KPI OVERVIEW

KPI01	Departure punctuality
Definition	Percentage of flights departing from the gate on-time (compared to schedule).
Mesurement Units	% of scheduled flights
Operations Measured	IFR departures of scheduled airlines
Variants	Variant 1A – % of departures within ± 5 minutes of scheduled time of departure Variant 1B – % of departures delayed ≤ 5 minutes versus schedule Variant 2A – % of departures within ± 15 minutes of scheduled time of departure Variant 2B – % of departures delayed ≤ 15 minutes versus schedule
Objects Characterized	The KPI is typically computed for traffic flows, individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This is an airspace user and passenger focused KPI: departure punctuality gives an overall indication of the service quality experienced by passengers, and the ability of the airlines to execute their schedule at a given departure location.
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) or Scheduled off-block time (SOBT) • Actual off-block time (AOBT)
Data Feed Providers	Schedule database(s), airports, airlines and/or ANSPs

Formula / Algorithm	At the level of individual flights: 1. Exclude non-scheduled departures 2. Categorize each scheduled departure as on-time or not At aggregated level: 3. Compute the KPI: number of on-time departures divided by total number of scheduled departures
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • China / Europe benchmarking study (CAUC - EUROCONTROL, 2017)

KPI02	Taxi-out additional time
Definition	Actual taxi-out time compared to an unimpeded/reference taxi-out time.
Mesurement Units	Minutes/flight
Operations Measured	The duration of the taxi-out phase of departing flights
Variants	Variant 1 – basic (computed without departure gate and runway data) Variant 2 – advanced (computed with departure gate and runway data)
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is intended to give an indication of the efficiency of the departure phase operations on the surface of an aerodrome. This may include the average queuing that is taking place in front of the departure runways, non-optimal taxi routing and intermediate aircraft stops during taxi-out. The KPI is also typically used to estimate excess taxi-out fuel consumption and associated emissions (for the Environment KPA). The KPI is designed to filter out the effect of physical airport layout while focusing on the responsibility of ATM to optimize the outbound traffic flow from gate to take-off.
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. • Recommended approach for the advanced variant of the KPI: a separate value for each gate/runway combination, e.g. the average actual taxi-out time recorded during periods of non-congestion (needs to be periodically reassessed).

Data Requirement	For each departing flight: • Actual off-block time (AOBT) • Actual take-off time (ATOT) In addition, for the advanced KPI variant: • Departure gate ID • Take-off runway ID
Data Feed Providers	Airports (airport operations, A-CDM), airlines (OOOI data), ADS-B data providers and/or ANSPs
Formula / Algorithm	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
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • Singapore / US / Europe benchmarking study (CAAS - FAA - EUROCONTROL, 2017) • China / Europe benchmarking study (CAUC - EUROCONTROL, 2017) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

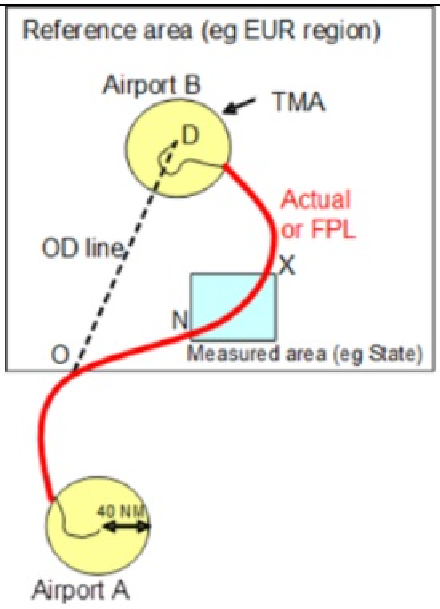
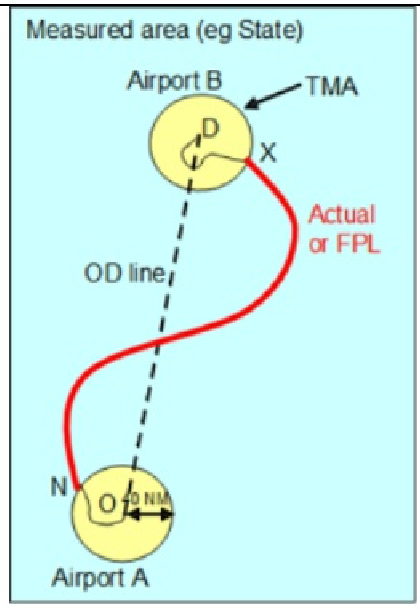
KPI03	ATFM slot adherence
Definition	Percentage of flights taking off within their assigned ATFM slot (Calculated Take-Off Time Compliance).
Mesurement Units	% of flights subject to flow restrictions
Operations Measured	The take-off of IFR flights subject to flow restrictions.
Variants	Variants are possible depending on the size of the ATFM slot window.
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).

Utility of the KPI	This KPI gives an indication of the capability of an airport to contribute to ATFM effectiveness by delivering outbound traffic in a predictable manner to the departure runway, in compliance with assigned ATFM slots.
Parameters	Size of the 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)
Data Feed Providers	Airports, ATFM service
Formula / Algorithm	At the level of individual flights: 1. Exclude flights not subject to an ATFM regulation 2. Categorize 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
References & Examples of Use	• PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Slot Tolerance Window (STW) compliance (Single European Sky Performance Scheme) • EDCT Window compliance (US) • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI04	Filed flight plan en-route extension
Definition	Flight planned en-route distance compared to a reference ideal trajectory distance.
Mesurement Units	% excess distance
Operations Measured	The planned en-route distance, as selected during the preparation of flight plans.
Variants	Variant 1, using a 40 NM cylinder around the departure and destination airport as the start/end of en-route airspace. Variant 2, using a 40 NM cylinder around the departure airport and a 100 NM cylinder around the destination airport as the start/end of en-route airspace.

