Report commissioned by the
Performance Review Commission

ATM Airport Performance (ATMAP) Framework

Measuring Airport Airside and Nearby Airspace Performance

December 2009

EUROCONTROL

BACKGROUND

This report has been produced by the Performance Review Commission (PRC). The PRC was established by the Permanent Commission of EUROCONTROL in accordance with the ECAC Institutional Strategy 1997. One objective of this strategy is "to introduce a strong, transparent and independent performance review and target setting system to facilitate more effective management of the European ATM system, encourage mutual accountability for system performance…"

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NOTICE

The PRC has made every effort to ensure that the information and analysis contained in this document are as accurate and complete as possible. Only information from quoted sources has been used and information relating to named parties has been checked with the parties concerned. Despite these precautions, should you find any errors or inconsistencies we would be grateful if you could please bring them to the PRU's attention.

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PERFORMANCE REVIEW UNIT

Prepared by the Performance Review Unit

15 December 2009

ATMAP Framework

(A Framework for Measuring Airport Airside and Nearby Airspace Performance)

VERSION 1

PERFORMANCE REVIEW UNIT

EUROCONTROL

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Executive Summary

The ATMAP (ATM Airport Performance) Project was launched by the Performance Review Commission (PRC) with a view to developing a framework to review ANS performance at coordinated airports (IATA Level 3) in consultation with aviation stakeholders.

The review of ANS performance at airports is explicitly included in the PRC's Terms of Reference. Article 2 (b) of the PRC's Terms of Reference states: *"the PRU shall propose, monitor and report on ATM related performance parameters which could include compliance with ATM procedures, airlines slot wastage (e.g. multiple flight planning); airlines ATM delay inducement (e.g. near simultaneous flight scheduling for same route(s)); airports (e.g. inadequacy of airside facilities); and other related factors".*

The "Performance scheme" of the second package of Single European Sky regulations (SES II, FR Art 11) states that: "*the establishment of the performance scheme shall take into account that en route services, terminal services and network functions are different and should be treated accordingly, if necessary also for performance-measuring purposes."*

Beyond any legal obligation, it is important to build a common understanding and proactive management of ANS performance at main airports, using a performance framework which is shared by all concerned parties and is actionable by authorities and service providers.

Accordingly, the PRC agreed in late-2007 to launch a project to establish a set of validated performance indicators addressing ANS performance at and around airports (ATMAP). Some 19 major airports, their corresponding ANSPs, major airlines, the Agency and IATA were involved on a voluntary basis. Together with the PRU and PRC representatives, they comprised the ATMAP Working Group.

The ATMAP project started in December 2007 and its Phase I was completed in July 2009 with the production of this report, which was approved by the PRC in October 2009. The main objectives agreed for that phase were as follows:

- Developing a high-level framework for consistent and continuous review of airside air transport performance with a focus on ATM;
- Identifying a set of easily understandable high-level indicators (KPIs) which enables interested parties:
  - to understand airside aspects of air transport performance network;
  - to measure performance across airports and over time;
  - to position ATM performance within airside air transport performance;
- Validating high-level indicators and performance measurement framework in consultation with airport stakeholders (airlines, airport operators, Air Navigation Service Providers).
- Specifying the underlying data required to populate the performance framework.

As a number of external factors have an impact on performance, airports are not directly comparable. This report does not attempt to establish a framework for comparison between airports, but a framework to measure ANS performance at main airports in a consistent and uniform manner throughout Europe, and possibly beyond.

This performance framework has been developed with the active support of the

ATMAP consultation group, which included 19 airport communities (airlines, airport operator and ANSP), the EUROCONTROL Agency and IATA.

The ATMAP performance framework measures the performance from an "airport system perspective" without assigning accountability to each stakeholder (airlines, airport operator, Air Traffic Control, Meteo office, ground handlers, de-icing services, etc.). The framework should further evolve in the second phase of ATMAP (August 2009 – December 2010) so as to be usable for ANS target setting purposes.

Air transport operational performance is the "end product" of complex interrelated systems, involving aircraft operators, airport operators and ANSPs. Hence, in view of the interlinked nature of the system, ATM performance measurement at airports cannot be seen as an independent and isolated structure. There is a clear interrelation not only between airlines, airport operators and ANS at a given airport, but also between air transport performance at major airports and at European network level.

The ATMAP performance framework contained in this report is made up of the following components:

- the definition of the scope within which the measurement is conducted;
- a list of factors affecting performance which have to be taken into account in order to contextualise performance at each airport;
- relevant Key Performance Areas (KPAs) to describe the performance objectives of an airport community (i.e. the common performance goals that all airport stakeholders wish to achieve together);
- Key Performance Indicators (KPIs) to measure performance in KPAs;
- data requirements to populate KPIs;
- a number of approaches on how to use the KPIs in order to assess and evaluate performance.

KPIs have been developed, tested and verified in the following KPAs:

- Flight Demand and Traffic Volume;
- Airport Declared Capacity in the scheduling phase and Operational Capacity on the day of operation;
- Punctuality;
- Efficiency of flight times;
- Predictability of flight schedules.

No well-established and commonly agreed performance framework appeared to exist so far to analyse ATM performance at airports and nearby airspace. The main added value from this ATMAP performance framework consists in:

- the selection of a limited set of KPIs that, when considered together, characterise the performance at main airports, from the gate to nearby airspace;
- a consistent measurement of ANS performance across European airports, using the same KPIs and the same data requirements;
- the measurement of performance in areas which had not yet been measured at European level, notably taxi-out and arrival in-flight additional times;
- the assessment of accuracy and completeness of the different data sets which could be used to populate the selected KPIs (CFMU, airline and airport operators data);

- the initial elaboration of an algorithm to measure the impact (severity and duration) of weather conditions on airport operations.

The main limitations of this version of the ATMAP performance framework are:

- KPIs for measuring Flexibility and Emissions Key Performance Areas have not yet been developed;
- approaches on how to use the KPIs in a combined way for assessing and evaluating performance have been described in this report, but not yet tested;
- the algorithm to capture the impact of weather conditions on airport operations has to be refined;
- the measurement for the taxi-out efficiency needs further testing and verification;
- the default data for measuring KPIs (CFMU and eCODA) do not provide the best possible accuracy and completeness. Well integrated data flows from airport operators and local ANSPs would generate significant improvements, but several airports have yet to improve data recording, collection and storage in order to be able to provide data of sufficient quality.

These limitations will be addressed during the second phase of the ATMAP project, due to be completed by end 2010. Its main objectives are to refine and stabilise the current ATMAP performance framework.

The reader should be aware that the ATMAP performance measurement framework represents a modelled picture of reality. Interpretation of indicators should therefore be made with caution, and KPIs should be considered together and not separately.

The performance framework presented in this report and future versions will be used by the Performance Review Commission as the basis for a permanent performance monitoring of ANS performance at European airports.

1 Introduction

1.1 Purpose of this document

This report presents a performance framework and the data requirements for the assessment of the performance of aircraft movement operations at major airports (in the movement area) and nearby airspace (maximum range 100 Nm radius from the airport).

The performance measurement framework is conceived for fulfilling performance review tasks, including consultation with stakeholders and performance monitoring. Due to the number of differing factors and their impact on performance, airports are not directly comparable. Although this report does not tend to establish a framework for comparison between airports, performance must be measured in a consistent manner throughout Europe.

The performance framework is an output of the “ATM Airport Performance “(ATMAP) project which has been launched by the Performance Review Unit to respond to the request of the Performance Review Commission for elaborating a framework to discharge performance review tasks, including consultation with aviation stakeholders and performance monitoring. ATMAP Phase I started in December 2007 and ended in July 2009. The Kick-off meeting of ATMAP Phase II took place in July 2009 and is expected to run until December 2010.

The ATMAP performance framework has been elaborated with the active support of the ATMAP consultation group which included 19 airport communities and major stakeholders: airlines, airport operators, ANSPs, the EUROCONTROL Agency and IATA. It must be noted that this document has been elaborated with the sole purpose of defining and testing performance indicators using limited data, and that neither the included graphs nor the figures should be taken as measures of the performance at selected airports until the definition of indicators becomes mature an the data set is completed.

The ATMAP performance framework proposes measures from an “airport system perspective” without assigning accountability to each stakeholder who contributes to the level of achieved performance. The framework will further evolve in forthcoming years as updates are expected in mid-2010 and mid-2011.

