punctuality and additional taxi-time indicators showed mixed trends across airports. Additional time in terminal airspace increased across most airports, suggesting greater inefficiencies in arrival flow management that warrant further monitoring.

2.6 The performance review of the 11 KPIs highlighted the need to interpret reported outcomes within the operational context of each airport to derive meaningful insights. Factors such as traffic level and composition, runway configuration, gate layout, and airspace design and procedures may affect KPI outcomes, as well as the practical applicability and comparability of different KPI variants across operating environments. The DAG will continue to study additional data that may be required for more accurate performance assessment and interpretation of reported KPI outcomes, along with the challenges States may face in measuring the KPIs or in utilizing them to support operational decision-making, with a view to informing future KPI review.

2.7 A common set of foundational operational data remains essential to support performance measurement across the region. In particular, **the collection of six key operational timestamps – (1) scheduled time of departure, (2) actual off-block time, (3) actual take-off time, (4) actual landing time, (5) actual in-block time, and (6) scheduled time of arrival – would enable States to measure the eight Stage 1 KPIs in the APANPIRG-endorsed ATM/PMF**. The DAG therefore encourages States that have not already done so to begin collecting these timestamps as an initial step towards measuring and tracking the eight KPIs over time.

Next Steps

2.8 To further advance data analysis and performance management among the region, the DAG intends to expand the data collection scope to include two additional GANP KPIs:

a) KPI03 – ATFM Slot Adherence; and

b) KPI12 – Airport/Terminal ATFM Delay.

2.9 These two additional KPIs were selected to broaden performance measurement to cover ATFM operations. KPI03 (ATFM Slot Adherence) provides an indicator of an airport's capability to contribute to ATFM effectiveness by delivering outbound traffic in a predictable manner in compliance with ATFM slots. KPI12 (Airport/Terminal ATFM Delay) provides an indicator of additional delay generated by flow restrictions established to protect destination airports against demand-capacity imbalances. Together, these indicators provide network awareness for the region as ATFM effectiveness depends on the coordination of ANSPs across different airports. These indicators align with Stage 3 of the ATM/PMF endorsed by APANPIRG and represent progress of expanding the basket of KPIs for analysis.

2.10 At the ATFM & A-CDM/SG/16 in April 2026, it was reported that the participating ANSPs of the Asia-Pacific Cross-Border Multi-Nodal ATFM Collaboration (AMNAC) will trial a standardised set of KPIs and methodologies for ATFM post-operations analysis reporting, with results to be shared at the next two AMNAC meetings. To ensure alignment within the region, the DAG will defer the measurement of KPI03 and KPI12 until AMNAC completes the trial and agrees on a standardised set of KPIs and methodologies. In the interim, the definitions and calculation methodologies for KPI03 and KPI12 have been incorporated into the data collection guide in **Appendix B**.

2.11 The expansion of performance measurement capabilities is a critical step towards establishing a harmonised framework for performance evaluation to enable States to benchmark against their own historical performance and contribute to a broader understanding of regional trends and opportunities for improvement. The DAG will continue to adopt a phased and inclusive approach, considering the varying data capabilities and operational contexts of participating States.

Complementary Workstreams at APAC ANSP Committee (AAC)

2.12 Following AAC/4's decision, two projects that complement the work of the DAG were approved and initiated. The first is the development of a *Regional Data Management Guidance Document* to govern the acquisition, storage, and use of operational and performance data across member States, in anticipation of the growing number of regional projects requiring data contribution across member States. The second is a gate-to-gate efficiency study measuring flight performance across each segment of identified city-pairs, to identify performance gaps and propose mitigation measures to enhance regional performance.

2.13 The DAG has since developed a *Regional Data Management Guidance Document* based on a survey of current data sharing use cases and challenges conducted by the AAC. The *Regional Data Management Guidance Document* can be found in **Appendix C** and comprises three key pillars as listed below. While developed primarily for data sharing within the DAG, other groups within APAC are encouraged to adapt the Guidance Document for their own data sharing use cases.

a) **Align with Existing Policy and Legal Requirements:** Data management principles set out within the Guidance Document builds upon existing policy and legal foundations and function as a complementary extension guide to data management.

b) **Good Data Management Principles:** Prescribes data management principles across the data lifecycle and good data practices for different data roles and responsibilities for cross-border data sharing use cases.

c) **Recommended Interoperability Measures:** Recommended common data standards and formats, along with best practices to ensure data quality.

2.14 In progressing the gate-to-gate efficiency study, the DAG has identified a parallel effort under the APAC Trajectory-Based Operations (TBO) Pathfinder Project, where similar analysis is being undertaken as part of its TBO benefit analysis work. Given this synergy, the DAG will collaborate with the APAC TBO Pathfinder Project team to take the study forward.

2.15 To enhance coordination and maximise synergies across related initiatives, the AAC projects on Regional Data Management Guidance and the Gate-to-Gate Efficiency Study will be consolidated under the DAG.

3. ACTION BY THE MEETING

3.1 The meeting is invited to

a) note the information contained in this paper;

b) consider and endorse **Conclusion ATM/SG/14-X: Regional Data Management Guidance Document**;

c) encourage other groups within the region to adapt the *Regional Data Management Guidance Document* for their own data sharing use cases;

d) collect data on the six key operational timestamps to enable measurement and tracking of the eight Stage 1 KPIs, if not already doing so;

e) encourage member States who are not currently members to join the DAG; and

f) seek continued support from existing members to actively participate and share data.

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<table>
<tr><td colspan="2">Conclusion ATM/SG/14-X: Regional Data Management Guidance Document</td></tr>
<tr><td>What: That, the Regional Data Management Guidance Document at Appendix X to the Report be adopted as a guiding reference for data management, sharing, and use of operational and performance data across APAC DAG member States.</td><td>Expected impact:
☐ Political / Global
☐ Inter-regional
☐ Economic
☐ Environmental
☒ Ops/Technical</td></tr>
<tr><td>Why: While regional bodies like APEC, OECD, and ASEAN have data sharing guidelines,</td><td>Follow-up: ☒Required from States</td></tr>
</table>

there is no overarching guidance for the wider APAC region. A survey by the AAC identified three key concerns among ANSPs: (a) absence of clearly defined data governance measures and risk of data misuse; (b) inconsistent data quality standards across states; and (c) differing data formats that require significant effort to standardise. A *Regional Data Management Guidance Document* is therefore essential to guide APAC DAG member states to adopt good data management practices and unlock the value of historical data for impactful use cases.	
When: 7-Aug-26	Status: Draft to be adopted by Subgroup
Who: ☐Sub groups ☐APAC States ☐ICAO APAC RO ☐ICAO HQ ☒Other: APAC DAG	

APPENDIX A

COMPREHENSIVE YEAR-ON-YEAR PERFORMANCE REVIEW OF 11 KPIs

1. INTRODUCTION

1.1 Building on the analysis of performance data for year 2024 conducted in 2025, DAG members have expanded the analysis to include full-year data for 2024 and 2025, enabling a year-on-year comparison of performance.

2. COMPREHENSIVE PERFORMANCE REVIEW OF 11 KPIs

Capacity

2.1 **Figure** and **Figure** present the airport peak capacity and airport peak throughput for arrival and departure respectively.

2.2 Airport peak throughput is calculated as the 95th percentile of hourly aircraft movements, representing observed operational performance under high-demand conditions. In contrast, airport peak capacity is a declared value derived from various strategic and operational considerations such as fleet mix, wake turbulence separation requirements, runway occupancy time, and approach characteristics. While throughput reflects actual performance, capacity reflects planned or operationally achievable limits. The differences between these two measures provide insight into whether an airport is under-utilised, operating efficiently, or approaching saturation.

2.3 Arrival capacity is determined based on forecasted meteorological conditions, runway configuration, and operational constraints such as maintenance or construction activities. At airports with single or intersecting runways, arrival capacity typically constrains departure operations. Conversely, airports with parallel or multiple runway systems may achieve partial decoupling between arrival and departure flows, resulting in independent arrival and departure capacities. Airports with three or more runways may also alternate runway usage between arrivals and departures to accommodate peak demand, resulting in throughput temporarily exceeding declared capacity limits.

2.4 It was observed that most airports continued to operate below their declared peak capacities, which could indicate available operational headroom. Hong Kong International Airport (VHHH), Bangkok Suvarnabhumi International Airport (VTBS), and Noi Bai International Airport (VVNB) were among airports that were already operating near their peak capacities in 2024 and had increased their declared capacities in 2025. This suggested either recalibration of operational limits or incremental improvements in infrastructure and procedures. Recent assessments have indicated the declared runway capacity at Ninoy Aquino International Airport (RPLL) has been exceeded in recent years. This result may be attributed to ongoing airspace and runway optimisation initiatives. Additionally, new concepts of operations that are supported by a comprehensive safety study to ensure that efficiency gains do not compromise operational integrity are ongoing. Once finalised, a revised runway capacity declaration is expected to be issued.