Objects Characterized	The KPI can be computed for any volume of en-route airspace; this implies that it can be computed at State level (covering the FIRs of a State).
Utility of the KPI	This KPI measures the en-route horizontal flight (in)efficiency contained in a set of filed flight plans crossing an airspace volume. Its value is influenced by route network design, route & airspace availability, airspace user choice (e.g. to ensure safety, to minimize cost and to take into account wind and weather) and airspace user constraints (e.g. overflight permits, aircraft limitations). A significant gap between this KPI and the Actual en-Route Extension KPI indicates that many flights are not flown along the planned route, which should trigger an analysis of why this is happening.
Parameters	A '*Measured area*' is defined for which the KPI is computed. For example, a State. A '*Reference area*' is defined as a (sub)regional boundary considered, containing all '*Measured areas*', for example States within the same ICAO Region. Departure terminal area proxy: a cylinder with 40 NM radius around the departure airport. Destination terminal area proxy: a cylinder with 40 NM radius around the destination airport (variant 1). For variant 2 the radius is 100 NM.
Data Requirement	For each flight plan: • Departure airport (Point A) • Destination airport (Point B) • Entry point in the '*Reference area*' (Point O) • Exit point from the '*Reference area*' (Point D) • Entry points in the '*Measured areas*' (Points N) • Exit points from the '*Measured areas*' (Points X) • Planned distance for each NX portion of the flight
Data Feed Providers	ANSPs

Formula / Algorithm	For the horizontal trajectory of each flight, different parts (trajectory portions) are considered (see Figure 1 for the example of a flight departing outside the '*Reference Area*' and overflying a measured State; Figure 2 for the example of a domestic flight within a measured State): 1. The part of the flight which is within the reference area (segment OD). If airports A and/or B are located within the reference area, the points O and/or D are placed on the airport reference point (ARP). 2. The part of the flight for which the State level indicator is computed (between points N and X). If points A and/or B (the airports) are located within the measured State, the points N and/or X are placed on the 40 NM circle (variant 1) around the airport reference point as shown in Figure 2, to exclude terminal route efficiency from the indicator. Between points N and X, three quantities can be computed: the planned distance (length of flight plan trajectory), the local direct distance (great circle distance between N and X, not required for this indicator), and the contribution of the trajectory between N and X to the completion of the great circle distance between O and D. This contribution is called the "achieved distance". The formula for computing this is based on four great circle distances interconnecting the points O, N, X and D: achieved distance = [(OX-ON)+(DN-DX)]/2. When a given flight traverses multiple States, the sum of the planned distance in each State equals the total planned distance from O to D. Likewise the sum of all achieved distances equals the direct distance from O to D. The extra distance for a portion NX of a given flight is the difference between the actual/flight planned distance and the achieved distance. The total extra distance observed within a measured area (e.g. a State) over a given time period is the sum of the planned distances across all traversing flights, minus the sum of the achieved distances across all traversing flights. The KPI is computed as the total extra distance divided by total achieved distance, expressed as a percentage.
References & Examples of Use	• ICAO EUR Doc 030 EUR Region Performance Framework Document (July 2013) • Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

 Figure 1 - Significant points and trajectory segments (example 1)	 Figure 2 - Significant points and trajectory segments (example 2)

Significant points and trajectory segments (examples 1 and 2)

KPI05	Actual en-route extension
Definition	Actual en-route distance flown compared to a reference ideal distance.
Mesurement Units	% excess distance
Operations Measured	The actual distance flown by flights in en-route airspace.
Variants	Variant 1, using a 40 NM cylinder around the departure and destination airport as the start/end of en-route airspace. Variant 2, using a 40 NM cylinder around the departure airport and a 100 NM cylinder around the destination airport as the start/end of en-route airspace.
Objects Characterized	The KPI can be computed for a traffic flow or a volume of en-route airspace; this implies that it can be computed at State level (covering the FIRs of a State).

Utility of the KPI	This KPI measures the en-route horizontal flight (in)efficiency as actually flown, of a set of IFR flights crossing an airspace volume. Its value is influenced by route network design, route & airspace availability, airspace user choice (e.g. to ensure safety, to minimize cost and to take into account wind and weather) and airspace user constraints (e.g. overflight permits, aircraft limitations), and tactical ATC interventions modifying the trajectory (e.g. reroutings and 'direct to' clearances). The KPI is also typically used to estimate the excess fuel consumption and associated emissions (for the Environment KPA) attributed to horizontal flight inefficiency.
Parameters	Identical to the parameters of the 'Filed Flight Plan en-Route Extension' KPI.
Data Requirement	For each actual flight trajectory: • Departure airport (Point A) • Destination airport (Point B) • Entry point in the 'Reference Area' (Point O) • Exit point from the 'Reference Area' (Point D) • Entry points in the 'Measured Areas' (Points N) • Exit points from the 'Measured Areas' (Point X) • Distance flown for each NX portion of the actual flight trajectory, derived from surveillance data (radar, ADS-B...).
Data Feed Providers	ANSPs, ADS-B data providers
Formula / Algorithm	Identical to the formula/algorithm of the 'Filed Flight Plan en-Route Extension' KPI.
References & Examples of Use	• ICAO EUR Doc 030 EUR Region Performance Framework Document (July 2013) • Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI06	En-route airspace capacity
Definition	The maximum volume of traffic an airspace volume will safely accept under normal conditions in a given time period.
Mesurement Units	Variant 1: Movements/hr Variant 2: Number of aircraft (occupancy count)

Operations Measured	The nominal capability of an ANSP to deliver ATM services to IFR traffic in a given volume of en-route airspace, as seen at a given planning horizon. For each horizon a different type of capacity is to be considered: • Planned capacity: expected values one or more years ahead for planning and investment purposes • Declared capacity: values used during the strategic and pre-tactical ATFM processes • Expected capacity: values as finalised at the end of the pre-tactical process • Actual capacity: values as actually used on the day of operation during tactical ATFM and ATC.
Variants	Variant 1: airspace throughput (entry flow rate) Variant 2: airspace occupancy count
Objects Characterized	The KPI is typically used at the level of individual sectors (sector capacity) or en-route facilities (ACC capacity).
Utility of the KPI	The KPI measures an upper bound on the allowable throughput or occupancy count of an en-route facility or sector. Planned capacities are primarily used for multi-year and investment planning. Declared, expected and actual capacities are used in traffic flow management as well as for measuring and monitoring service delivery and efficiency. Some ANSPs may prefer not to declare capacities, and only have these capacities established on a daily basis based on known/current operational factors. Establishing capacities at different planning horizons provides an important reference for understanding the total system performance under normal operating conditions and provides a basis to work from when determining the impact of operational factors limiting capacity. These factors include – but are not limited to – ATCO availability and workload.
Parameters	Variant 1: time interval at which the throughput declaration is made. Variant 2: time interval at which the average occupancy count declaration is made.
Data Requirement	The various capacities are determined by the ANSP, and are dependent on traffic pattern, sector configuration, ATCO and system capability, etc.
Data Feed Providers	ANSPs
Formula / Algorithm	At the level of an individual en-route facility: 1. Select highest value from the set of established capacities (the maximum configuration capacity). 2. Compute the KPI: for variant 1, convert the value to an hourly movement rate, if the declaration is at smaller time intervals.
References & Examples of Use	• Brazil / Europe benchmarking study (DECEA - EUROCONTROL, 2017) • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI07	En-route ATFM delay