The ATMAP performance framework is made up of the following components:

1. Scope definition within which measurements are conducted;
2. List of factors affecting performance that have to be taken into account to contextualise performance at and around each airport;
3. Relevant Key Performance Areas to describe the performance objectives of an airport community (i.e. what are the common performance goals that all airport stakeholders try to achieve together);
4. Key Performance Indicators (KPIs) to measure Key Performance Areas;
5. Data requirements to populate Key Performance Indicators;
6. Various approaches on how to use the Key Performance Indicators in order to assess and evaluate performance.

KPIs have been developed, tested and verified in the following Key Performance Areas:

- Demand and Traffic Volume;
- Capacity;
- Punctuality;
- Efficiency of flight times;
- Predictability of flight schedules.

1.2 Institutional background for performance review

The performance review function on Air Traffic Management has been introduced in Europe in 1997 based on the adoption of the ECAC institutional strategy on "common performance". At that time, the ECAC strategy was incorporated in the revision of the EUROCONTROL convention which took place during the same year. The Performance Review Commission (PRC) and Unit (PRU) have been established based on the early implementation of the EUROCONTROL Revised Convention.

In March 2004 the EU Parliament and Council adopted the first Single European Sky (SES) package of regulations[1]. The SES package has introduced the performance review function on Air Navigation Services in the European Union. In March 2009, the second SES package has introduced a Performance Scheme. Whereas SES I introduced requirements for performance monitoring and data collection, SES II introduced the setting of binding targets on ANS.

There is a large degree of overlap between the performance review function in EU and EUROCONTROL; consultation with aviation stakeholders, data collection, performance monitoring and target setting exist in both environments. The main differences are in the scope (larger in EU as it also includes meteorological and aeronautical information services) and in the target setting (more enforceable in EU environment than in EUROCONTROL). Functions and role of EUROCONTROL PRC and PRU are expressed in Art. 2[2] of the EUROCONTROL Revised Convention and in the PRC and PRU terms of reference[3]. The Performance Review function in the European Union is included in the recently modified Art.11 of the EC Regulation 549/2004 (See Annex G).

Data collection within the ATMAP context will be reduced to the minimum essential information required, leveraging other collected data within Eurocontrol as much as possible, coordinating with the appropriate units within the Agency to minimize duplication of data requests to stakeholders.

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[1] The package consists of four regulations: 549/2004, 550/2004, 551/2004 and 552/2004.

[2] The EUROCONTROL *Organisation shall undertake to establish an independent performance review system that will address all aspects of air traffic management, including policy and planning, safety management at and around airports and in the airspace, as well as financial and economic aspects of services rendered, and set targets that will address all these aspects;*

[3] Term of references of the EUROCONTROL PRC and PRU are reported in: http://www.eurocontrol.int/prc/public/standard_page/PRC_Background.html

1.3 Reasons for launching the ATMAP project

In 2005 the PRC published a special report entitled "Punctuality Drivers at major European Airports". The report provided an initial insight on ATM performance at airports and nearby airspace. In that report, the PRC concluded that:

- There was no well established and commonly agreed performance framework to analyse ATM performance at airports and nearby airspace; and that,
- Air transport operational performance is the "end product" of a complex interrelated system, involving aircraft operators, airport operators and ANSPs. Hence, in view of the interlinked nature of the system, ATM performance measurement at airports cannot be seen as an independent and isolated structure. There is a clear interrelation between airlines, airport operators and ATC; but also between the air transport performance at major airports and at European network level.

In accordance with PRC Terms of Reference and in line with SES regulations, the PRC decided to conduct a pilot project together with interested stakeholders to assemble initial experience in measuring ATM performance at main airports, and to develop a framework for a permanent review of ATM performance at airside airports and nearby airspace.

The pilot project has been called ATM Airport Performance (ATMAP).

1.4 The objectives of the ATMAP project

The objectives of the ATMAP project were:

- to develop – together with airport stakeholders (airlines, airport operators and ANSPs) – a high-level framework for consistent and continuous review of ATM airside performance at airports in Europe;
- to identify a set of easily understandable high-level indicators which enable the interested parties:
    - to understand airport performance within the network;
    - to relate ATM performance with airport performance; and,
    - to measure performance consistently across airports and over time;
- to specify the underlying data requirements to populate the performance framework;
- to validate the framework for high-level performance review with a number of airport communities on a voluntary basis.

1.5 Working method in ATMAP

As a first step, and in order to fulfil its duty of consultation, the PRU invited airport stakeholders to participate in an ATMAP advisory group. The participants were invited to nominate representatives from the main aircraft operators, airports and local ANSPs, and to coordinate locally the airport position in the ATMAP group. The purpose was to achieve a better cohesion, a non-blaming culture and focus the work of the ATMAP group towards the identification and definition of the performance goals.

Nineteen major European airport communities accepted the invitation to take part into the ATMAP project.

In consultation with the ATMAP group the following activities were launched:

1. Collection of published reports on performance measurement and of indicators used in ATMAP airports;
2. Definition of a list of factors affecting performance (airport layout, facilities, ATM/CNS infrastructures and procedures, weather conditions, noise restrictions, scheduling facts and network effects).
3. Review of performance indicators proposed or used at international level, namely:
    a. ICAO Doc 9883: manual on Global Performance of the Air Navigation System;
    b. SESAR Performance Target (D2);
    c. EUROCONTROL Airport CDM Manuals and Data specifications;
    d. DMEAN Performance Indicators.
4. Conceptualisation and elaboration of KPIs in a top-down approach: from common performance goals of airport communities, through Key Performance Areas, down to KPIs;
5. Definition of data requirements and potential data sources for measuring KPIs;
6. Provision of a data sample to PRU directly from airport operators and local ANSPs;
7. Testing and selection of KPIs according to pre-defined criteria: SMART principles, robustness of KPIs, ability to measure the underlying Key Performance Area;
8. Validation of different data sets, made available by different data sources, which could be used to fulfil the expressed data requirements;
9. Drafting of the final ATMAP performance framework report.

A list of unpublished deliverables documenting the activity in ATMAP can be found in Annex A.

Furthermore a number of meetings have been held to provide inputs to the activity conducted in ATMAP:

- General meetings to discuss strategic lines of the project and to ensure major reviews at critical project phases;
- Focus meetings to discuss specific subjects;
- Bilateral meetings to thoroughly observe the difference between local performance framework and what was elaborated in ATMAP;
- Drafting meetings to achieve the final ATMAP performance framework report.

1.6 Interpretation of the ATMAP performance measurement framework

The reader must be aware that the ATMAP performance measurement framework represents a modelled picture of reality. Interpretation of indicators should therefore be done with caution, in particular:

- KPIs should be considered all together and not separately; trade offs are not specifically indicated in this report, but it is impossible to maximise all performance at the same time. Some of these trade-offs are decided months in advanced and vary from airport to airport, for example, the demand/capacity ratio, or the planned quality of service.

- KPIs should be seen in each airport context; a myriad of factors make an airport different from each other; the link between airport processes and KPIs should always be kept in mind.
- In some cases, it may not be possible to use the best data source for measuring KPIs. The accuracy and completeness of the different data sources should always be kept in mind.

1.7 Acknowledgements

The PRC is very grateful to all ATMAP members for the spirit of openness, transparency and pro-active co-operation among participants in the ATMAP working group. Words of thanks, recognition and appreciation are owed to airport operators, ANSPs and airlines of the following airports: Amsterdam Schipol, Barcelona, Brussels, Copenhagen, Dublin, Frankfurt Fraport, Helsinki Vantaa, Lisbon, London Gatwick, London Heathrow, Madrid Barajas, Milan Malpensa, Munich, Palma, Paris Charles-de-Gaulle, Paris Orly, Praha, Roma Fiumicino, Vienna and Zurich.

2 ATMAP Performance Framework Overview

The ATMAP performance framework:

- shall serve the purpose of measuring the status of airport airside and nearby airspace performance at European level and to provide basis to the Performance Review Commission for consultation with the aviation industry and for providing high-level advices to policy makers;
- is being developed to consistently measure and continuously monitor airport airside and nearby airspace performance at coordinated airports in Europe;
- is consistent with the European legislation, notably EC regulations 95/93 and 549/04, Art.2 of the EUROCONTROL Revised Convention and terms of reference of the PRC and PRU.