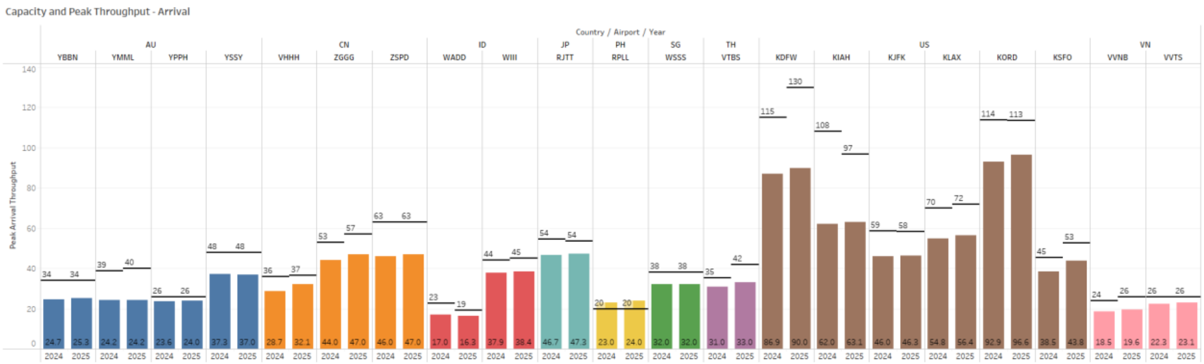

Figure 1. Arrival capacities and peak arrival throughputs (KPI09-A, KPI10-1A)

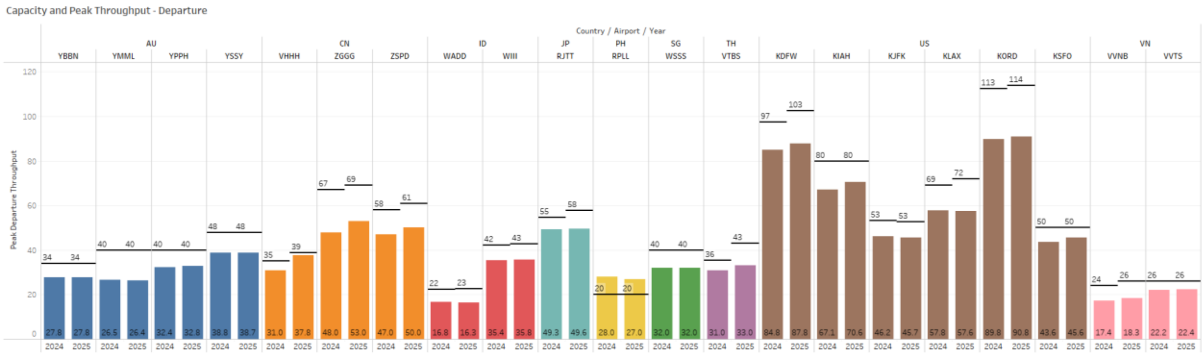

Figure 2. Departure capacities and peak departure throughputs (KPI09-D, KPI10-1D)

2.5 **Figure 3** presents the airport throughput efficiency for arrival and departure.

2.6 Airport throughput efficiency is a measure of the effectiveness of an ANSP in accommodating demand relative to available capacity. By comparing actual throughput against the lower of demand or capacity, the indicator helps distinguish between situations where capacity is not fully utilised and situations where operational constraints prevent available capacity from being delivered. Airport throughput efficiency may exceed 100% when actual operations can accommodate more aircraft than the declared capacity as the latter is often set based on planning parameters such as traffic fleet mix.

2.7 Most airports were observed to operate at relatively high throughput efficiency levels. However, throughput efficiency differed depending on the aggregation interval used, with the 60-minute variant generally producing higher values than the 15-minute variant. This could be due to the 60-minute variant smoothening short-term fluctuations and potentially masking periods of congestion or underutilisation, while the 15-minute variant is more responsive to operational variations within the hour.

2.8 The DAG will continue to assess the applicability of the airport throughput efficiency KPI across different operating environments, including how the interdependencies between capacity, demand, and throughput may affect its interpretation. This will help determine how the KPI should be interpreted under demand-limited and capacity-constrained conditions, including whether a minimum demand threshold should be established for meaningful application.

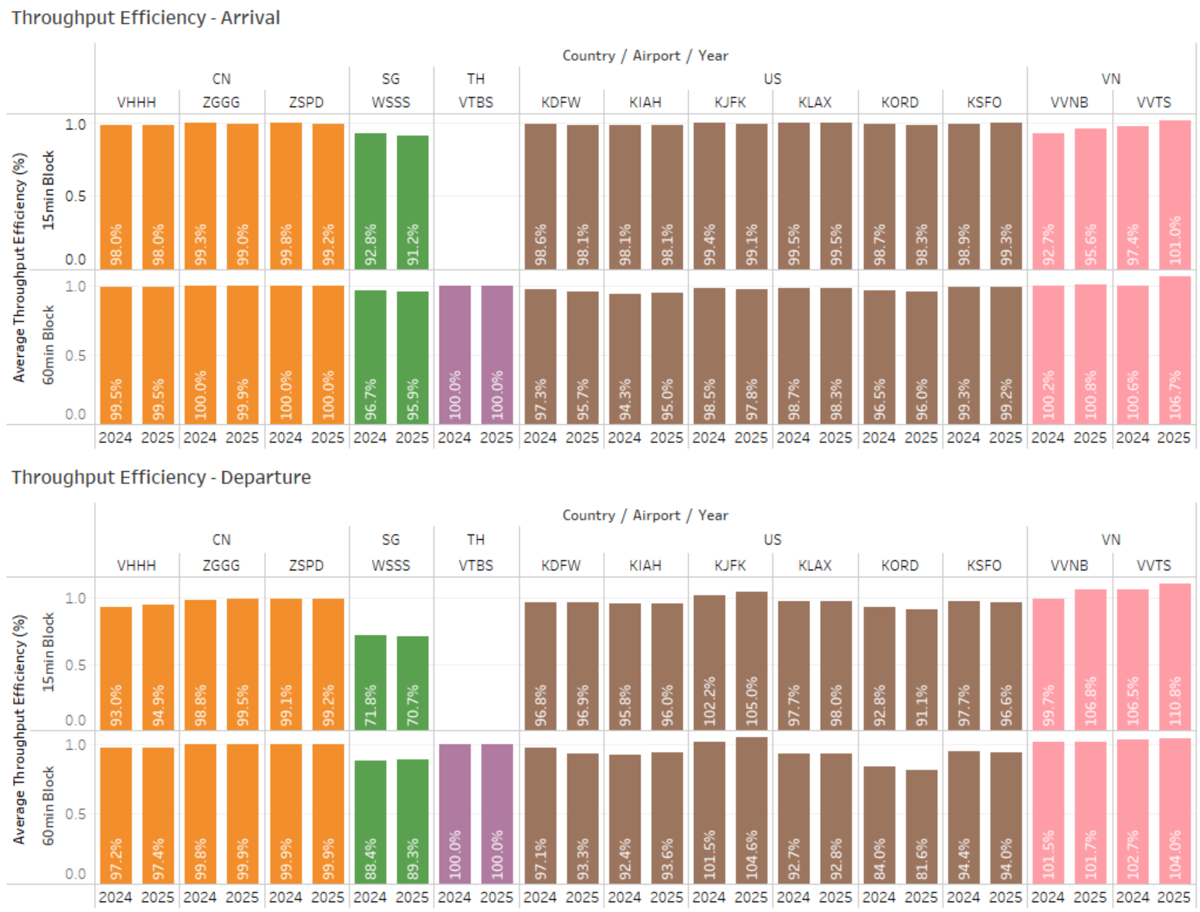

Figure 3. Arrival and Departure Throughput Efficiency for 15-minute and 60-minute block (KPI11-A, KPI11-D)

<u>Efficiency</u>

2.9 **Figure** and **Figure** presents the average additional taxi time taken for arrival and departure respectively.

2.10 Following DAG/5's decision, the group adopted the advanced variant for computing additional taxi-in and taxi-out time. The advanced variant applies a distinct reference taxi time for each runway and gate combination, in contrast to the basic variant which uses a single reference taxi time for all flights. The use of the advanced variant accounts for the varying distances between runways and gates, thereby enabling a fairer comparison of additional taxi time across airports with differing layouts.

2.11 It was observed that additional taxi-out times were generally longer than additional taxi-in times across all airports, a trend that was consistent year-on-year. This difference can be attributed to departure queue management at runway holding points. During taxi-out, aircraft often need to join a sequence of departing traffic and may experience additional waiting time at holding points to maintain safe separation between successive departures. This queuing effect is less pronounced during taxi-in operations, where arriving aircraft may proceed directly to their assigned gates with minimal holding, notwithstanding any gate availability issues.

2.12 Year-on-year, additional taxi-in and taxi-out performance showed mixed trends across airports, with some airports recording opposite movements between the two measures. For example, Hong Kong International Airport (VHHH) recorded a decrease in additional taxi-out time but an increase in additional taxi-in time. This may reflect transitional impacts from the implementation of its 3-runway system in late 2024, with taxi-in performance expected to improve once the passenger terminal expansion is completed.