Definition	ATFM delay attributed to flow restrictions in a given en-route airspace volume
Mesurement Units	Minutes/flight
Operations Measured	The management of (temporary) capacity shortfalls in en-route airspace due to high demand and/or capacity reductions for a variety of reasons, resulting in the allocation of ATFM delay
Variants	None
Objects Characterized	The KPI can be computed for any volume of en-route airspace which participates in the ATFM process.
Utility of the KPI	This KPI is a time aggregation of the ATFM delay generated by flow restrictions which are established to protect a given volume of en-route airspace against demand/capacity imbalances. These flow restrictions (also called ATFM regulations) normally have a delay cause associated with them. This allows the KPI to be disaggregated by cause, which allows better diagnosis of the reasons for demand/capacity imbalances. Typically, the KPI is used to check whether ANSPs provide the capacity needed to cope with demand.
Parameters	None
Data Requirement	For each IFR flight: - Estimated Take-off Time (ETOT) computed from the last filed flight plan - Calculated Take-off Time (CTOT) - ID of the flow restriction generating the ATFM delay - Airspace volume associated with the flow restriction - Delay code associated with the flow restriction
Data Feed Providers	ATFM
Formula / Algorithm	At the level of individual flights: 1. Select the flights crossing the volume of en-route airspace 2. Select the subset of flights which are affected by the flow restrictions in this airspace 3. Compute ATFM delay: CTOT minus ETOT At aggregated level: 4. Compute the KPI: sum of ATFM delays divided by number of IFR flights crossing the airspace
References & Examples of Use	• ICAO EUR Doc 030 EUR Region Performance Framework Document (July 2013) • Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI08	Additional time in terminal airspace
Definition	Actual terminal airspace transit time compared to an unimpeded time. Actual trajectories are generally longer in time and distance due to path stretching and/or holding patterns. In the example below the unimpeded trajectories are shown in red, and the actual trajectories in green and blue. See Figure 1: Terminal trajectories.
Mesurement Units	Minutes/flight
Operations Measured	The terminal airspace transit time during the arrival flight phase.
Variants	Variants are possible depending on the chosen size of terminal airspace (40 NM or 100 NM cylinder) and the richness of the data feed: basic (without arrival runway ID) or advanced (with arrival runway ID) Variants with 100 NM cylinder are useful if airports have holding patterns outside the 40 NM cylinder. The use of generic cylinders abstracts local specifics in terms of approach airspace design (e.g. TMA) and ensures comparability across different airports. See table 1: Cylinder variants
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is intended to give an indication of the average queuing that is taking place in terminal airspace. This queuing is the result of sequencing and metering. The KPI captures the extent to which arriving flights are subjected to speed reductions, path extensions and holding patterns to absorb the queuing time. The KPI is also typically used to estimate excess fuel consumption and associated emissions (for the Environment KPA) attributable to horizontal flight inefficiency in terminal airspace. The KPI is designed to filter out the operational variability of terminal airspace transit time (e.g. due to wind, aircraft speed and length of the approach procedure, such as the difference between a straight-in approach and a downwind arrival) while focusing on the responsibility of ATM to optimize the inbound traffic flow from terminal airspace entry to landing.

Parameters	Destination terminal area proxy (also called Arrival Sequencing and Metering Area – ASMA): a cylinder with 40 NM radius around the destination airport. For variants A100 and B100 the radius is 100 NM. For the advanced variants only: list of terminal airspace entry segments (used to group flights entering the cylinder from ± the same direction). Unimpeded terminal airspace transit time: • Recommended approach for the basic variants of the KPI: a single value at airport level = 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 variants of the KPI: a separate value for each entry segment/landing runway combination = the average terminal airspace transit time recorded during periods of non-congestion (needs to be periodically reassessed).
Data Requirement	For each arriving flight: • Terminal airspace entry time, computed from surveillance data (radar, ADS-B...) • Actual landing time (ALDT) In addition, for the advanced KPI variants: • Terminal airspace entry segment, computed from surveillance data (radar, ADS-B...) • Landing runway ID
Data Feed Providers	Airlines (OOOI data), airports, ADS-B data providers and/or ANSPs
Formula / Algorithm	At the level of individual flights: 1. Select arrivals, exclude helicopters 2. Compute actual terminal airspace transit time: ALDT minus terminal airspace entry time 3. Compute additional terminal airspace transit time: actual terminal airspace transit time minus unimpeded terminal airspace transit time At aggregated level: 4. Compute the KPI: sum of additional terminal airspace transit times divided by number of IFR arrivals
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • Singapore / US / Europe benchmarking study (CAAS - FAA - EUROCONTROL, 2017) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