The ATMAP performance framework has not been developed to assess what should be the infrastructural investments to adapt the airport capacity to the future demand; rather, the framework has been developed to monitor the utilisation of the capacity made available by the infrastructure in place and the level of service that is provided to aircraft.

In a first stage, the ATMAP performance framework has the ambition to measure the performance of airport airside and nearby airspace without identifying ANS contribution in performance. The identification of this contribution will be developed at a later stage when sufficient experience is gained in measuring airport performance[4].

The ATMAP performance framework is geared towards a common performance goal which was agreed during previous ATMAP meetings between main airport stakeholders (main aircraft operators, airport managing bodies and ANSPs). This commonly agreed performance goal is:

> *"to maximise the use of the airport airside capacity in line with air traffic demand at an accepted[5] level of service quality (efficiency, predictability, flexibility) in a safe and cost-effective manner while optimising environmental impacts (noise & emissions) and maintaining the awareness of network effects."*

Figure 1 Commonly agreed performance goal

The ATMAP performance framework does not include safety and cost-effectiveness, which will be developed at a later stage in different projects with the same consultation process as the one used in ATMAP.

[4] The only exception is the apportionment of pre-departure delays to different stakeholders by using the IATA delay coding.

[5] The accepted level of service quality represents a (commercial) trade-off between the envisaged runway utilisation and the service quality based on the value of airport slots and is locally agreed by all stakeholders during the airport scheduling process. The "agreed level" of efficiency may vary between airport communities as it is largely driven by the economic value of the airport slot.

2.1 The scope of the ATMAP performance framework

The scope of the ATMAP performance framework will be defined as "airside"[6] in this report. This scope is focused on airport airside and nearby airspace operations (see Figure 2), and includes:

- Aircraft movements (with the intention to depart or to arrive) which take place:
  - at the movement area of an airport;
  - in the surrounding airspace contained within a circle of a radius of 100NM (in order to capture performance related to the sequencing and approach of aircraft arriving at the airport).
- Air traffic demand expressed either in the scheduling phase (up to one day in advance) or in the planning phase (up to few hours before the flight operation);
- Pre-departure delays experienced by flights at the departure aircraft stand;
- Turnaround processes;
- External performance affecting factors such as weather or noise constraints;
- Interface between airports and the rest of the network; impact of the network on airport performance and vice versa.

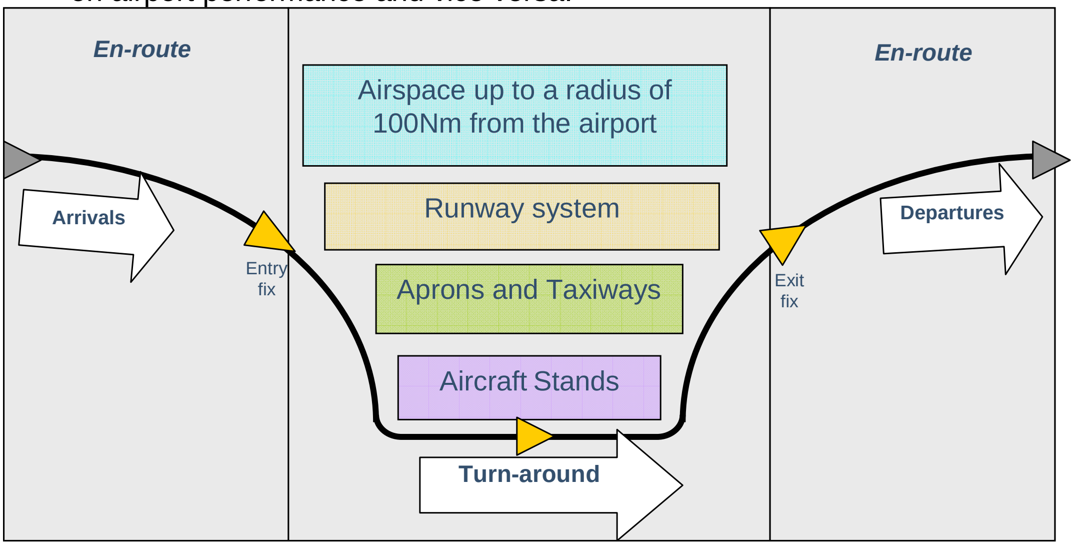

Figure 2: The scope of the ATMAP performance framework 1/2

It is worth elaborating on the airspace contained in the ATMAP project. Many airports contain sequencing and approach flight phases into a radius of 40 NM. However, a flight could be requested to reduce speed well before that 40 NM radius. It mainly depends on the level of congestion of an airport and the way sequencing and approach operations are organised. The PRU did some studies and concluded that two key distances should be taken into account when measuring the efficiency of these operations: 100 and 40 NM. This approach will capture the total amount of additional times related to sequencing and approach operations (see

Figure 23). It should be noted that the new concept of operations[7] envisage pushing the allocation of additional times further away from the arrival airport.

The daily period analysed by the ATMAP performance framework starts at 06:00 Local Time and ends at 21:59 Local Time.

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[6] "Airside" refers to the movement area of an aerodrome, adjacent terrain and buildings or portions thereof, access to which is controlled. The movement area includes aircraft stands, aprons, taxiways and runways.

[7] See TMA 2010+ and CASSIS at http://www.eurocontrol.int/tma2010/public/subsite_homepage/homepage.html

Turnaround processes (airline, ground handling, etc.) will not be analysed in detail but their consolidated impact on aircraft movements and flight demand will be taken into account.

The ATMAP performance framework takes into account how airports operations are strategically organised at coordinated airports. The airport performance is highly impacted by the scheduling traffic process (months before actual operations); at that time, airport capacity is declared and then allocated to requesting airlines according to principles developed by IATA [1].The ATMAP performance framework aims at measuring performance in days of operations, but gathering sufficient elements of the scheduling phase in order to put the daily performance into perspective (e.g. declared capacity or numbers of allocated airport slot). The ATMAP performance framework does not aim at measuring the quality of the scheduling process.

The ATMAP performance framework aims at providing a fair representation of airport system performance (airside and nearby airspace) and must take into account as many factors affecting performance as feasible. Incorporating these factors to the analysis may be achieved by considering factors affecting performance in the data analysis process (e.g. processing meteorological data) or by providing a simple description of the factors affecting performance (e.g. description of infrastructures or noise constraints on operations).

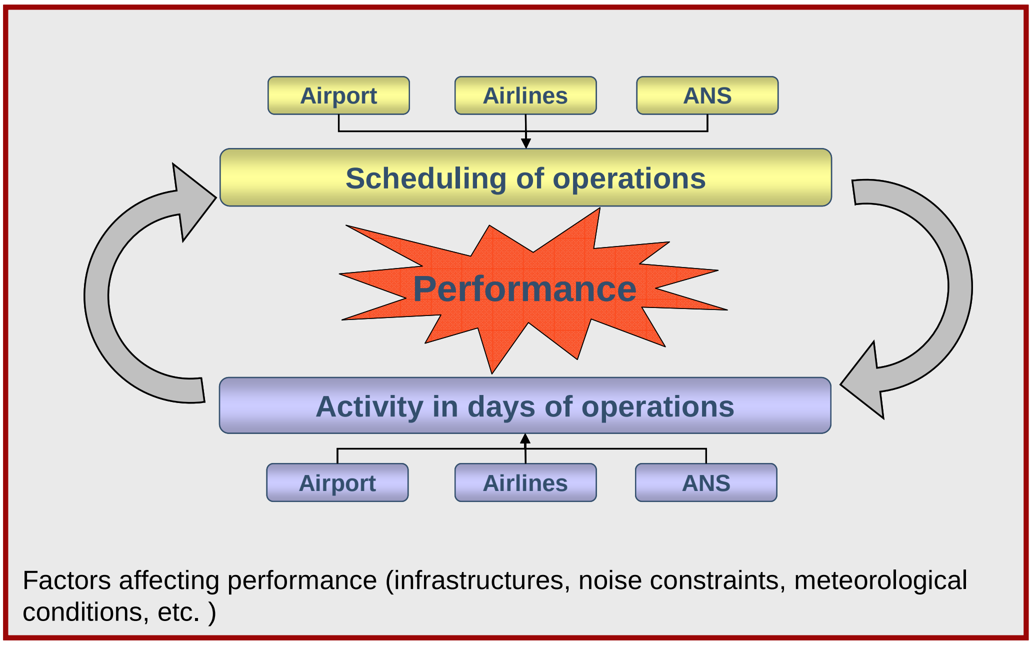

Figure 3: The scope of the ATMAP performance framework 2/2

2.2 Key Performance Areas and Key Performance Indicators

The ATMAP group has drawn up seven (see Figure 4) Key Performance Areas (KPAs) starting from the statement on common performance goals (see Figure 1). The seven KPAs categorize performance subjects of the airport system to achieve common performance goals and are consistent with the ICAO performance framework. However, only five KPAs have been developed so far (coloured in yellow in Figure 4).