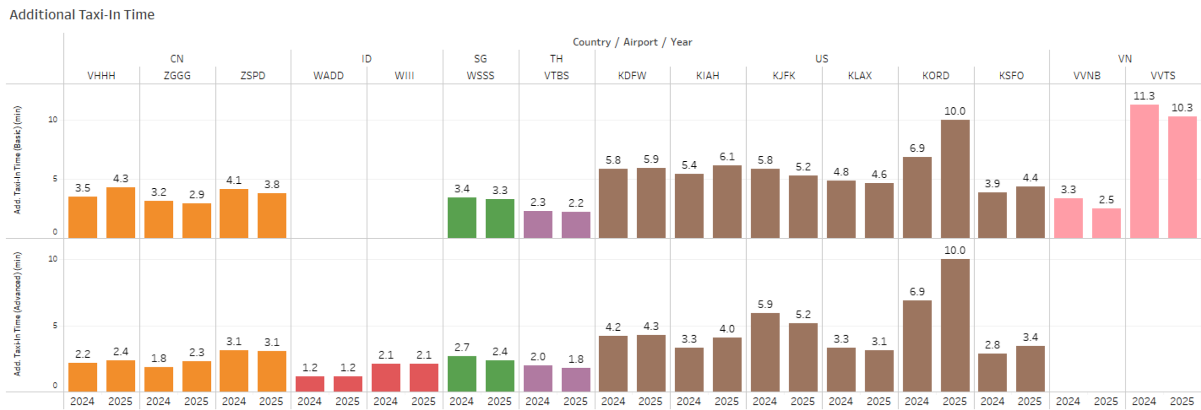

Figure 4. Additional Taxi-In Time for Basic and Advanced Variants (KPI13-1, KPI13-2)

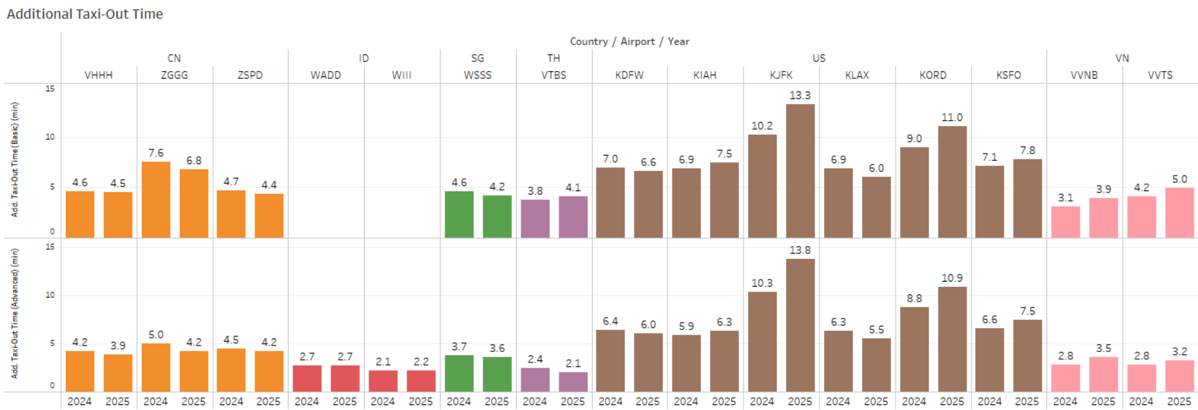

Figure 5. Additional Taxi-Out Time for Basic and Advanced Variants (KPI02-1, KPI02-2)

2.13 **Figure 6** presents the additional time in terminal airspace for arrivals.

2.14 The additional time in terminal airspace quantifies inefficiencies of actual arrival trajectories by comparing the time spent within the terminal airspace against an unimpeded reference time. The terminal airspace is proxied using a cylinder with either 40NM radius or 100NM radius around the destination airport, with the 100NM variant being more appropriate where holding patterns or sequencing activities occur beyond 40NM. The basic variant uses a single reference time for all arrivals, regardless of entry segment and runway. In contrast, the advanced variant applies a distinct reference time for each entry segment and runway combination, thereby accounting for variations in trajectory length and allowing a fairer comparison of additional time in terminal airspace across airports.

2.15 Most airports observed an increase in additional time in terminal airspace over the year. Among airports that measured both the 40NM and 100NM variants, the additional time in terminal airspace was generally higher under the 100NM variant. This suggests that the wider measurement boundary may capture additional inefficiencies arising from arrival sequencing, vectoring or holding before flights enter the 40NM terminal area. The selection of an appropriate boundary should therefore take into account local approach airspace design and procedures. In this regard, the 40NM variant was assessed to be more appropriate for Bangkok Suvarnabhumi International Airport (VTBS), while the 100NM variant was more appropriate for Hong Kong International Airport (VHHH).

2.16 The DAG will continue to examine the suitability of the 40NM and 100NM variants across different operating environments, with a view to identifying the most appropriate variant for each airport to support greater harmonisation in regional performance measurement.

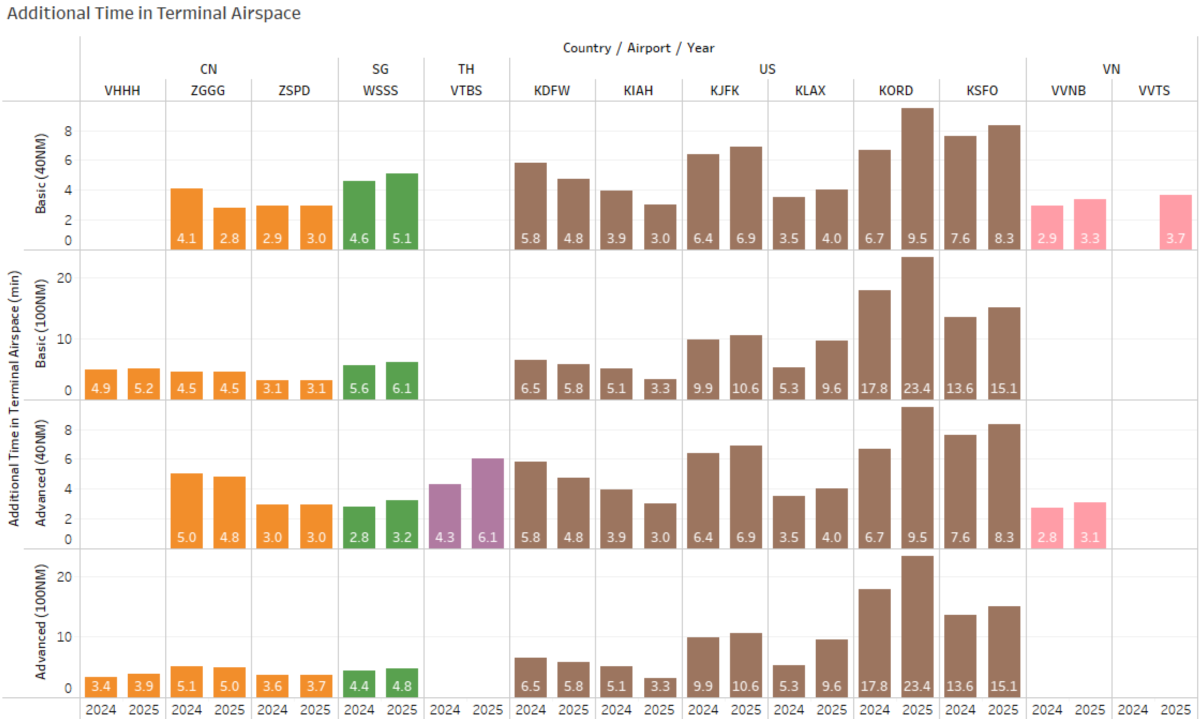

Figure 6. Additional Time in Terminal Airspace for Basic and Advanced Variants (KPI08-1, KPI08-2)

<u>Predictability</u>

2.17 **Figure** presents the arrival and departure punctuality distribution binned by its deviation from the respective scheduled arrival and departure time.

2.18 Across all airports, it was observed that arrival on-time performance consistently performed poorer than departure on-time performance. This was due to the observed high occurrences of early arrivals while departures were rarely early. More arrivals falling out of the +/- 15 min on-time bin would indicate poor adherence to slot schedules which may lead to demand-capacity imbalance.

2.19 Comparing year-on-year, it was observed that departure on-time performance improved across most airports. On the other hand, arrival on-time performance showed mixed results with decreases observed for Bangkok Suvarnabhumi International Airport (VTBS) and airports in the United States. In the United States, adverse weather is the primary contributor to flight delays. While the flow of departure can be managed through ground-based measures, arrival flows are generally subject to up-station factors such as en-route congestion, weather conditions, and network-wide disruptions.