	40 NM cylinder	100 NM cylinder
Advanced data feed	Variant A40	Variant A100
Basic data feed	Variant B40	Variant B100

Table 1: Cylinder variants

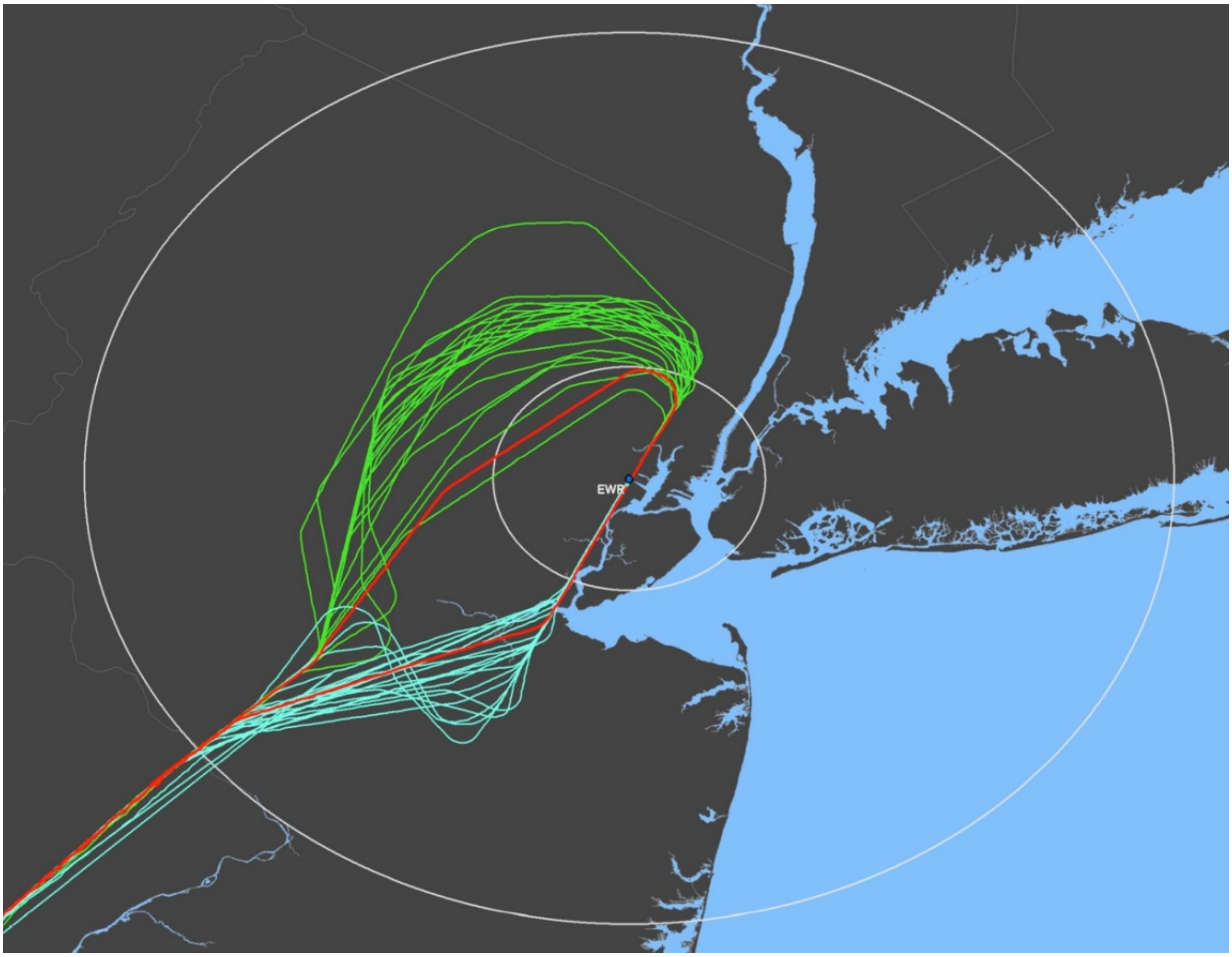


Figure 1: Terminal trajectories

KPI09	Airport peak capacity
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.
Mesurement Units	Number of departures / hour, Number of landings / hour, Number of (departures+landings) / hour
Operations Measured	The capacity declaration of an airport.
Variants	Variant A: Airport peak arrival capacity Variant D: Airport peak departure capacity Variant AD: Airport peak movement capacity (departures + arrivals)
Objects Characterized	The KPI is computed for individual airports.
Utility of the KPI	This KPI indicates the highest number of operations that an airport will accept, using the most favorable runway configuration under optimum operational conditions. The runways may or may not be the most constraining factor for airport capacity: at some airports the most constraining factor may be the terminal airspace, the taxiways, the number of gates, passenger handling capacity etc. The KPI is typically used for scheduling and ATFM purposes, and to develop capacity investment plans.
Parameters	None
Data Requirement	Scheduling parameters for slot controlled airports Airport Acceptance Rates (AAR), Airport Departure Rates (ADR)
Data Feed Providers	Airports
Formula / Algorithm	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.
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • Brazil / Europe benchmarking study (DECEA - EUROCONTROL, 2017) • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI10	Airport peak throughput
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.
Mesurement Units	Number of departures / hour, Number of landings / hour, Number of (departures+landings) / hour
Operations Measured	The actual number of operations at an airport.
Variants	Variant 1: IFR operations only Variant 2: IFR + VFR operations (relevant for airports with a high percentage of VFR traffic) To be combined with: Variant A: Airport peak arrival throughput Variant D: Airport peak departure throughput Variant AD: Airport peak movement throughput (departures + arrivals)
Objects Characterized	The KPI is computed for individual airports.
Utility of the KPI	This KPI gives an indication of “busy-hour” actual movement rates at an airport, as recorded during a given time period. For congested airports, this throughput is an indication of the effectively realized capacity; for uncongested airports it is a measure of demand.
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).
Data Feed Providers	Airports

Formula / Algorithm	At the level of individual flights: 1. Select flights, exclude helicopters At the level of individual “rolling” hours: 2. Convert the set of flights to hourly landing rates and 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 rate value of the 95th percentile of the “rolling” hours
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • Singapore / US / Europe benchmarking study (CAAS - FAA - EUROCONTROL, 2017) • China / Europe benchmarking study (CAUC - EUROCONTROL, 2017) • Brazil / Europe benchmarking study (DECEA - EUROCONTROL, 2017)

KPI11	Airport throughput efficiency
Definition	Airport throughput (accommodated demand) compared to capacity or demand, whichever is lower. Can be computed for arrivals, departures or arrivals+departures.
Mesurement Units	Average Over/Under Delivery or % of accommodated operations.
Operations Measured	The number of unaccommodated operations at an airport.
Variants	Variant A: IFR arrivals Variant D: IFR departures Variant AD: IFR Operations (arrivals + departures)
Objects Characterized	The KPI is computed for individual airports.
Utility of the KPI	This KPI assesses how effectively capacity is managed by the ANSP. It is a measure of accommodated demand, compared to the available capacity of the airport, irrespective of the delay incurred by arriving traffic. Seen in another way, it captures the “missed” slots. At congested airports, the KPI relates the throughput to the declared capacity. At uncongested airports (or airports without declared capacity) the KPI relates the throughput to the unconstrained demand based on flight plans.
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

Data Feed Providers

Airports

Formula / Algorithm

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

3a. if demand >= capacity: efficiency = throughput / capacity

3b. if demand < capacity: efficiency = throughput / demand

At aggregated level (longer time periods):

4. Compute the KPI: sum(efficiency*demand) / sum(demand)

Note: See Table 1: Example for arrivals. The average percentage weighted by actual arrivals is 96.1%. The average under-delivery of arrivals is -1.8. The same process can be used for departures or combined operations.