Trade-offs exist between the seven KPAs. For instance, when declared capacity is close to the maximum use of airport infrastructures and the majority of declared airport capacity is taken up by the demand, time efficiency from a single flight perspective is expected to be relatively low.

At this stage, the ATMAP performance framework has no ambition to quantify trade-offs between the different KPAs. The best approach, at this stage, is to put KPIs side by side to illustrate the fact that while some KPI may provide good results (e.g. handled traffic or capacity), others may show lower performance (e.g. Efficiency and Predictability).

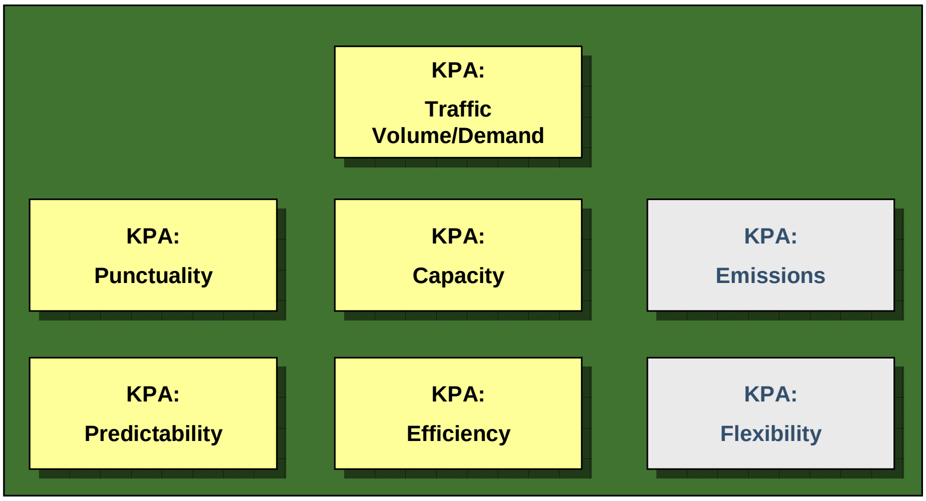

Figure 4: KPA addressed by the ATMAP project

A set of Key Performance Indicators and metrics, reflecting the status of a given Key Performance Area and contributing to the analysis of airport airside and nearby airspace performance, were developed for each KPA.

The elaboration of Key Performance Indicators was quite complex as the following requirements had to be taken into account:

- ensuring that measurements reflect a meaningful and manageable performance;
- ensuring that measurements are easy to share and understand;
- providing a fair representation of performance across all European airports;
- avoiding KPI representations which could lead to gross misunderstandings or easy instrumental manipulations.

2.3 Approaches for assessing airside airport performance

One of the purposes of ATMAP is to provide ways on how KPIs could be combined in a meaningful way to draw high-level conclusions on the performance of European airports.

Three types of approach are illustrated in Chapter 5.

3 Factors affecting airport airside and nearby airspace performance

This chapter lists the main affecting factors which have to be taken into account when assessing performance at airports. This list will then be transformed in a graphical template to be applied identically to all airports. An example can be found in Annex N.

In summary there are six main performance affecting factors at airports:

- Infrastructures, facilities and staff (hardware and liveware);
- Noise constraints to operations;
- Scheduling facts;
- Adverse weather;
- Operational procedures;
- Network effects.

Often, impact on performance does not come from an isolated affecting factor, but from a combination of factors: e.g. noise distribution plans combined with adverse winds have more impact at heavily saturated airports. At this stage, however, a quantitative link between the level of performance and influencing factors cannot be established.

3.1 Infrastructures, facilities and staff

- Airport layout (location, geometry, number of runways, orientation, surrounding obstacles, type and location of taxiway exits, etc).
- Instrument approach equipment (ILS, VOR/DME, RWY Lighting System).
- Surveillance Systems (TAR, SMR, A-SMGCS).
- Automation Systems.
- Landside infrastructure impacting airside operations (passenger terminals and corresponding equipment).
- Number of ground handler providers

3.2 Noise constraints to operations

- Constraints on runways usage.
- Noise distribution plans and budgets.
- Constraints on SIDs and STARs.
- Cap on traffic.
- Other noise adaptations which does not impact on operations.

3.3 Scheduling facts

- Nature of the traffic demand at airport (e.g. hub airports have a push of arrivals at certain times followed by later push of departures).
- Mix of aircraft type.
- Number of allocated airport slots.
- Airport coordinators practices.
- Level of airport saturation.

3.4 Adverse weather conditions

- Weather phenomena affecting Air Traffic Management operations (e.g. strong winds, snowfalls, icing conditions, low visibility and cloud base, etc).

3.5 ANS operational procedures

- Arrival sequencing organisation in the air (e.g. combination of airspace design, sequencing software, ATC procedures) and departure sequencing organisation on the ground (CDM/DMAN).
- Flow management procedures, i.e. which procedures are available? What is the combination of CFMU/ATFM and local ATFM regulations?
- Separation minima.

3.6 Network Effects

Airports are part of a wider aviation network. From an airport centric perspective the network is composed of:

- The other airport-pairs with which flights are connecting;
- The En-route ATC sectors which deliver or accept traffic to/from the airport.

The airside performance of an airport is heavily impacted by events which happen in the network. In this context, identifying the following points is crucial:

- which parts of the European network are more critical for a given airport;
- under which circumstances the European network negatively impacts performance at a given airport.

The effect that network has on airports was not studied within the framework of ATMAP phase I. Nevertheless, this could be analysed in the second phase of the project. An outlook of how the study could be organised is reported in the Chapter "approaches for assessing airport airside and nearby airspace performance".

3.7 Key factors affecting seasonal variation of airport airside and nearby airspace performance

Measuring performance at European level is a challenging task. As seen above in this chapter, there are many factors influencing performance that need to be contextually considered in order to correctly construe information given by selected indicators.

Airside airport performance varies season after season, not only due to continuous improvement of services and variation of the demand, but also because some seasons are more affected than others by events such as adverse weather, runway maintenance, or unexpected events. Without keeping records of such events, wrong conclusions could be drawn about the performance of a given airport.

In order to take into account all these factors when measuring airport airside and nearby airspace performance, it was agreed to define criteria and data flows for considering adverse weather, status of infrastructures, and availability of staff and facilities. The definitions of criteria and data flows were addressed along the ATMAP project, but particularly at Munchen Focus Meeting (30 May 08), at 3rd ATMAP General Meeting (27 Nov. 08) and at Brussels Focus Meeting (17 Feb. 09).

The general idea is to divide days of operations into three groups: nominal, degraded, and disrupted. Following this division the overall performance of a season could be divided in three groups. This approach would allow drawing better and fairer conclusions about the performance achieved.

3.7.1 Impact of adverse weather conditions

Weather situation should be factual and assessed independently from other factors (e.g. airport scheduling facts). A weather situation is an independent external condition which impacts airport airside and nearby airspace processes and performance.

In order to take into account the impact of weather on airport performance, the following distinction can be made:

- Nominal weather condition: a weather condition which is excellent or good to conduct airport operations: CAVOK, favourable winds, etc.
- Degraded weather condition: a condition which might have a significant negative impact on airport performance unless a proper response is organized (i.e. the selection of an airport operating mode to respond to given degraded conditions and eventually the use of additional airport resources such as de-icing/anti-icing services). This would be the case when visibility is poor and/or in case of freezing conditions, precipitations, etc.
- Disruptive weather condition: a condition which is very unlikely to occur, it has a severe impact on airport performance, but the airport does not have an appropriate organized response (this might be the case of heavy snow in Rome). In addition, convective weather might create disruptive conditions, even if the airport is well prepared to respond to weather.