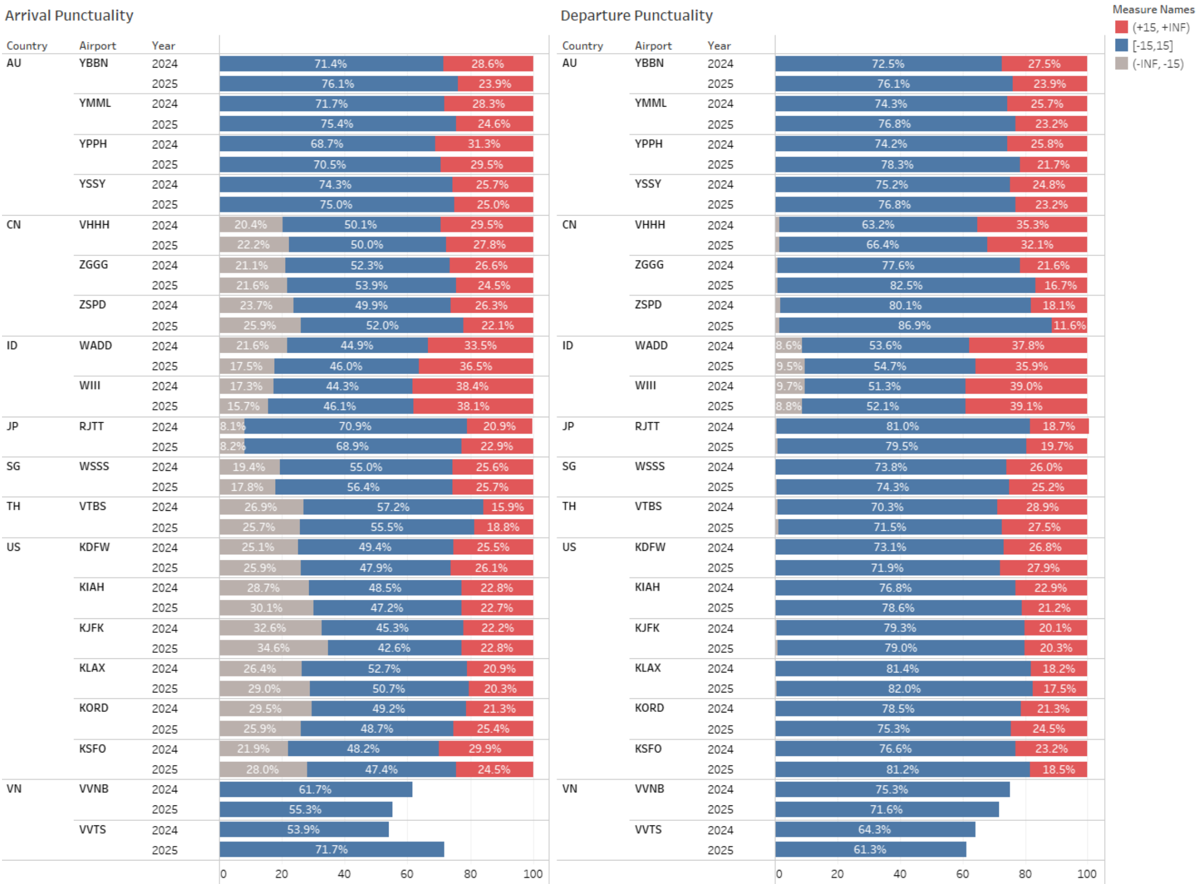

Figure 7. Range of arrival and departure punctuality across airports (KPI14, KPI01)

APPENDIX B

DATA COLLECTION GUIDE

1. INTRODUCTION

This document contains the definitions and calculation methodologies to be used for the Data Analytics Group’s (DAG's) performance management and data collection purposes. The data gathered will be studied and used to provide insights and illustrate the benefits of performance management.

2. PROTECTION AND USE OF DATA

a) All data provided and used shall be protected against public disclosure.
b) Data provided should only be used for the purposes of the DAG’s work as guided by the DAG’s Terms of Reference and Task List.
c) Written permission from the data provider shall be sought for the use of data for any purpose not provided for in (b).
d) Data quality and validation is the responsibility of the data provider.

3. GENERAL NOTES

The KPIs are based on GANP KPIs and organized by the GANP Performance Objectives (https://www4.icao.int/ganpportal/ASBU/KPI). Deviations from GANP definitions are italicized (if applicable). Only KPI variants considered by the DAG will have their definitions listed here. KPI variants will be identified by suffixing the main KPI identifier. For example, Variant 2A of KPI01 will be referred to as KPI01-2A. Data will be collected at a resolution of once a month. Cut-offs will be determined by Actual Take-off Time (ATOT) and Actual Landing Time (ALDT) in UTC.

States may choose their preferred reference year for calculating unimpeded or reference times.

4. PREDICTABILITY

For the predictability performance objective, the group will be collecting data to calculate KPI01 and KPI14. We will be calculating variants 2A and 2B of the KPIs, i.e. KPI01-2A, KPI01-2B, KPI14-2A, KPI14-2B.

4.1 DEFINITIONS

KPI Name	Departure Punctuality (KPI01)
Definition	Percentage of flights departing from the gate on-time (compared to schedule).
Measurement	% of scheduled flights
Variants	Variant 2A – % of departures delayed within ± 15 mins of scheduled time of departure Variant 2B – % of departures delayed <= 15 mins versus schedule
Parameters	On-time threshold (maximum positive or negative deviation from scheduled departure time) which defines whether a flight is counted as on-time or not. Recommended values: 5 minutes and 15 minutes.
Data Requirement	For each departing scheduled flight: • Scheduled time of departure (STD) • Actual off-block time (AOBT)

Formula	At the level of individual flights: • Exclude non-scheduled departures • Categorize each scheduled departure as on-time or not At aggregated level: • Compute the KPI: number of on-time departures divided by total number of scheduled departures

Table 1. Departure Punctuality Definition

KPI Name	Arrival Punctuality (KPI14)
Definition	Percentage of flights arriving at the gate on-time (compared to schedule).
Measurement	% of scheduled flights
Variants	Variant 2A – % of arrivals delayed within ± 15 mins of scheduled time of arrival Variant 2B – % of arrivals delayed <= 15 mins versus schedule
Parameters	On-time threshold (maximum positive or negative deviation from scheduled arrival time) which defines whether a flight is counted as on-time or not. Recommended values: 5 minutes and 15 minutes.
Data Requirement	For each arriving scheduled flight: • Scheduled time of arrival (STA) • Actual in-block time (AIBT)
Formula	At the level of individual flights: • Exclude non-scheduled arrivals • Categorize each scheduled departure as on-time or not At aggregated level: • Compute the KPI: number of on-time departures divided by total number of scheduled departures

Table 2 – Arrival punctuality definition

4.2 DATA COLLECTION

To calculate the predictability KPIs, we would require the breakdown of flights by Arrival, Departure, and time buckets. There will be three time buckets and x = Actual – Scheduled for the below definitions:

- (-INF, -15) Flights arriving or departing when $x < -15$ minutes.
- [-15,15] Flights arriving or departing when $-15 \leq x \leq 15$ minutes.
- (15, INF) Flights arriving or departing when $x > 15$ minutes.

Table 3 shows a sample of the data collection template with dummy data for illustration.

Airport	Date	Phase	No. of Flights	(-INF, -15)	[-15,15]	(15, INF)
ZZZZ	2025-01	DEP	12,345	190	8,386	3,769
ZZZZ	2025-02	DEP	12,346	114	8,064	4,168
ZZZZ	2025-03	DEP	12,347	137	8,886	3,324
ZZZZ	2025-01	ARR	12,348	2,203	6,887	3,258
ZZZZ	2025-02	ARR	12,349	2,038	6,237	4,074
ZZZZ	2025-03	ARR	12,350	2,347	6,619	3,384

Table 3: Data collection template for predictability with dummy data

4.3 CALCULATION METHODOLOGY

For departures,

1. Exclude non-scheduled flights and cancelled flights.
2. Calculate the time difference AOBT – STD.
3. Categorize each flight into the 3 buckets of (-INF, -15), [-15,15], (15, INF).
4. To get aggregated level:
    a. Monthly: Sum up the number of flights in each bucket for every month.
    b. Yearly: Sum up the number of flights in each bucket for every year.

For arrivals,

1. Exclude non-scheduled flights and cancelled flights.
2. Calculate the time difference AIBT – STA.
3. Categorize each flight into the 3 buckets of (-INF, -15), [-15,15], (15, INF).
4. To get aggregated level:
    a. Monthly: Sum up the number of flights in each bucket for every month.
    b. Yearly: Sum up the number of flights in each bucket for every year.

5. EFFICIENCY (BASIC)

For the basic efficiency performance objective, the group will be collecting data to calculate KPI02 and KPI13. We will be calculating both the basic and advanced variants of the KPIs. i.e. KPI02-1, KPI02-2, KPI13-1, KPI13-2.

5.1 DEFINITIONS

KPI Name	Additional taxi-out time (KPI02)
Definition	Actual taxi-out time compared to an unimpeded/reference taxi-out time.
Measurement	Minutes/flight
Variants	Variant 1 – Basic (computed without departure gate and runway data) Variant 2 – Advanced (computed with departure gate and runway data)
Parameters	Unimpeded/reference taxi-out time: • Recommended approach for the basic variant of the KPI: A single value at airport level, e.g. the 20th percentile of actual taxi times recorded at an airport, sorted from the shortest to the longest. *[For basic variant, reporting can be done at runway level if data is available]* • Recommended approach for the advanced variant of the KPI: A separate value for each runway/gate combination, e.g. the average actual taxi-out time recorded during periods of non-congestion (needs to be periodically reassessed). *[For advanced variant, the reference taxi-out time will be set at 20th percentile of actual taxi times recorded. To prevent issues with low sample sizes, data may be reported at runway and gate cluster level instead of at the individual gate level.]*
Data Requirement	For each departing flight: • Actual off-block time (AOBT) • Actual take-off time (ATOT) In addition, for the advanced variant: • Departure gate ID

	• Take-off runway ID
Formula	At the level of individual flights: 1. Select departing flights, exclude helicopters 2. Compute actual taxi-out duration: ATOT minus AOBT 3. Compute additional taxi-out time: actual taxi-out duration minus unimpeded taxi-out time At aggregated level: 4. Compute the KPI: sum of additional taxi-out times divided by number of IFR departures

Table 4 – Additional taxi-out time definition

KPI Name	Additional taxi-in time (KPI13)
Definition	Actual taxi-in time compared to an unimpeded/reference taxi-in time.
Measurement	Minutes/flight
Variants	Variant 1 – Basic (computed without landing runway and arrival gate data) Variant 2 – Advanced (computed with landing runway and arrival gate data)
Parameters	Unimpeded/reference taxi-in time: • Recommended approach for the basic variant of the KPI: A single value at airport level, e.g. the 20th percentile of actual taxi times recorded at an airport, sorted from the shortest to the longest. *[For basic variant, reporting can be done at runway level if data is available]* • Recommended approach for the advanced variant of the KPI: A separate value for each runway/gate combination, e.g. the average actual taxi-in time recorded during periods of non-congestion (needs to be periodically reassessed). *[For advanced variant, the reference taxi-in time will be set at 20th percentile of actual taxi times recorded. To prevent issues with low sample sizes, data may be reported at runway and gate cluster level instead of at the individual gate level.]*
Data Requirement	For each arriving flight: • Actual in-block time (AIBT) • Actual landing time (ALDT) In addition, for the advanced variant: • Arrival gate ID • Landing runway ID
Formula	At the level of individual flights: 1. Select arriving flights, exclude helicopters 2. Compute actual taxi-in duration: AIBT minus ALDT 3. Compute additional taxi-in time: actual taxi-in duration minus unimpeded taxi-in time At aggregated level: 4. Compute the KPI: sum of additional taxi-in times divided by number of IFR arrivals

Table 5 – Additional taxi-in time definition

5.2 DATA COLLECTION

The Basic Efficiency KPIs will be collected with the following data collection template.