References & Examples of Use

- Singapore / US / Europe benchmarking study (CAAS - FAA - EUROCONTROL, 2017)
- Brazil / Europe benchmarking study (DECEA - EUROCONTROL, 2017)
- CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

Hour	15	16	17	18	19	20	21	22	23
Data									
Demand	41	58	59	70	67	59	63	72	66
Capacity	35	35	35	35	35	35	40	45	45
Throughput	30	38	36	36	36	32	35	37	44
Performance Score									
Throughput / Min (Demand, Capacity)	85.7%	108%	103%	103%	103%	91.4%	87.5%	82.2%	97.8%
Throughput minus Min (Demand, Capacity)	-5	3	1	1	1	-3	-5	-8	-1

Table 1: Example for arrivals

KPI12	Airport/Terminal ATFM delay
Definition	ATFM delay attributed to arrival flow restrictions at a given airport and/or associated terminal airspace volume.
Mesurement Units	Minutes/flight
Operations Measured	The management of (temporary) capacity shortfalls at and around destination airports due to high demand and/or capacity reductions for a variety of reasons, resulting in the allocation of ATFM delay.
Variants	None
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is a time aggregation of the ATFM delay generated by flow restrictions which are established to protect a destination airport or its terminal area against demand/capacity imbalances. If a terminal area covers multiple airports, each individual flight delay is attributed to the corresponding destination airport. These flow restrictions (also called ATFM regulations) normally have a delay cause associated with them. This allows the KPI to be disaggregated by cause, which allows better diagnosis of the reasons for demand/capacity imbalances. Typically, the KPI is used as a proxy to check whether airports and ANSPs provide the capacity needed to cope with demand.

Parameters	None
Data Requirement	For each IFR flight: • Estimated Take-off Time (ETOT) computed from the last filed flight plan • Calculated Take-off Time (CTOT) • ID of the flow restriction generating the ATFM delay • Airport or terminal airspace volume associated with the flow restriction • Delay code associated with the flow restriction
Data Feed Providers	ATFM
Formula / Algorithm	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 at 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
References & Examples of Use	• ICAO EUR Doc 030 EUR Region Performance Framework Document (July 2013) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal • Single European Sky Performance Scheme • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI13	Taxi-in additional time
Definition	Actual taxi-in time compared to an unimpeded/reference taxi-in time
Mesurement Units	Minutes/flight
Operations Measured	The duration of the taxi-in phase of arriving flights
Variants	Variant 1 – basic (computed without landing runway and arrival gate data) Variant 2 – advanced (computed with landing runway and arrival gate data)
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).

Utility of the KPI	This KPI is intended to give an indication of the various taxi-in inefficiencies that occur after landing. Its value may be influenced by unavailability of the arrival gate and effects such as non-optimal taxi routing and intermediate aircraft stops during taxi-in. The KPI is also typically used to estimate excess taxi-in fuel consumption and associated emissions (for the Environment KPA). The KPI is designed to filter out the effect of physical airport layout while focusing on the responsibility of the airport to provide parking space and ATM to optimize the inbound traffic flow from landing to in-blocks.
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 • 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)
Data Requirement	For each arriving flight: • Actual landing time (ALDT) • Actual in-block time (AIBT) In addition, for the advanced KPI variant: • Landing runway ID • Arrival gate ID
Data Feed Providers	Airports (airport operations), airlines (OOOI data), ADS-B data providers and/or ANSPs
Formula / Algorithm	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
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • China / Europe benchmarking study (CAUC - EUROCONTROL, 2017) • PRC Performance Review Report (EUROCONTROL 2017) • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI14	Arrival punctuality

Definition	Percentage of flights arriving at the gate on-time (compared to schedule)
Mesurement Units	% of scheduled flights
Operations Measured	IFR arrivals of scheduled airlines
Variants	Variant 1A – % of arrivals within ± 5 minutes of scheduled time of arrival Variant 1B – % of arrivals delayed ≤ 5 minutes versus schedule Variant 2A – % of arrivals within ± 15 minutes of scheduled time of arrival Variant 2B – % of arrivals delayed ≤ 15 minutes versus schedule
Objects Characterized	The KPI is typically computed for traffic flows, individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This is an airspace user and passenger focused KPI: arrival punctuality gives an overall indication of the service quality experienced by passengers, and the ability of the airlines to execute their schedule at a given destination.
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) or Scheduled in-block time (SIBT) • Actual in-block time (AIBT)
Data Feed Providers	Schedule database(s), airports, airlines and/or ANSPs
Formula / Algorithm	At the level of individual flights: 1. Exclude non-scheduled arrivals 2. Categorize each scheduled arrival as on-time or not At aggregated level: 3. Compute the KPI: number of on-time arrivals divided by total number of scheduled arrivals
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • China / Europe benchmarking study (CAUC - EUROCONTROL, 2017) • PRC Performance Review Report (EUROCONTROL 2017)

KPI15	Flight time variability

Definition	Distribution of the flight (phase) duration around the average value.
Mesurement Units	Minutes/flight
Operations Measured	Scheduled flights with the same flight ID on a given airport-pair (flight XYZ123 from A to B): the gate-to-gate duration, and at more detailed level the duration of the individual flight phases (taxi-out, airborne, taxi-in)
Variants	Different parameter values possible (see 'Parameters').
Objects Characterized	The KPI is typically computed for the scheduled traffic flows interconnecting a given cluster of airports (two or more; selection/grouping based on size and/or geography).
Utility of the KPI	The "variability" of operations determines the level of predictability for airspace users and hence has an impact on airline scheduling. It focuses on the variance (distribution widths) associated with the individual phases of flight as experienced by airspace users. The higher the variability, the wider the distribution of actual travel times and the more costly time buffer is required in airline schedules to maintain a satisfactory level of punctuality. In addition, reducing the variability of actual block times can potentially reduce the amount of excess fuel that needs to be carried for each flight in order to allow for uncertainties.
Parameters	Minimum monthly flight frequency filter: flights with a frequency less than 20 times per month are not included in the indicator. Outlier filter: Variant 1: Only 70% of the (remaining) flights are considered in the indicator, i.e. the 15th percentile (percentile 1) is used to determine the shortest duration, the 85th percentile (percentile 2) is used to determine the longest duration Variant 2: Only 60% of the (remaining) flights are considered in the indicator, i.e. the 20th percentile (percentile 1) is used to determine the shortest duration, the 80th percentile (percentile 2) is used to determine the longest duration
Data Requirement	For each flight: OOOI data: gate "out" (AOBT), wheels "off," wheels "on," and gate "in" (AIBT) actual times.
Data Feed Providers	Airlines