The PRU developed an algorithm (see Annex A for a summary and more details in [20]) to technically implement the three conditions defined above. The number of days classified according to this algorithm is presented in Figure 5. The first version of the algorithm has already been finalised, but some fine-tuning is necessary especially when assessing precipitations and freezing conditions. Another limitation is that the current algorithm does not provide technical criteria for defining disruptive weather conditions. The option to include wind direction and not only wind intensity should be considered.

A second and more accurate version of the algorithm is planned in the second part of the ATMAP project (in the period July 2009 – June 2010). The algorithm, which will be transparent to all ATMAP participants, will contain the same weather criteria at each airport, but also agreed special criteria in case of specific circumstances at some airports.

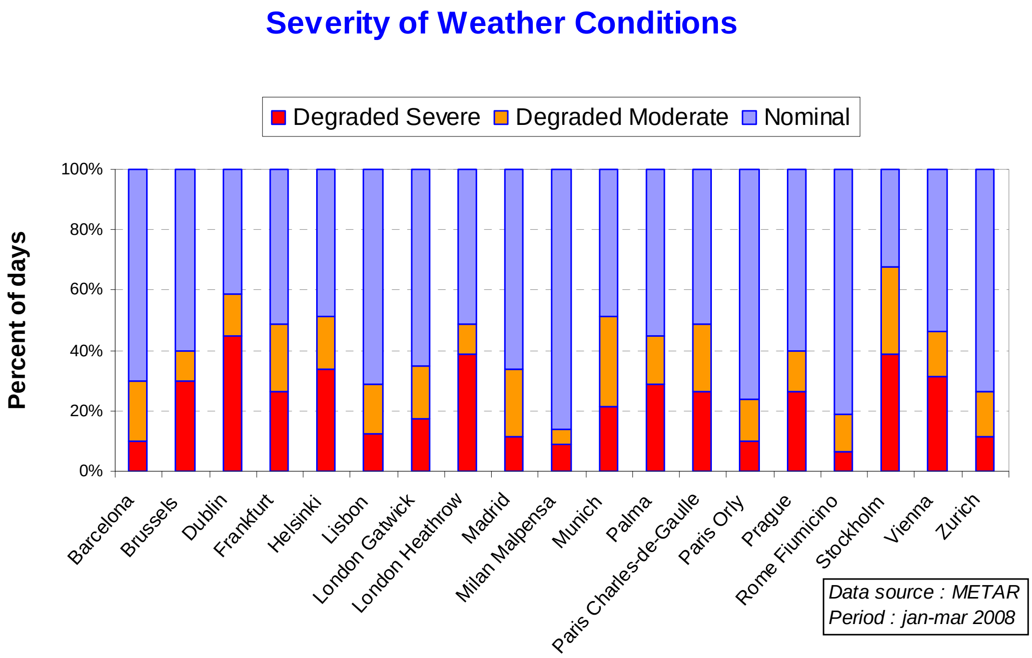

Figure 5: Percentages of nominal and degraded (moderate/severe) conditions

The algorithm will be automatically fed with METAR data collected in Eurocontrol through the SADIS network. In ATMAP Phase II, the ability of METAR data to accurately describe weather situation at airports will be validated.

3.7.2 Impact of infrastructures status and of staff and facilities availability

Infrastructures, facilities and staff can be configured in various airport operating modes. An airport operating mode is deployed for responding to given weather conditions (nominal, degraded, disrupted).

An airport operating mode could be classified in four categories:

- “standard” to respond to nominal weather conditions,
- “adapted” to respond to “degraded weather conditions”,
- “significantly reduced”. due to planned maintenance or unforeseen significant failures which limit the availability or efficiency of infrastructures
- “dramatically reduced” when an exceptional event happens (e.g. a baggage handling system crash, staff strike, closure of the runway, etc.).

Further refinements are necessary to detail the four categories.

Data used to classify seasonal days could be manifold, but a proposed approach to take into account the different data sources is as follows[8]:

- The PRU will make an initial list of “reduced days” using the information available in CFMU daily logs and Network Operation Plans.
- The initial list formulated by PRU will be sent to each airport. Airports will check this list and may report modifications by providing evidences (e.g. NOTAMS).

[8] See item 3.1 presented at the third ATMAP general meeting (27/11/2008)

4 Key Performance Areas and Key Performance Indicators

4.1 Organisation of the KPA/KPI description chapter

KPAs/KPIs are divided into three consistent groups:

- Traffic Volume, Demand and Capacity
- Punctuality, Time Efficiency, Predictability, and Flexibility (to be developed)
- Gaseous and Noise Emissions (to be developed at a later stage)

Hereunder is a brief overview of each sub-section that shows how the description of each Key Performance Area is organised.

Overview

This part contains a summary table with the following fields:

KPA	Brief summary and definition of the Key Performance Area. *Key Performance Areas are a way of categorising performance subjects related to high level ambitions and expectations [2]*
KPIs	Name of Key Performance Indicators. *Indicators are a mean of deriving past, current, expected performance levels, which are quantitatively expressed. [2]*
Breakdowns	Different dimensions in which the indicator can be divided (time, geography, etc.)
KPI Metrics and Formulas	Description of metrics and formulas used to compute KPIs. *Indicators are calculated from supporting metrics according to clearly defined formulas. [2]*
Data sources	The originator of the data set which is used to populate KPIs.

Key Performance Area

This sub-section presents a planned description of the Key Performance Area.

Key Performance Indicators

Graphics and tables illustrate the KPIs that have been selected for measuring the KPAs.

Computation of KPIs

This part will be added should the computation not be self-explanatory.

Data source

A brief summary will describe the different data sources that can be used to populate the KPIs and their main characteristics.