Airport	Date	KPI02-1	KPI02-2	KPI13-1	KPI13-2
ZZZZ	2025-01	10.03	4.85	2.07	1.75
ZZZZ	2025-02	11.71	5.27	2.34	1.83
ZZZZ	2025-03	11.89	5.32	2.40	1.90

Table 6 – Data collection template for efficiency (basic) with dummy data

5.3 CALCULATION METHODOLOGY

Reference Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT – AOBT or AIBT – ALDT respectively.
3. Group flights by runway and gate / gate clusters (e.g. 20L_G).
4. For each group, obtain the 20th percentile taxi-out or taxi-in time as the runway and gate / gate cluster combination's reference time.

Additional Taxi Time

1. Only include IFR flights.
2. Calculate actual taxi-out or taxi-in times for each flight: ATOT – AOBT or AIBT – ALDT respectively.
3. Group flights by runway and gate / gate clusters (e.g. 20L_G).
4. For each group, subtract the reference time from the actual times to obtain the additional taxi-out or taxi-in time, using a different reference time for each runway and gate / gate cluster combination.
5. To get aggregated level:
    a. Monthly: Obtain the average additional taxi-out or taxi-in times across all flights for every month.
    b. Yearly: Obtain the average additional taxi-out or taxi-in times across all flights for every year.

6. EFFICIENCY (ADVANCED)

6.1 DEFINITIONS

For the advanced efficiency performance objective, the group will be collecting data to calculate KPI08. For KPI08, we will be calculating the advanced variants of the KPIs.

<table>
<tr><th>KPI Name</th><th>Additional time in terminal airspace (KPI08)</th></tr>
<tr><td>Definition</td><td>Actual terminal airspace transit time compared to an unimpeded time.</td></tr>
<tr><td>Measurement</td><td>Minutes/flight</td></tr>
<tr><td>Variants</td><td>Variants are possible depending on the chosen size of terminal airspace (40NM or 100NM cylinder) and the richness of the data feed: basic (without arrival runway ID) or advanced (with arrival runway ID).

Variants with 100NM cylinder are useful if airports have holding patterns outside the 40NM cylinder.

The use of generic cylinders abstracts local specifics in terms of approach airspace design (e.g. TMA) and ensures comparability across different airports.

<table><tr><td></td><td>40NM cylinder</td><td>100NM cylinder</td></tr><tr><td>Advanced</td><td>Variant A40</td><td>Variant A100</td></tr><tr><td>Basic</td><td>Variant B40</td><td>Variant B100</td></tr></table></td></tr>
<tr><td>Parameters</td><td>Destination terminal area proxy (also called Arrival Sequencing and Metering Area – ASMA): a cylinder with 40NM radius around the destination airport. For variants A100 and B100 the radius is 100NM.

Unimpeded/reference terminal airspace transit time:
Recommended approach for the basic variant of the KPI: A single value at airport level, e.g. the 20th percentile of actual terminal airspace transit times recorded at an airport, sorted from the shortest to the longest.
Recommended approach for the advanced variant of the KPI: A separate value for each entry segment/landing runway combination, e.g. the average terminal airspace transit time recorded during periods of non-congestion (needs to be periodically reassessed).
[The reference time in terminal airspace will be set at 20th percentile of actual times recorded.]</td></tr>
<tr><td>Data Requirement</td><td>For each arriving flight:
Terminal airspace entry time, computed from surveillance data (radar, ADS-B…)
Actual landing time (ALDT)
In addition, for the advanced variant:
Terminal airspace entry segment, computed from surveillance data (radar, ADS-B…)
Landing runway ID</td></tr>
<tr><td>Formula</td><td>At the level of individual flights:
Select arrivals, exclude helicopters
Compute actual terminal airspace transit time: ALDT minus terminal airspace entry time
Compute additional terminal airspace transit time: actual terminal airspace transit time minus unimpeded terminal airspace transit time
At aggregated level:<ol start="4">
Compute the KPI: sum of additional terminal airspace transit times divided by number of IFR arrivals</td></tr>
</table>

Table 7 – Additional time in terminal airspace

6.2 DATA COLLECTION

The Advanced Efficiency KPIs will be collected with the following data collection template.

Airport	Date	KPI08-A40	KPI08-A100	KPI08-B40	KPI08-B100
ZZZZ	2025-01	10.03	9.43	10.03	9.43
ZZZZ	2025-02	11.71	8.24	11.71	8.24
ZZZZ	2025-03	11.89	6.24	11.89	6.24

Table 8 – Data collection template for efficiency (advanced) with dummy data

6.3 CALCULATION METHODOLOGY

Reference Time

1. Only include IFR flights.
2. Calculate actual terminal airspace transit times for each flight: ALDT – terminal airspace entry time.
3. Group flights by runway direction and terminal airspace entry segment (e.g. 02_PASPU).
4. For each group, obtain the 20th percentile terminal airspace transit time as the runway direction and terminal airspace entry segment combination's reference time.

Additional Terminal Airspace Transit Time

1. Only include IFR flights.
2. Calculate actual terminal airspace transit times for each flight: ALDT – terminal airspace entry time.
3. Group flights by runway direction and terminal airspace entry segment (e.g. 02_PASPU).
4. For each group, subtract the reference time from the actual times to obtain the additional terminal airspace transit time, using a different reference time for each runway direction and terminal airspace entry segment combination.
5. To get aggregated level:
   a. Monthly: Obtain the average additional terminal airspace transit times across all flights for every month.
   b. Yearly: Obtain the average additional terminal airspace transit times across all flights for every year.

7. CAPACITY (BASIC)

For the basic capacity performance objective, the group will be collecting data to calculate all variants of KPI09, i.e. KPI09-A, KPI09-D, KPI09-AD. For KPI10, variant 1 on IFR operations will be calculated, i.e. KPI10-1A, KPI10-1D, KPI10-1AD

7.1 DEFINITIONS

KPI Name	Airport Peak Capacity (KPI09)
Definition	The highest number of operations an airport can accept in a one-hour time frame (also called declared capacity). Can be computed for arrivals, departures, or arrivals + departures.
Measurement	Number of departures / hour, Number of landings / hour, Number of (departures + landings) / hour
Variants	Variant A – Airport peak arrival capacity Variant D – Airport peak departure capacity

	Variant AD – Airport peak movement capacity (departures + arrivals)
Parameters	None
Data Requirement	Scheduling parameters for slot controlled airports Airport acceptance rates (AAR) Airport departure rates (ADR)
Formula	At the level of an individual airport: 1. Select highest value from the set of declared capacities 2. Compute the KPI: convert the value to an hourly rate, if the declaration is at smaller time intervals

Table 9 – Airport peak capacity definition

KPI Name	Airport Peak Throughout (KPI10)
Definition	The 95th percentile of the hourly number of operations recorded at an airport, in the "rolling" hours sorted from the least busy to the busiest hour. Can be computed for arrivals, departures, or arrivals + departures.
Measurement	Number of departures / hour, Number of landings / hour, Number of (departures + landings) / hour
Variants	Variant 1 – IFR operations only To be combined with: Variant A – Airport peak arrival capacity Variant D – Airport peak departure capacity Variant AD – Airport peak movement capacity (departures + arrivals)
Parameters	Time interval for "rolling" hours. Recommended value: 15 minutes The percentile chosen to exclude outliers. Recommended value: 95th percentile
Data Requirement	For each flight: Actual landing time (ALDT) Actual take-off time (ATOT)
Formula	At the level of an individual flights: 1. Select flights, exclude helicopters 2. Convert the set of landings to hourly landing / departure rates by "rolling" hour 3. Sort the "rolling" hours from the least busy to the busiest hour 4. Compute the KPI: it equals the landing rate value of the 95th percentile of the "rolling" hours

Table 10 – Airport peak throughput definition

7.2 DATA COLLECTION

Data will be collected for all variants of KPI09. For KPI10, data will be collected for KPI10-1A, KPI10-1D, and KPI10-1AD.

Airport	Date	KPI09-AD	KPI10-1AD	KPI09-A	KPI10-1A	KPI09-D	KPI10-1D
ZZZZ	2025-01	73	45	38	27	40	24
ZZZZ	2025-02	73	47	38	28	40	25
ZZZZ	2025-03	73	47	38	27	40	24

Table 11 – Data collection template for capacity with dummy data

7.3 CALCULATION METHODOLOGY

This section will focus on KPI10 only as KPI09 consists of declared capacities.