Formula / Algorithm	At the level of flights with the same flight ID, at monthly or longer (e.g. annual) time aggregation level: 1. Exclude flight IDs not meeting the minimum monthly frequency requirement 2. Sort flights in ascending order of flight (phase) duration 3. Identify shortest (percentile 1) and longest (percentile 2) duration 4. Compute variability: (longest – shortest) / 2 At the more aggregated level: 5. Compute the KPI: weighted average of the individual flight ID variabilities
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • CANSO Recommended KPIs for Measuring ANSP Operational Performance (2015)

KPI16	Additional fuel burn
Definition	Additional flight time/distance and vertical flight inefficiency converted to estimated additional fuel burn attributable to ATM
Mesurement Units	kg fuel/flight
Operations Measured	Actual IFR flights
Variants	Variant 1 – simple approach: calculation based on the average value other KPIs for groups of flights and corresponding average fuel burn values Variant 2 – advanced approach: calculation based on values computed for individual flights
Objects Characterized	This KPI is a conversion of the additional flight time/distance and vertical flight inefficiency KPIs to a corresponding (estimated) additional fuel consumption; hence it describes a performance characteristic of the same objects as the additional flight time/distance and vertical flight inefficiency KPIs: en-route airspace, terminal airspace and airports. Typically the KPI is published at the level of a State or (sub)region.

Utility of the KPI	This KPI is designed to provide a simple method for estimating ATM-related fuel efficiency at aggregated level, without the need to model fuel burn at the level of individual flights. By adding the average additional fuel burn value of the individual flight phases, a gate-to-gate value is produced which is representative for an "average flight". The KPI is often further converted into additional CO2 emission (for the environment KPA) and/or the monetary value of fuel savings (for the cost effectiveness KPA). The KPI is sometimes called the "benefit pool": it gives an indication of the ATM-induced flight inefficiency that is theoretically actionable by ATM. In practice the actionable "benefit pool" is smaller: real optimum performance is achieved at a residual non-zero value of the KPI.
Parameters	Average fuel flow (kg/min) during taxi Average fuel flow (kg/min) during arrival in terminal airspace Average fuel flow (kg/km) in en-route airspace Average additional fuel flow (kg/FL/km) during cruise due to flying lower
Data Requirement	Indicator values to be converted to estimated additional fuel burn: KPI02 Taxi-Out Additional Time (min/flight) KPI13 Taxi-In Additional Time (min/flight) KPI05 Actual en-Route Extension (%) & average en-route distance flown (km/flight) KPI08 Additional time in terminal airspace (min/flight) KPI17 Level-off during climb KPI18 Level capping during cruise & average cruise (ToC-ToD) distance flown (km/flight) KPI19 Level-off during descent
Data Feed Providers	Performance analysts
Formula / Algorithm	At aggregated level: Compute the KPI: (KPI02 Taxi-Out Additional Time x Average fuel flow during taxi) + (KPI13 Taxi-In Additional Time x Average fuel flow during taxi) + (KPI05 Actual en-Route Extension (%) x Average en-route distance flown x Average fuel flow in en-route airspace) + (KPI08 Additional time in terminal airspace x Average fuel flow during arrival in terminal airspace) + (KPI17 Level-off distance during climb x Average additional fuel flow during climb) + (KPI18 Average number of FL too low x Average distance during cruise x Average additional fuel flow per FL too low during cruise) + (KPI19 Level-off distance during descent x Average additional fuel flow during descent).
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016)

KPI17	Level-off during climb
Definition	Distance and time flown in level flight before Top of Climb.
Mesurement Units	NM/flight and minutes/flight
Operations Measured	Actual IFR flights
Variants	Variant 1: Average distance flown in level flight before Top of Climb Variant 2: Average time flown in level flight before Top of Climb
Objects Characterized	The KPI is typically computed for traffic flows, individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is intended to give an indication of the amount of level flight during the climb phase. Ideally, there should be no level flight during climbs because level flight results in a higher fuel burn and possibly more noise. Aircraft should reach their cruising altitudes as soon as possible since the fuel consumption is lower at higher altitudes.
Parameters	• Analysis radius: the radius around the analysed airport within which the climb trajectory is analysed (e.g. 200NM). • Vertical speed limit: maximum vertical speed used to detect the start and end of a level segment (e.g. 300 feet/minute). • Level band limit: altitude band within which data points have to stay to be included in a level segment (e.g. 200 feet). • Minimum level time: minimum time duration for a level segment to be considered in the results (e.g. 20 seconds). • Exclusion box percentage: percentage of the Top of Climb altitude which is used to define the lower altitude of the exclusion box (e.g. 90%). E.g. level segments occurring above the lower altitude limit of the exclusion box and longer than the exclusion box time are excluded from the results. • Exclusion box time: a level segment in the exclusion box and longer than the exclusion box time is excluded (e.g. 5 minutes). • Minimum altitude: the altitude where the level segment detection during the climb starts. The trajectory below this altitude is not analysed (e.g. 3000 feet).
Data Requirement	For each flight trajectory: • 4D data points (latitude, longitude, altitude and time) • Departure airport ARP coordinates
Data Feed Providers	Trajectory data providers (reporting archived actual trajectories based on ADS-B and/or other surveillance data sources) and/or ANSPs.