4.2 Summary of KPAs and KPIs breakdown

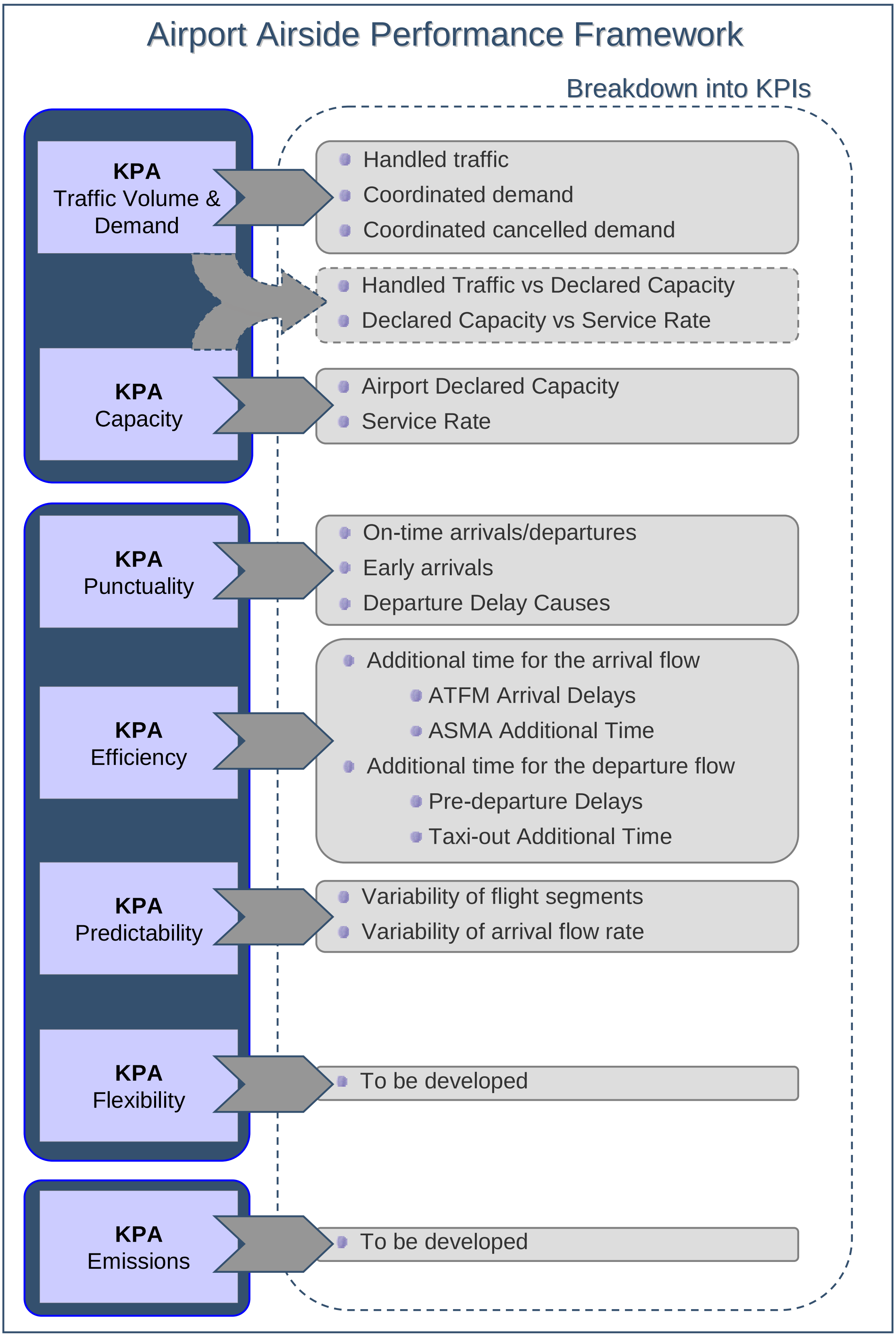

Figure 6 Summary of KPAs and KPIs framework

SECTION I
KPAs/KPIs
Traffic Volume, Demand and Capacity

4.3 KPA Traffic Volume and Demand, and Capacity: definition and relationship

ATMAP framework deals with coordinated airports. According to definition, at coordinated European airports the airport capacity is often insufficient to fulfil airline demand during peak hours. There is an airport scheduling process implemented that aims at matching airline demand and airport capacity several months before the actual day of operations.

Airport scheduling at coordinated airports is based on two distinct but interrelated local processes. In the first step, the airport coordination committee or the State announces an airport capacity declaration which determines the airport coordination parameters and as their most relevant component the number of airport slots available to airlines. In a second step, the airport slot coordinator allocates airport slots to airlines according to rules laid out in EC Regulation 95/93[9].

Due to the nature of the scheduling process, a scheduling phase precedes the day of operations. Therefore, both capacity and traffic volume may be differentiated according to a temporal dimension, before and during the day of operations.

The demand evolves through time since the airport slot assignment phase (during the IATA scheduling conference) until the aircraft leaves the stand. The movements (handled traffic) are counted in the post operation phase (e.g. number of take-off and landings operations).

The capacity declared in the airport scheduling phase is usually aligned with the operational capacity which is deployed in the day of operations. The former is a fix value which is valid for all a given season; the latter can vary depending on the status of infrastructures, facilities, staff availability, and weather and traffic conditions.

	Before the day of Operations	**During the day of Operations**
KPA: Capacity	Declared capacity	Operational capacity
KPA: Demand and traffic volume	Coordinated demand	Handled Traffic

Figure 7: Capacity and demand before and during the day of operations

Each of these concepts and how to measure them are explained in the following sections.

[9] 'Airport slot', 'coordinated airport', 'coordination committee' and 'coordination parameters' as defined by EC Regulation 95/93 and included in Annex H.

4.4 KPA: Traffic Volume and Demand

4.4.1 Overview

KPA Traffic Volume and Demand	Aircraft movements handled during a given time period. The number of flights requesting to use the airport system in a given time period (scheduled flights).
KPIs	• Handled traffic • Coordinated demand • Coordinated cancelled demand
Breakdown	• Global, arrival, departures; • Hourly, daily, seasonal, yearly; • Traffic mix
KPI Metrics and Formulas	• Handled traffic: Number of flights arrived and departed to and from an airport in a given time period. • Coordinated demand: Number of flights with assigned airport slot. • Coordinated cancelled demand: number of cancellations, out of the coordinated demand, per 1.000 flight operations in a given time period.
Data sources	Airport operators data, EU-ACA, CFMU

4.4.2 Key Performance Area

Aircraft movements handled during a season are generally one of the first parameters to be found in any activity report related to airport operations as it provides a first view about the level of activities at a given airport. Additional statistics, such as the average movements per day, or movements per hour can provide additional information.

Coordinated Demand is the daily list of flight schedules produced before the day of operations (also said mayfly list); this is the output of the scheduling process at coordinated airports. Depending on data availability, it may be the daily list prepared by the airport coordinator and sent to the airport operator or the daily list prepared by the airport operator itself the day before the operations.

Difference between actual demand and coordinated demand may be due to several factors. Actual demand can be higher due to the presence of uncoordinated demand or lower than expected due to coordinated cancelled demand. On a short time period (e.g. one hour) difference may cause a shift of demand to earlier or later period.

4.4.3 Key Performance Indicators

KPI Handled Traffic:

Handled traffic is the number of flight movements served by an airport in a given time period. It includes coordinated demand (see below) and demand without an airport slot, once cancellations, diversions and aborted operations are deducted from the total demand.

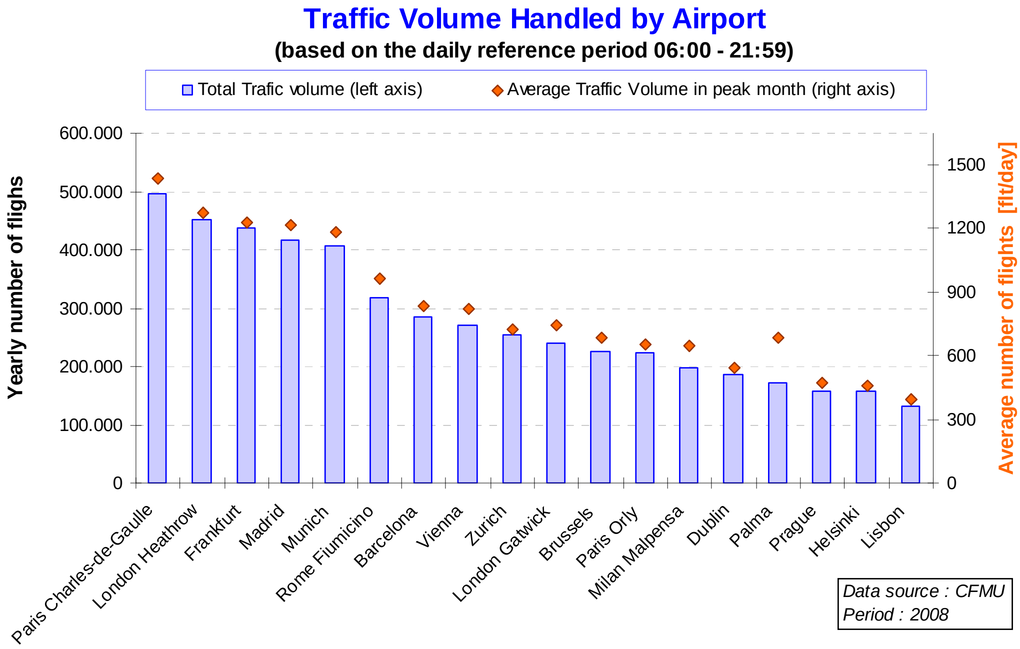

Figure 8: Handled traffic at ATMAP airports

KPI Coordinated Demand:

Coordinated Demand is the amount of flights with an assigned airport slot. Coordinated demand evolves through time from the IATA scheduling conference date until one day before operations (the daily list of flight schedules, also known as “mayfly list”). ASLT and/or DSLT are required data to identify coordinated demand.

The same metric breakdown as in the handled traffic indicator can be used (i.e. by day, by day in the peak month, and by season)

KPI Coordinated cancelled demand:

Coordinated cancelled demand is the number of cancelled flights in a given time period. It is composed of coordinated arrival or departure flights which were contained in the daily list of flight schedules produced before the day of operations, but for which actual landing or take-off never occurred[10]. Coordinated Cancelled Demand is briefly named “cancellations”.

The number of cancellations in itself is a metric of quality of service, not only due to its impact on passengers, but also due to the high economic and disruptive impact on airlines and airports.[11]

The main objective of measuring cancellations is to measure the robustness of airport operations during degraded and disrupted conditions, either caused by weather or other special events (e.g. the closure of a runway). It is particularly relevant to be able to identify causes associated to cancellations and to compare

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[10] This definition assembles together flights which never occurred with diversions or aborted operations. However the absolute number of the latters is negligible in monthly, seasonal and yearly statistics.