Rolling Hours

The time interval for rolling hours will be set at 15 minutes. To illustrate rolling hours, consider the below example where we begin from 0900. Hourly peak throughputs will be calculated for the following time periods, where a new hourly period is considered every 15 minutes:

- 0900 – 1000
- 0915 – 1015
- 0930 – 1030

… and so on

Airport Peak Throughput

1. Restrict the hours considered to 0600 – 2259 local time for all airports.
2. To get aggregated level:
   a. Monthly: For each month, calculate the number of flights per rolling hour for arrivals, departures, and arrivals + departures.
   b. Yearly: For each year, calculate the number of flights per rolling hour for arrivals, departures, and arrivals + departures.
3. Arrange these rolling hours from the least number of flights to the greatest number of flights.
4. The 95th percentile rolling hour will be taken as the peak throughput

8. CAPACITY (ADVANCED)

For the advanced capacity performance objective, the group will be collecting data to calculate KPI11. Data will be collected for KPI11-A, KPI11-D, and KPI11-AD.

8.1 DEFINITIONS

KPI Name	**Airport Throughput Efficiency (KPI11)**
Definition	Airport throughput (accommodated demand) compared to capacity or demand, whichever is lower. Can be computed for arrivals, departures or arrivals + departures.
Measurement	Average Over/Under Delivery or % of accommodated operations
Variants	Variant A – IFR Arrivals Variant D – IFR Departures Variant AD – IFR Operations (arrivals + departures)
Parameters	Time interval at which to perform the most granular calculations. Recommended value: 15 minutes.
Data Requirement	For each arriving and/or departing flight: • Actual landing time (ALDT) and take-off time (ATOT) • Estimated landing time (ELDT) and take-off time (ETOT) (from flight plan) For each time interval: • Declared landing capacity of the airport • Declared departure capacity of the airport • Declared total capacity of the airport

Formula	Example for arrivals: For each time interval: 1. Compute the throughput: count the number of actual landings based on ALDT 2. Compute the demand: count the number of estimated landings based on ELDT 3. If demand >= capacity: efficiency = throughput/capacity 4. If demand < capacity: efficiency = throughput/demand At aggregated level (longer time periods): 5. Compute the KPI: sum(efficiency*demand) / sum(demand)

Table 12 – Airport peak capacity definition

8.2 DATA COLLECTION

Data will be collected for all variants of KPI11, using both 15-minute and 1-hour time intervals. The average of the time intervals will be recorded for each month

Airport	Date	KPI11-A (15 min)	KPI11-D (15 min)	KPI11-AD (15 min)	KPI11-A (60 min)	KPI11-D (60 min)	KPI11-AD (60 min)
ZZZZ	2025-01	95.6%	95.3%	95.7%	95.6%	95.3%	95.7%
ZZZZ	2025-02	99.2%	92.3%	95.3%	99.2%	92.3%	95.3%
ZZZZ	2025-03	94.7%	98.3%	96.4%	94.7%	98.3%	96.4%

Table 13 – Data collection template for capacity (advanced) with dummy data

8.3 CALCULATION METHODOLOGY

Compute the throughput

1. Count the number of actual landings/take-offs based on ALDT/ATOT respectively.

Compute the demand

2. Count the number of estimated landings/take-offs based on ELDT/ETOT respectively.
    a. ELDT = Time over entry fix + Estimated Elapsed Time from Fix to Landing
    b. ETOT = SOBT/TOBT + Unimpeded Taxi-out Time

    States may also use ELDT/ETOT data from AMAN/DMAN systems, respectively.

3. To rollover demand count to next time bin until the flight has landed/departed.
    - E.g. ABC123 arrival - ATA: 1310H, ELDT: 1030H

ABC123	1000H	1100H	1200H	1300H
Throughput count				1
Demand count	1	1	1	1

Compute the capacity

4. Based on declared, operational or any other capacity definitions as relevant.
    E.g. if ATFM GDP is implemented, lowered AAR will be utilized

Compute the KPI

5. For each time interval (15-min or 60-min block), calculate the throughput efficiency:

    KPI11 = Throughput / Lower of Demand or Capacity

a. If demand < capacity: KPI11 = throughput/demand
b. If demand >= capacity: KPI11 = throughput/capacity

If throughput is higher than capacity and/or demand, the KPI will be calculated as >100%.

6. To get aggregated level:
   a. Monthly: Obtain the average throughput efficiency for the month across all the time intervals.
   b. Yearly: Obtain the average throughput efficiency for the year across all the time intervals.

9. ATFM-RELATED KPIs

The group will collect data for KPI03 and KPI12 once AMNAC completes their trial and agrees on a standardised set of KPIs and methodologies for ATFM post-operations analysis reporting. In the interim, the definitions and calculation methodologies for KPI03 and KPI12 are added in this guide for reference.

9.1 DEFINITION FOR KPI03

KPI Name	ATFM Slot Adherence (KPI03)
Definition	Percentage of flights taking off within their assigned ATFM slot (Calculated Take-Off Time Compliance)
Measurement	% of participating flights within compliance window
Variants	Based on size of ATFM slot window Variant 1: The period between 5 minutes before and 10 minutes after the CTOT Variant 2: The period between 5 minutes before and 5 minutes after the CTOT
Data Requirement	For each departing IFR flight subject to an ATFM regulation: • Calculated take-off time (CTOT) • Actual take-off time (ATOT)
Formula	At the level of individual flights: 1. Exclude flights not subject to an ATFM regulation 2. Categorise each departing flight as compliant with its ATFM slot window or not At aggregated level: 3. Compute the KPI: number of compliant departures divided by total number of departing flights subject to an ATFM regulation

Table 14 – ATFM Slot Adherence definition

9.2 CALCULATION METHODOLOGY FOR KPI03

<u>Identify flights subject to ATFM regulation</u>

1. Extract all departing IFR flights that have been assigned a CTOT during the measurement period.

<u>Categorise compliance for each flight</u>

2. For each flight subject to ATFM regulation:
   a. Calculate the difference between ATOT and CTOT.

   b. For Variant 1, categorise the flight as:

- Early: ATOT is more than 5 minutes before CTOT
- Compliant: ATOT is between 5 minutes before and 10 minutes after CTOT
- Late: ATOT is more than 10 minutes after CTOT

c. For Variant 2, categorise the flight as:
- Early: ATOT is more than 5 minutes before CTOT
- Compliant: ATOT is between 5 minutes before and 5 minutes after CTOT
- Late: ATOT is more than 5 minutes after CTOT

Compute the KPI

3. At the aggregated level monthly or yearly:

KPI03 = (Number of Compliant Flights / Total Number of Flights Subject to ATFM Regulation) × 100%

Where:
- Number of Compliant Flights = flights with ATOT within [-5, +10] minutes of CTOT for Variant 1 and within [-5, +5] minutes of CTOT for Variant 2
- Total Number of Flights Subject to ATFM Regulation = all flights assigned a CTOT during the period

9.3 DEFINITION FOR KPI12

KPI Name	Airport/Terminal ATFM Delay (KPI12)
Definition	ATFM delay attributed to arrival flow restrictions at a given airport and/or associated terminal airspace volume
Measurement	Minutes/flight
Variants	None
Data Requirement	For each arriving IFR flight subject to an ATFM regulation: • Estimated take-off time (ETOT) computed from the last filed flight plan • Calculated take-off time (CTOT)
Formula	At the level of individual flights: 1. Select the flights arriving at this airport 2. Select the subset of flights which are affected by the flow restrictions in this airport or its terminal airspace 3. Compute ATFM delay: CTOT minus ETOT At aggregated level: 4. Compute the KPI: sum of ATFM delays divided by number of arrivals at the airport

Table 15 – Airport ATFM Delay definition

9.4 CALCULATION METHODOLOGY FOR KPI12

Identify flights subject to ATFM regulation

1. Extract all arriving IFR flights at the airport that have been assigned a CTOT due to flow restrictions at the airport or its associated terminal airspace during the measurement period.

Compute ATFM delay for each flight

2. For each flight subject to ATFM regulation:

Calculate the ATFM Delay: ATFM delay = CTOT – ETOT (in minutes)

Where:
- CTOT = Calculated Take-Off Time assigned by ATFM
- ETOT = Estimated Take-Off Time from the last filed flight plan

<u>Compute the KPI</u>

3. At the aggregated level monthly or yearly:

KPI12 = Total ATFM Delay / Total Number of Arriving Flights Subject to ATFM Regulation

Where:
- Total ATFM Delay = sum of all individual flight ATFM delays (in minutes)
- Total Number of Arriving Flights Subject to ATFM Regulation = count of all arriving flights assigned a CTOT due to airport/terminal flow restrictions during the period

APPENDIX C

REGIONAL DATA MANAGEMENT GUIDANCE DOCUMENT

1. INTRODUCTION

1.1 While international and cross-border data sharing and management guidelines exist for regional bodies such as APEC, OECD or ASEAN, there is currently no overarching Guidance Document for the wider APAC region. Examples of existing guidelines include the APEC Cross Border Privacy Rules, ASEAN Model Contractual Clauses, ASEAN Data Management Framework, OECD Guide to Data Governance and Policymaking.

1.2 In 2025, a survey conducted gathered 14 data sharing use cases in APAC, where States expressed concerns about:

a) the lack of clearly defined data governance measures governing the use, storage, and protection of shared data, as well as the associated risk of data misuse;

b) inconsistent data quality standards across participating states, with variations in timeliness, completeness, and accuracy, often stemming from technical and resource limitations; and

c) differing data formats, requiring substantial effort to process and standardise before meaningful analysis can occur

1.3 See **Appendix 1** for detailed survey findings on the use cases, challenges and additional considerations gathered.

2. PROPOSED APPROACH

2.1 Considering the challenges and concerns observed, and given that APAC States depend on one another for data especially when it comes to data sharing use cases on performance benchmarking and CONOPS development, a Regional Data Management Guidance Document is essential to guide APAC States to collectively work towards unlocking the value of historical data to drive impactful use cases, with a focus on implementing good data management practices.