Formula / Algorithm	Level segments in the climb trajectory within the analysis radius are detected using the vertical speed limit and level band limit. The methodology considers a data point as the start of a level segment when the following conditions are met: • the altitude difference with the next data point is less than or equal to the level band limit; and • the vertical speed towards the next data point is less than or equal to the vertical speed limit. The level segment ends when the altitude difference between the altitude of the beginning of the level segment and the altitude of a data point is more than the level band limit or when the vertical speed between two consecutive data points is more than the vertical speed limit.
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal

KPI18	Level capping during cruise
Definition	Flight Level difference between maximum Flight Levels on a measured airport pair and maximum Flight Levels on similar unconstrained airport pairs.
Mesurement Units	Flight Levels/flight
Operations Measured	The cruise phase of IFR flights.
Variants	Variant 1: based on the maximum cruise Flight Level in the last filed flight plans Variant 2: based on the maximum cruise Flight Level of actual trajectories (surveillance data)
Objects Characterized	The KPI is typically computed for traffic flows on individual airport pairs or groups of airport pairs (weighted average).
Utility of the KPI	This KPI is intended to give an indication of the amount of vertical flight inefficiency related to maximum Flight Levels during the cruise phase (level capping). It measures the average Flight Level difference between the maximum Flight Levels of respectively flights on the analysed airport pair and flights on similar unconstrained airport pairs. The KPI is purely based on statistical processing of vertical flight profiles; it does not require any data on operational level capping constraints.

Parameters

- Great Circle Distance (GCD) interval: the width of the ranges of great circle distances (e.g. 10NM). If 10 NM is used, reference distributions are built for airport pairs with a great circle distance in the following ranges: [0NM, 10NM), [10NM, 20NM), [20NM, 30NM)...
- Number of reference flights: minimum number of flights in every GCD interval (e.g. 1000 flights).
- Percentile interval: the interval between the calculated percentiles of the distributions (e.g. 1 percent).
- Excluded flights percentage: percentage of flights excluded from the higher and lower end of the distributions to account for outliers (e.g. 10%).

Data Requirement

For each flight trajectory:

- Maximum cruise Flight Level
- Departure airport
- Arrival airport

Data Feed Providers

For variant 1: ANSPs; For variant 2: Trajectory data providers (reporting archived actual trajectories based on ADS-B and/or other surveillance data sources) and/or ANSPs

Formula / Algorithm

Reference distributions of the maximum Flight Levels of reference flights are built for every GCD interval. Reference flights are flights on airport pairs which have a great circle distance similar to the great circle distance of the analysed airport pair and which have no flight level capping constraints. The reference distributions are then converted into percentiles for every percentile interval.

Distributions and percentiles for the analysed airport pair are calculated in the same way.

For each percentile interval, the Flight Level value of the airport pair is subtracted from the Flight Level value of the reference. When the airport pair value is higher than the reference value, the result of the subtraction is negative. This might appear as if the flights are more efficient than the reference flights. Nevertheless, the focus is put on finding the inefficiencies, so negative values are set to 0.

The result of the percentile interval is then multiplied by the number of flights corresponding to the percentile interval (e.g. if the width of the percentile interval is 1%, the number of flights corresponding to the percentile interval is 1% of the total number of flights on the airport pair).

Summing up over all percentile intervals gives the total vertical flight inefficiency (number of Flight Levels summed over all flights). The vertical flight inefficiency per flight value is then calculated by dividing the total vertical flight inefficiency by the number of flights on the considered airport pair. The number of flights for this calculation step is 80% of the total number of flights on the airport pair if the excluded flights percentage is 10% (lowest 10% and highest 10% of the flights are not used).

This methodology is done for groups of aircraft types having similar performance to avoid comparing e.g. jet aircraft and turboprop aircraft which have significantly different nominal cruising altitudes.

References & Examples of Use

- PRC Performance Review Report (EUROCONTROL 2017)

KPI19	Level-off during descent
Definition	Distance and time flown in level flight after Top of Descent.
Mesurement Units	NM/flight and minutes/flight
Operations Measured	Actual IFR flights.
Variants	Variant 1: Average distance flown in level flight after Top of Descent Variant 2: Average time flown in level flight after Top of Descent
Objects Characterized	The KPI is typically computed for traffic flows, individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is intended to give an indication of the amount of level flight during the descent phase. Ideally, there should be no level flight during descents because level flight results in a higher fuel burn and possibly more noise. Ideally, aircraft should be able to descend from Top of Descent until touchdown.
Parameters	• Analysis radius: the radius around the analysed airport within which the descent trajectory is analysed (e.g. 200NM). • Vertical speed limit: maximum vertical speed used to detect the start and end of a level segment (e.g. 300 feet/minute). • Level band limit: altitude band within which data points have to stay to be included in a level segment (e.g. 200 feet). • Minimum level time: minimum time duration for a level segment to be considered in the results (e.g. 20 seconds). • Exclusion box percentage: percentage of the Top of Descent altitude which is used to define the lower altitude of the exclusion box (e.g. 90%). E.g. level segments occurring above the lower altitude limit of the exclusion box and longer than the exclusion box time are excluded from the results. • Exclusion box time: a level segment in the exclusion box and longer than the exclusion box time is excluded (e.g. 5 minutes). • Minimum altitude: the altitude where the level segment detection during the descent ends. The trajectory below this altitude is not analysed (e.g. 1800 feet).
Data Requirement	For each flight trajectory: • 4D data points (latitude, longitude, altitude and time) • Arrival airport ARP coordinates
Data Feed Providers	Trajectory data providers (reporting archived actual trajectories based on ADS-B and/or other surveillance data sources) and/or ANSPs.

Formula / Algorithm	Level segments in the descent trajectory within the analysis radius are detected using the vertical speed limit and level band limit. The methodology considers a data point as the start of a level segment when the following conditions are met: • the altitude difference with the next data point is less than or equal to the level band limit; and • the vertical speed towards the next data point is less than or equal to the vertical speed limit. The level segment ends when the altitude difference between the altitude of the beginning of the level segment and the altitude of a data point is more than the level band limit or when the vertical speed between two consecutive data points is more than the vertical speed limit.
References & Examples of Use	• Comparison of ATM-Related Operational Performance: U.S./Europe (September 2016) • PRC Performance Review Report (EUROCONTROL 2017) • European ANS Performance Data Portal

KPI20	Number of aircraft accidents
Definition	'Accident' is defined in ICAO Annex 13, Chapter 1-Definitions; ADREP: Accident Data Report
Mesurement Units	Number of accidents / year
Operations Measured	Aircraft accidents during all flight phases that occurred in a year within the State/Region of occurrence..
Variants	Variant 1 (GASP): Aircraft MTOW > 2 250 kg 1.1 National accident occurrence level 1.2 Regional accident occurrence level Variant 2: All aircraft 2.1 National accident occurrence level 2.2 Regional accident occurrence level
Objects Characterized	The KPI is typically computed for individual State, or Region (selection/grouping based on geography)
Utility of the KPI	The KPI is typically computed for individual State, or Region (selection/grouping based on geography)
Parameters	None.