[11] The negative economic impact on airport operators occurs when a number of airport slots have been assigned to a coordinated flight for a given season, but the flight does not systematically show-up (no-show) in operations. A no-show flight could be withdrawn any time between the Slot Return Date (2 months before the season starts) and the day of operations. A no-show flight may not have been included in the mayfly list. The ATMAP performance indicator on cancellations is not conceived to measure “no-show” in operations.

cancellations caused by degraded and disrupted conditions with the number of cancellations in days of operations.

While cancellations are a system performance that each airport stakeholder is interested to improve, it will take some years to understand the relationship between degraded/disrupted conditions and the level of cancellations. This is mainly due to:

- The policy of trading delays against cancellations could vary between airlines (some would be willing to accept long delays, others would cancel if delays are higher than one hour especially when the flight frequency between a city-pair is high).
- Although ATMAP definition of cancellation has been agreed12, it is not yet sure that all airports apply the same meaning of cancellation and collect the same data.
- There is no aviation-wide coding system to record the reasons for cancellations and obviously no European-wide data collection on cancellations.

It should also be noted that a variety of airport stakeholders could be accountable for cancellations during disrupted and degraded conditions. This can be illustrated by some examples of this non-exhaustive list:

- Aircraft not equipped for a given weather condition (e.g. ILS CAT IIIb not equipped);
- Weather condition is unsafe for a given type of aircraft (e.g. crosswind above 40 knots);
- Pilot is not certified for a given type of operation (e.g. ILS CAT IIIb);
- Airport is not equipped to respond to a given weather condition (e.g. ILS CATIIIb not installed);
- Excess of delays due to dramatic runway capacity reduction;
- Airline cancellation policy;
- Type of traffic mixed (e.g. long haul vs short haul)
- Staff strike (maintenance, controllers, pilots, handling, etc);
- Closure of a runway.

All things considered, cancellations being an important performance of the airport system, setting up a data collection on cancellations could be worthwhile. Nevertheless, a few years may be required for this data collection to provide useful advice in managing performance.

The first step in analysing cancellations may be to measure the total number of cancellations without making any classification about causality (see Figure 9). The second step would be to analyse causality of cancellations.

[12] Flights which were contained in the daily list of flight schedules produced before the day of operations (also said mayfly list), but for which the actual landing or the actual take off never occurred.

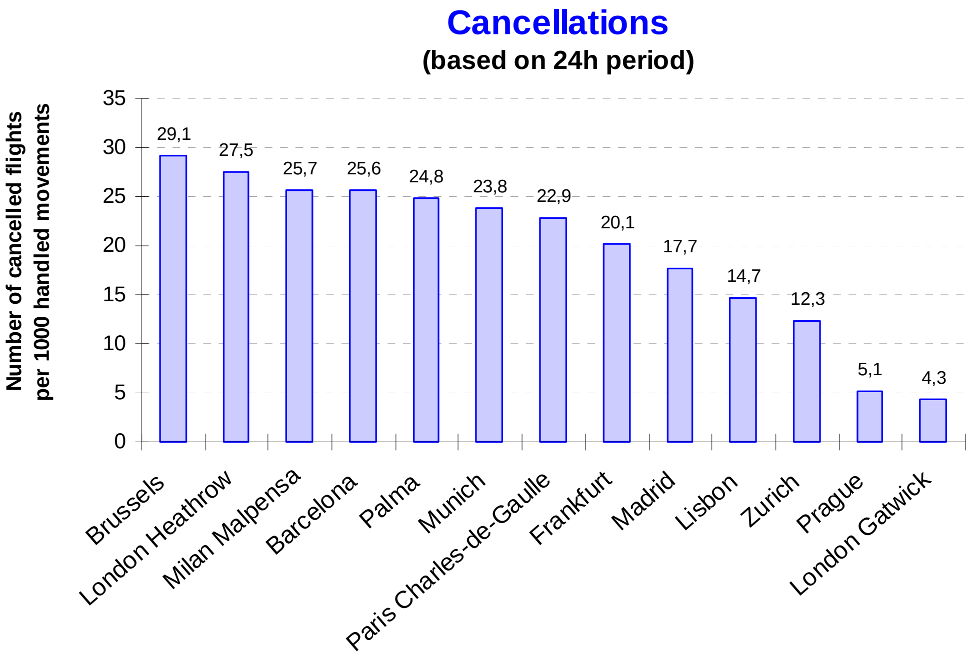


Figure 9: Coordinated Cancellations[13] per 1000 handled operations

Two possible approaches have been identified in order to analyze the causality of cancellations:

- Analyzing the distribution of cancellation per category reason;
- Inferring the impact of degraded and disrupted conditions on the number of cancellations by comparing the number of cancellations occurred in nominal, degraded and/or disrupted days (see Figure 10).

Each approach has its advantages and drawbacks. The former one might leave room for interpretation on the assignment of cause for cancellations. The latter might prove difficult to identify the real impact of degraded conditions. Both approaches for measuring cancellations are rather complementary than mutually alternative.

A proposal for classifying reasons for cancellations has been made by Air France and is based on the IATA Standard Schedules Information Manual (See Annex C).

Figure 10 illustrates cancellations occurring in nominal and degraded weather conditions[14]. The rate of cancellations per 1000 operations in degraded and nominal conditions is presented. See also Figure 5 to assess the number of days per category.

[13] Cancellation data at Spanish airports do include coordinated and uncoordinated demand. Work is in progress to isolate uncoordinated data.
[14] The current algorithm used to classify normal and degraded moderated, and degraded severe is briefly presented in Annex A. This algorithm may be subject to further refinement.

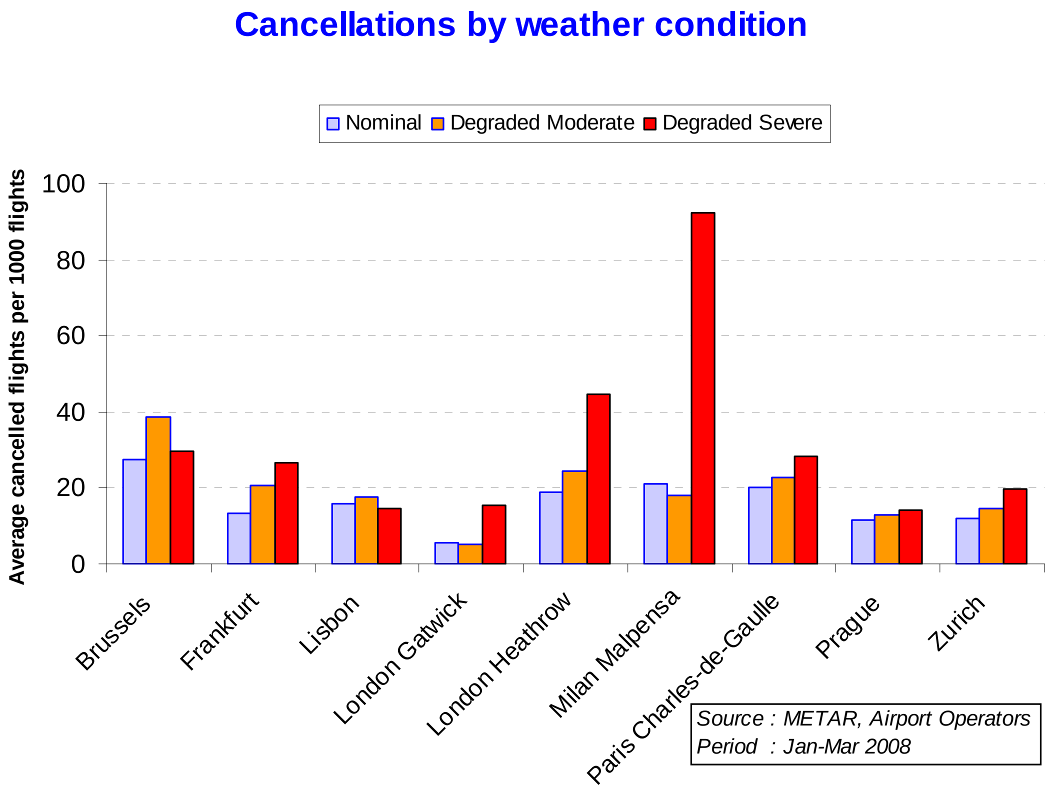


Figure 10: Cancellation rate in various weather conditions

4.4.4 Data source

The Traffic Volume can be well described both by airport operator data and by CFMU data.