2.2 To facilitate safe and efficient data sharing across APAC, the Regional Data Management Guidance Document aims to establish a trusted and interoperable guide with data management best practices and recommend standardised data semantics to promote responsible and effective use of data.

2.3 While this Guidance Document has been developed primarily for data sharing within the APAC Data Analytics Group (DAG), other groups within APAC that wish to adapt this document for their data sharing use cases are welcome to do so, and are encouraged to reach out to the DAG for guidance and support.

3. REGIONAL DATA MANAGEMENT GUIDANCE DOCUMENT

3.1 The Regional Data Management Guidance Document comprises the following key pillars: (1) Aligned with Existing Policy and Legal Requirements; (2) Good Data Management Principles; and (3) Recommended Interoperability Measures.

(1) Aligned with Existing Policy and Legal Requirements

3.2 As the Regional Data Management Guidance Document is developed to provide non-obligatory guidance based on best practices in data management, the Guidance Document should not be read nor constitute as legal advice or used as a tool for compliance with any law or regulatory requirements.

3.3 For avoidance of doubt, this Guidance Document will not take precedence over existing legal or regulatory requirements that APAC States are subject to. The data management principles set out within this Guidance Document build upon existing policy and legal foundations (see **Appendix 1** for information) and function as a complementary extension guide to data management.

(2) Good Data Management Principles

3.4 This section outlines data management practices and principles across the data lifecycle (see **Figure 1**) which is largely mirrored after existing APAC data sharing use cases.

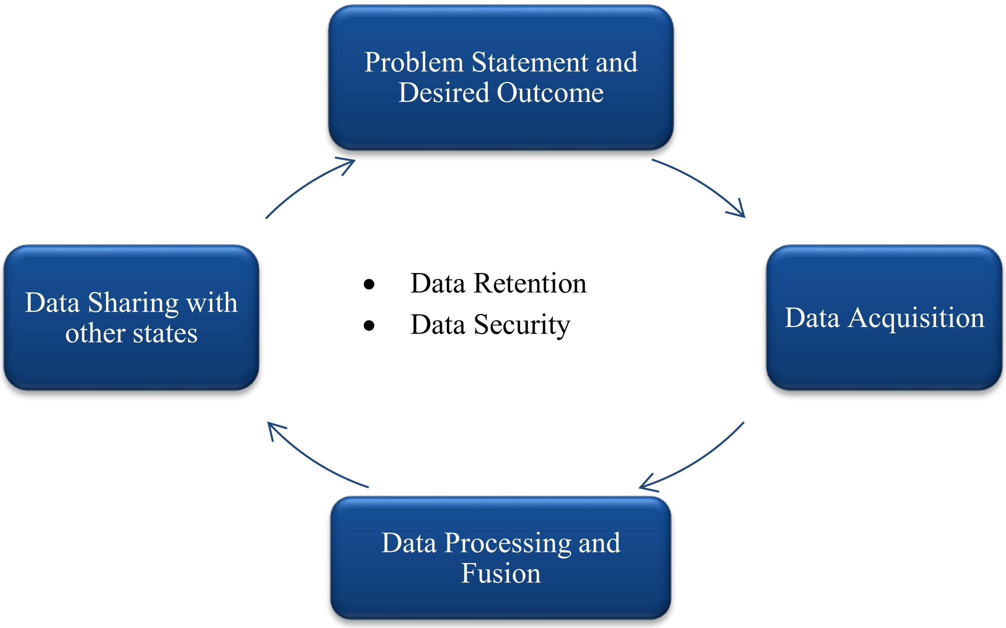

Figure 1. Data Lifecycle

3.5 <u>Data Acquisition</u>

3.5.1 The use case should be clearly defined with the data identified required to fulfil the use case, before acquiring data from other States.

3.5.2 To minimise risks of unauthorised use or disclosure, the acquisition of data should be minimised to only what is necessary.

3.5.3 When data is acquired from States, the data should as far as possible be acquired via electronic means.

3.6 Data Processing and Fusion

3.6.1 To minimise errors arising from data processing and fusing, APAC States that process and fuse data should put in place processes such as data validation checks, documentation of formulations and algorithms, and periodic review of error logs.

3.6.2 When processing and fusing data, APAC States should as far as possible, apply anonymisation techniques, including the alteration or removal of identifiers, to minimise the risk of unauthorised identification or disclosure of sensitive or proprietary information.

3.7 Data Sharing

3.7.1 Before APAC States share data with another State, they should check whether there is any law (e.g. legislation, contract, legal privilege, state-level policies etc.) governing such data disclosure.

3.7.2 Where APAC States receive data from another APAC State, they should not disclose the data received to other parties and only use the data for specified or directly related purpose(s), without the explicit approval of said APAC State, unless otherwise authorised (e.g. by the State) or required by law. In addition, APAC States receiving data should not publish any summary conclusions or interpretations based on the data received without the explicit approval of the APAC State which the data originated from, unless otherwise authorised or required by law.

3.7.3 Recommended Roles and Responsibilities

Role/ Definition	**Responsibilities**
Data Provider APAC States which the data originated from	• Communicate the known limitations of the requested data as far as practicable (e.g. completeness, accuracy, time specificity, other physical attributes including Intellectual Property rights and limitations, and contextual limitations) • Inform the Data Requestor of any issues with the publication of the requested data and/ or its statistics derived after being informed of the intention to publish • Take reasonable effort to evaluate data requests. For more complex data requests, the Data Provider, Data Controller and Data Requestor should work together to establish the time required to meet the data request at the onset • Transfer the data at the mutually agreed frequency
Data Controller APAC States that have possession or custody of the data	• Take reasonable measures to ensure that the shared data is protected against loss, unauthorised access, use, modification, disclosure or other misuse • Ensure that data and/or data or statistics derived from Data Providers are not shared with any third party without explicit approval of the Data Provider • Only use the data for the specified or directly related purpose(s) and seek approval from the Data Provider if it wishes to use the requested data for other purposes

	• Notify the Data Provider without undue delay when it becomes aware of any data breach, and in no event later than the maximum period permitted under any applicable laws, and take all reasonable measures to rectify the breach, including measures directed by the Data Provider • Purge the data when it is no longer needed
Data User APAC States	• Only use the data for the specified or directly related purpose(s) and seek approval from the Data Provider if it wishes to use the requested data for other purposes (e.g. Background Intellectual Property/ Raw data should not be shared without approval from the Data Provider) • Ensure that the Data Provider is notified at a mutually agreed timeframe prior to any publication of the requested data and/or its derived statistics (e.g. Foreground Intellectual Property/ Reports etc.) • Notify the Data Provider without undue delay when it becomes aware of any data breach, and in no event later than the maximum period permitted under any applicable laws, and take all reasonable measures to rectify the breach, including measures directed by the Data Provider • Purge the data when no longer needed

3.8 Data Retention

3.8.1 APAC States should retain data only for the period necessary to fulfil the purposes for which it was collected.

3.8.2 APAC States should set a retention period for each dataset. Upon the expiry of the stipulated retention period, the data shall be securely destroyed in accordance with the respective APAC State's data management policies.

3.9 Data Security

3.9.1 APAC States should consider the following data security measures to protect data and prevent data compromises:

a) ensure that Data User (i.e. APAC States) request and retrieve only the data required for the use case and do not retrieve more data than necessary;

b) processes and controls to ensure that the rights to access data are granted on a need-to-know basis, where data access rights are regularly reviewed;

c) predefined limits for volume of data to be accessed and duration of access through access control features;

d) log and monitor data transactions to detect suspicious or risky activities and take action to prevent any data compromises;

e) implement technical measures to protect data and render the data unusable to an attacker (e.g. field level encryption, hashing with salt, tokenization, obfuscation/ masking of entity attributes); and

f) password protect and/or encrypt files when sharing data.

(3) Recommended Interoperability Measures

3.10 Common Data Standards and Format

3.10.1 Existing international data standards such as the following (non-exhaustive) should be used as reference:

a) ISO/IEC 11179: Guidance Document for a Metadata Registry;

b) UN/CEFACT Core Components Library;

c) World Customs Organisation (WCO) Data Model;

d) Organisation for Economic Co-operation and Development (OECD) Data Quality guidelines;

e) DAMA-Data Management Body of Knowledge (DMBOK);

f) IATA Airline Industry Data Model (AIDM); and

g) FAA System Wide Information Management (SWIM).

3.10.2 To strengthen interoperability, APAC States should adhere to mutually agreed data standard and format prior to the data sharing use case.

3.10.3 Where possible, APAC States should use standard data templates which fulfil the needs of the use case when sharing data. For example, where there are joint projects, members should only share data using a common data template, whether agreed upon collectively by all members or proposed by any single member, provided that the data template adheres to an existing international data standard.

3.11 Data Quality

3.11.1 To ensure that data is reliable and fit for us, APAC States should consider the following data quality indicators:

a) Usability (for example, APAC States to ensure that the historical data records provided are in usable formats);

b) Accuracy (for example, APAC States to ensure that the historical data records provided are error free); and

c) Data Error/ Discrepancy Resolution (for example, APAC States who provide data should take reasonable measures to rectify and address data errors and/or discrepancies and inform Data Controller and downstream Data Users).