Data Requirement	For each reported occurrence: Date of occurrence Occurrence Category State of occurrence
Data Feed Providers	ICAO ADREP database; iSTARS Application "ADREP et al."
Formula / Algorithm	Count accidents if: a) The local date of occurrence is in between 01 January and 31 December of the year in question; b) It is of the type that is notifiable to ICAO; c) The circumstances of the accidents match the definition of Annex 13 definition of 'Accident'; and d) If variant 1, the aircraft involved in the accident is of maximum take-off mass of over 2 250 kg
References & Examples of Use	• ADREP: Accident Data Report • EUROCONTROL Performance Review Report 2019 • EUROCONTROL Performance Review Report 2015 • EASA Annual Safety Review 2020 • UAE SAFETY MANAGEMENT SYSTEM (SMS)

KPI21	Number of runway incursions
Definition	Number of occurrences at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and take-off of aircraft. (CICTT Taxonomy definition)
Mesurement Units	Number of runway incursions / year
Operations Measured	The actual number of runway incursions at an aerodrome
Variants	None
Objects Characterized	The KPI is computed for individual aerodrome
Utility of the KPI	This KPI gives an indication of the incorrect or unsafe usage of the runways and of the safety performance improvement on the runway.
Parameters	None

Data Requirement	For each reported occurrence: Date of occurrence Airport of occurrence
Data Feed Providers	Airports and airlines
Formula / Algorithm	Count number of runway incursions: a) the local date of occurrence in between 01 January and 31 December of the year in question; and b) the circumstances of the occurrence match the definition of CICTF 'RI'; or the occurrence category has been determined to be runway incursion – vehicle, aircraft or person (RI-VAP).
References & Examples of Use	• EUROCONTROL Performance Review Report 2019 • EUROCONTROL Performance Review Report 2015 • UAE SAFETY MANAGEMENT SYSTEM (SMS) • SINGAPORE RUNWAY INCURSION IN SELETAR BY VEHICLE

KPI22	Number of runway excursions
Definition	Number of veer offs or overruns of the runway surface.
Mesurement Units	Number of runway excursions / year
Operations Measured	• Only applicable during either the takeoff or landing phase. • The excursion may be intentional or unintentional. For example, the deliberate veer off to avoid a collision, brought about by a Runway Incursion. In this case, code both categories. • Use RE in all cases where the aircraft left the runway/helipad/helideck regardless of whether the excursion was the consequence of another event.
Variants	None
Objects Characterized	The KPI is computed for individual aerodrome.
Utility of the KPI	This KPI gives an indication of the incorrect or unsafe usage of the runways and of the safety performance improvement on the runway.
Parameters	None
Data Requirement	For each reported occurrence: Date of occurrence Airport of occurrence

Data Feed Providers	Airports and airlines
Formula / Algorithm	Count number of runway excursions: a) the local date of occurrence in between 01 January and 31 December of the year in question; b) the circumstances of the occurrence match the definition of CICTT 'RE'; and c) the Occurrence Category has been determined to be runway excursion (RE).
References & Examples of Use	• EUROCONTROL Performance Review Report 2019 • EUROCONTROL Performance Review Report 2015 • EASA Annual Safety Review 2020 • UAE SAFETY MANAGEMENT SYSTEM (SMS) • SINGAPORE T-50 RUNWAY EXCURSION DURING TAKE-OFF FROM CHANGI AIRPORT

KPI23	Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)
Definition	Number of airproxes, TCAS alerts, loss of separation as well as near collisions or collisions between aircraft in flight.
Mesurement Units	Number of airprox/TCAS alert/loss of separation/near midair collisions/midair collisions (MAC)/ year
Operations Measured	· Includes all collisions between aircraft while both aircraft are airborne. · Both air traffic control and cockpit crew separation-related occurrences are included. · Genuine TCAS alerts are included here.
Variants	Variant 1: Number of airproxes Variant 2: TCAS alerts Variant 3: loss of separation Variant 4: near midair collisions Variant 5: midair collisions (MAC)
Objects Characterized	The KPI is computed for volumes of airspace as designated by the State.
Utility of the KPI	This KPI gives an indication of safety performance improvement in the air.
Parameters	None

Data Requirement	For each reported occurrence: Date of occurrence FIR of occurrence
Data Feed Providers	ANSPs and airlines
Formula / Algorithm	Count number of airproxes, TCAS alerts, loss of separation as well as near collisions or collisions between aircraft in flight: a) the local date of occurrence in between 01 January and 31 December of the year in question; b) the circumstances of the occurrence match the definition of CICTT 'MAC'; and c) the Occurrence Category has been determine
References & Examples of Use	• EUROCONTROL Performance Review Report 2015 • EASA Annual Safety Review 2020 • UAE SAFETY MANAGEMENT SYSTEM (SMS)

KPI24	People/Area Impacted by Significant Noise
Definition	Quantification of population/area size exposed to noise above a specified threshold(s)
Mesurement Units	People/Area
Operations Measured	Take-off, departure, arrival, approach
Variants	Variants can be based on different metrics that are considered acceptable by different global jurisdictions. Examples of noise metrics include DNL, Lden, LAeq.
Objects Characterized	The KPI is typically computed for individual airports, or clusters of airports (selection/grouping based on size and/or geography).
Utility of the KPI	This KPI is intended to give an indication of the total noise footprint impact of all operations on people living and working in the vicinity of airports. The noise impact can be used for assessing the total noise of an airport, the change in noise impact due to operational improvements, air traffic system changes, and airport growth.
Parameters	• Area within a noise footprint contour representing a given threshold level of significant noise • Total number of people living within a noise footprint contour representing a given threshold level of significant noise

Data Requirement	• Noise monitoring data from NTK systems • Flight tracks • Aircraft type • Mission range/take-off mass • Number of departures/arrivals • Population/census data
Data Feed Providers	Airports (airport operations), airlines (OOOI data), ADS-B data providers and/or ANSPs
Formula / Algorithm	In a noise modelling tool: a) Determine the total number of movements by aircraft type b) Assign flight procedures to each movement c) Compute the noise footprint d) Generate contours of the significance threshold, and the area/people within that contour
References & Examples of Use	