4. OPEN DATA SHARING

4.1 APAC States should consider undertaking a stock-take of all their data and decide what data is possible, suitable and useful to be shared openly with other APAC States.

4.2 Where such data is identified, APAC States should make the data available in an appropriate manner to facilitate proper interpretation and meaningful use.

4.3 APAC States should explore the use of open source and third-party commercial data to supplement data gaps.

APPENDIX 1: DETAILED SURVEY FINDINGS

1. INTRODUCTION

This document contains the detailed survey findings for the Regional Data Management Guidance Document. The findings gathered includes: (a) APAC Data Sharing Use Cases and Challenges Faced by APAC States; (b) APAC States' Additional Considerations on Data Sharing and (c) Existing Regulatory and/or Legal Requirements that APAC States Adhere To.

(a) APAC Data Sharing Use Cases and Challenges Faced by APAC States

S/N	APAC States	Data Sharing Use Cases	Challenges Faced

1	Singapore	Singapore shares historical performance indicators on a yearly basis with APAC countries as part of our membership of the Data Analytics Group (DAG).
		
		The DAG uses the shared measures for analysis on eight Key Performance Indicators (KPIs) under the Global Air Navigation Plan (GANP), which aims to derive insights for ATM performance to support management and operational decisions.
			While Singapore does not face any particular challenge when sharing historical performance measures with APAC countries, Singapore observed that there are (a) concerns on the use of shared data and (b) different data quality.
			
			For (a), APAC States have previously raised concerns on data governance, particularly regarding how shared data will be used and stored. Currently, only in-principle agreement is being sought among members of the working groups that the performance measures will not be shared beyond the group and that any documents referring to these data should be cleared through the member States first. There have been no further follow-ups from this concern, but it will be useful if a regional governance guidance document could help support these works. Having explicit data governance and protection measures as part of the regional governance guidance document will also provide greater assurance that the contributed data is adequately protected and is likely to encourage more active contribution of data.
			
			For (b), Singapore notes that data quality varies across states (e.g. timeliness, completeness and accuracy), which could be due to technical/ resource limitations. It

2	Singapore	Singapore shares historical data on a yearly basis with members of the Performance Benchmarking Working Group (PBWG) which studies and benchmarks operational KPIs related to air traffic management. The PBWG intends to expand its analytical scope to include vertical flight efficiency, additional fuel burn, flight time variability, turnaround time which would require more data fields and higher granularity data to be shared.	
3	Singapore	Singapore shares historical data on a yearly basis with members of the Civil Air Navigation Services Organisation Global Benchmarking Workgroup (CANSO GBWG) conducts an annual global benchmarking exercise to produce the Global ANS Performance Report that measures and compares ANSPs' performance in cost-	

		effectiveness and ATCO productivity. Singapore contributes to the following KPIs in the CANSO ANS Performance Framework by sharing data on ANS cost, IFR flight hours, number of ATCOs in operations and ATCO in operations hours.	will be helpful if the regional governance guidance document stipulates baseline data quality standards, which promotes the contribution and use of quality data. To date, while performance measures are shared between countries, the underlying data are not shared due to different data laws. Sharing of such data and having common situational insights will unlock precious value to the participating countries.
4	Philippines	Under the Framework for ASEAN Simulation and Modelling Function (ASAM), Philippines is requested to do a one-time sharing of historical air traffic data to support the establishment of an updated baseline for the ASEAN region. This initiative is coordinated by the Air Traffic Management Research Institute (ATMRI) and involves depositing national traffic data into the ASEAN Air Traffic Management Data Repository (AADR). The data will be used for regional modeling, simulation, and performance analysis.	Data Formatting requirements
5	Philippines	In accordance with ICAO APANPIRG Conclusion 16/4, Air Traffic Service (ATS) provider States (i.e. Philippines) are required to submit Traffic Sample Data (TSD) on a yearly basis. This data supports regional airspace safety monitoring, including Reduced Vertical Separation Minimum (RVSM) compliance and performance-based communication and surveillance assessments. The Monitoring Agency for Asia Region (MAAR) coordinates the collection and analysis of this data.	
6	Indonesia	Indonesia provides historical ADS-B data for use in the Altimetry System Error (ASE) analysis	Different policies governing the availability and sharing of

<table>
<tr><td></td><td></td><td>conducted by the RVSM Regional Monitoring Agency (AAMA) to ensure that operators and aircraft conform to ICAO standards on aircraft altimetry and Long-Term Height Monitoring.</td><td rowspan="2">historical data to be shared internationally

Data collection and processing are currently semi-automated, where data is obtained and processed with heavy human intervention.

Differences in data formats and systems create challenges in integrating data from multiple ANSPs</td></tr>
<tr><td>7</td><td>Indonesia</td><td>Indonesia provides Traffic Sample Data every semester to ASEAN ATM SPG, covering the periods from 1st to 7th June and from 1st to 7th December each year.</td></tr>
<tr><td>8</td><td>Hong Kong SAR</td><td>Hong Kong provides daily sharing of Airport Acceptance Rate (AAR) though ATFM Daily Plan (ADP) by email to certain APAC states.</td><td rowspan="3">Data Management: Historical data often resides in isolated systems or departmental silos, making it difficult to consolidate into a unified, accessible format for sharing. Besides, historical datasets from various sources may have different formats, structures, coding standards, or contain inaccuracies, duplicates, and missing information. This poor data hygiene requires significant effort to cleanse and standardize before it can be used effectively for analysis.

Insufficient Tools and Technology: Legacy systems and a lack of interoperability standards or APIs can hinder seamless and automated data exchange between different platforms and organizations.

Loss of Control: Once data is shared with external partners, companies may lose partial or complete control over how that information is used, stored, and protected, which can lead to concerns about data governance and potential misuse.</td></tr>
<tr><td>9</td><td>Hong Kong SAR</td><td>As part of the Ground Delay Programme, the compliance rates of CTOT were sent by China, Hong Kong China, Singapore, Thailand, Korea, Vietnam, Cambodia and shared among AMNAC network members.

Data involved was ACFT callsign, EOBT, CTOT, ATOT, which are shared monthly through a common online platform.</td></tr>
<tr><td>10</td><td>Hong Kong SAR</td><td>As part of the ICAO APAC ATM/SG Data Analytic Ad-hoc Group (DAG), performance data are gathered a few times per year for the group rapporteur to consolidate and generate analytical reports on various areas of concern, e.g. Airport peak capacity and throughput, Additional Taxi Time etc.</td></tr>
<tr><td>11</td><td>Australia</td><td>Sharing of sample ADSB data between Indonesia and Australia to enable monitoring of altimetry system error as part of regional monitoring agency activities. Indonesia supplies data which</td><td>The lack of central accessible systems for transfer means defining new secure data transfer systems is complex and requires repeating.</td></tr>
</table>

		Airservices processes and provides monitoring results.	
12	Cambodia	Sharing of missing flight plan from adjacent FIRs upon request	Time consuming and accuracy of data. Lack of coordination. State policy and regulation.
13	Cambodia	Sharing of missing NOTAM from originator upon request.	
14	Cambodia	Exchange of AIDC historical record between Cambodia and Thailand for reviewing of operational usage	

(b) APAC States' Additional Considerations on Data Sharing

APAC States	Additional Considerations
Singapore	Singapore suggests that the countries can identify a set of raw data to be shared with other countries. Performance measures are good but does not provide insights into the "why". This will unlock value to operations. Singapore suggests that further efforts can be placed into organising the historical data that has been collected by Working Groups. E.g. clear folders/ documentation on what data is available and who can access this data, which will be helpful for member states who would like to review or conduct further analysis of the shared data.
Philippines	*N.A.*
Indonesia	Reciprocity and the right to access derived products resulted from the usage of shared data.
Hong Kong SAR	Resources associated with preparing, cleaning, storing, and securing data for sharing can be a major impediment
Australia	Based on sharing safety occurrence data across agencies within Australia, but would extend to any APAC framework, is ensuring that if data from the source is changed, it can be synchronised to all users, or users have a way to know that previous data has now been updated. The details of safety occurrences can change from the initial report to final review or investigation. Consideration of suitable lag times for making data available may also address this.
Cambodia	State policy/ regulation of each country.

(c) Existing Regulatory and/or Legal Requirements that APAC States Adhere To

APAC States	Existing Regulatory/ Legal Requirements

Singapore	Data Sharing within APAC N.A. Members adhere to the Terms of References of the Working Group. There is no legally binding agreement that Singapore refers to when sharing data to the above Working Groups. Data standards/ data quality used within Singapore For data sharing with the Working Groups, Singapore often collaborates with the members to develop a standard data template for all member states to adhere to, when contributing data. This ensures that the data shared is of a common standard, which facilitates the Working Group's analysis.
Philippines	*N.A.*
Indonesia	Data Sharing within APAC The exchange of historical data is currently managed on a case-by-case basis, as a specific regulatory framework for such exchanges has not yet been established. Data standards/ data quality used within Indonesia There is currently no known national standard on exchanging historical data. Data are exchanged based on the mutual agreements among parties regarding data quality, exchange frequency, etc.
Hong Kong SAR	*N.A.*
Australia	Data Sharing within APAC and Australia Based on sharing safety occurrence data across agencies within Australia, but would extend to any APAC framework, legal and regulatory considerations included: a. Privacy and handling confidential information b. Intellectual Property rights and end-user rights, obligations and risk c. Information Security which may also consider what data can be shared and stored outside of each country d. Freedom of Information obligations and how data will be treated if subject to disclosure requirements
Cambodia	*N.A.*

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