Data Source	Advantages	Limitations
Airport Operators	100% Flights	None
CFMU (EUROCONTROL)	Available in EUROCONTROL	98% of flights

Table 1. Advantages and limitations of data sources to calculate handled traffic

Coordinated demand can be well described both by airport operator data and by EU-ACA data.

Data source	Advantages	Limitations
Airport Operators	100% Flights	None
EU-ACA (i.e. airport coordinators)	- 99 % Flights - available in EUROCONTROL	Might stop 3-5 days before the day of operations. However the impact on accuracy is negligible.
OAG	- 80-90% Flights, - Easily accessible	Might stop 3-5 days before the day of operations. Will not include all coordinated flights

Table 2. Advantages and limitations of data sources to calculate coordinated demand

Cancelled coordinated demand can be well described both by airport operator data and by EU-ACA or CFMU data. Data coming from airlines may not include all cancellations due to the lack of report of some of them but would nevertheless remain the best source for reason for cancellation.

Data source	Advantages	Limitations
Airport Operators	100% Flights	None
Airlines	70% of flights (expected figure)	No existing data collection
Comparison EU-ACA and CFMU data	- 99 % Flights - Available in EUROCONTROL	The method might not be 100% accurate.

Table 3. Advantages and limitations of data sources for cancelled coordinated demand (number of cancellations)

Data source	Advantages	Limitations
Airlines (classification based on Air France proposal; see Annex C)	It may provide more explanations for cancellations	- May not include reason for all cancellations as some airlines may not report. - The coding should be agreed before starting the reporting.

Table 4. Advantages and limitations of data sources for cancelled coordinated demand (reason for cancellation)

The reporting of reasons for cancellations should start as early as possible. The recipient for reporting could be the airport operators, which could then integrate the reason for cancellations in their own statistics and EUROCONTROL eCODA.

4.5 KPA: Capacity

4.5.1 Overview

KPA Capacity	This KPA deals with the amount of traffic that an airport and its nearby airspace can serve. Considering the scheduling process that rules the operation of coordinated airports, two concepts of capacity are used. The former is "the airport declared capacity" (also named "coordination parameters") which is declared in advanced to determine the number of airport slots. The latter is the "operational capacity" which is set according to the specific situation of the day or hours of operations (weather, status of systems and infrastructures, availability of staff). The operational capacity cannot be measured directly, but could be inferred by the "service rate".
KPIs	• Airport Declared Capacity • Service Rate (i.e. throughput at given conditions)
Breakdowns	• Hourly, daily, seasonal. • Arrival, Departure, Global. • RWY configuration.
KPI Metric	• Airport Declared Capacity: Average number of airport slots per hour. • Service Rate: 1% percentile of the numbers of movements per 10-min rolling hours in busy periods.
Data sources	Airport Coordinators, Airport Operators, CFMU

4.5.2 Key Performance Area

Airport Declared Capacity is the number of aircraft movements per unit of time (usually one hour) that an airport could accept. The airport declared capacity could be quite complex and may contain various rolling parameters to control the concentration of demand.[15]

The declared capacity is a parameter decided months before operations considering:

- the type of traffic demand;
- the typical operational capacity;
- the desired level of service requested by aircraft operators; and,
- the additional constraints (noise limits, etc.).

The capacity declaration is used to set a limit on the number of movements per hour that can be scheduled according to the airport scheduling process described in the IATA scheduling manual and EC Regulation 95/93 and is usually accompanied by an associated delay value that all stakeholders are willing to accept for optimising the utilization of airport infrastructure.

The runway capacity may not be the most constraining factor as other airport elements, such as the apron, the terminal building, or noise control procedures can limit the declared capacity. In any case the airport declared capacity sets a standard requirement for daily airside airport operations.

[15] See "Study on the usage of declared capacity at major German airports."; RWTH Aachen Dipl.-Ing. Daniel Kösters;2007

The Operational Capacity is the expected movements that can be handled in one hour at airport airside and nearby airspace in the day of operations. The operational capacity could vary along the day of operations as it depends on the capacity of various elements (runway, TMA, aprons, taxiways, etc.) and is affected by weather conditions, runway conditions, traffic mix and status of associated infrastructures. Operational capacity cannot be measured directly and the service rate is usually used to infer it.

The Service Rate is the peak observed number of movements per hour which is handled by the airport in a given set of conditions (weather, status of airport infrastructure, separation standards, traffic mix, etc.), assuming continuous aircraft demand. In order for the service rate to represent the maximum operational capacity at given conditions, a sufficient number of hours of peak traffic must be selected and traffic must experience a certain level of delay to assume that there is continuous demand. "Service Rate" is used in the aviation industry to infer the level of operational capacity. For instance, "service rate" is regularly reported to the members of airport scheduling committees in UK by NATS.

4.5.3 Key Performance Indicators

KPI Airport Declared Capacity:

Airport declared capacity is the number of available slots per time interval.

Two metrics can be provided for this indicator due to the fluctuation of declared capacity throughout the day. The first one focuses on the declared average airport slots, which can be used to compute the total number of slots during a season. The second one is the peak number of slots per hour during the day, which is used to accommodate peak hours of demand. Figure 11 show both metrics in a single graph. It is worth mentioning that some airports have a single average value of declared capacity by hour throughout the day, but other airports provide variation of declared capacity during the day.

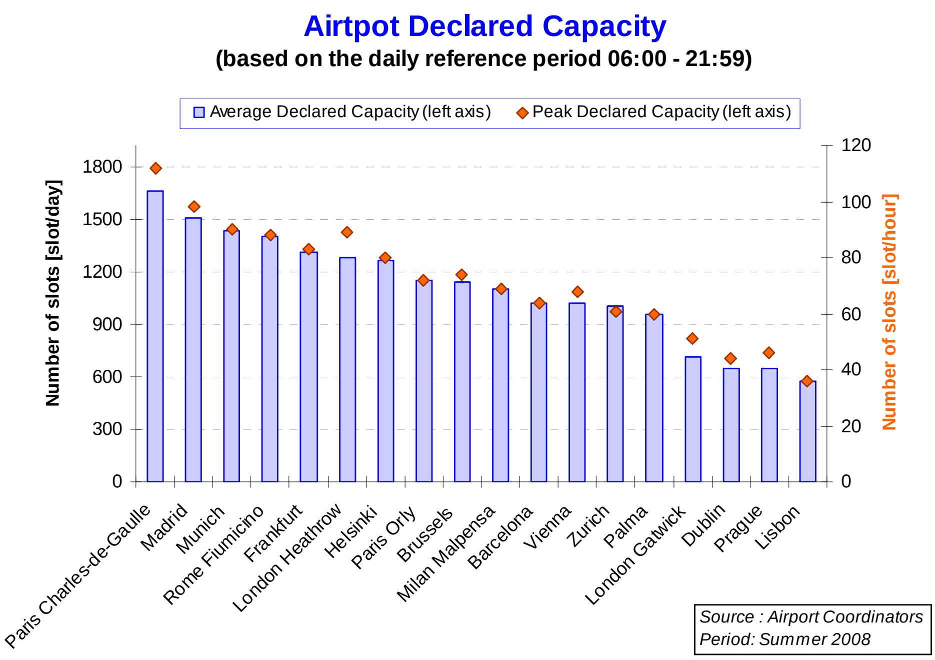


Figure 11: Airport Declared Capacity (Arrivals & Departures)

KPI Service Rate:

Service rate is the 1% percentile of the average number of movements per 10-min rolling hours in busy periods.

The metric is calculated based on the throughput during the peak month of a year. The number of movements per rolling hours of that month is then ordered by magnitude. The 1% of the busiest hours is defined as Service Rate.

The service rate shall be accompanied by key supporting data providing indications of the conditions during which the value was achieved:

- period of time of the traffic sample (e.g. a season, a peak month, a year);
- traffic mix composing the service rate;
- flight additional time[16] which was achieved on average in the hours included in the 1st percentile in order to verify the level of queuing.

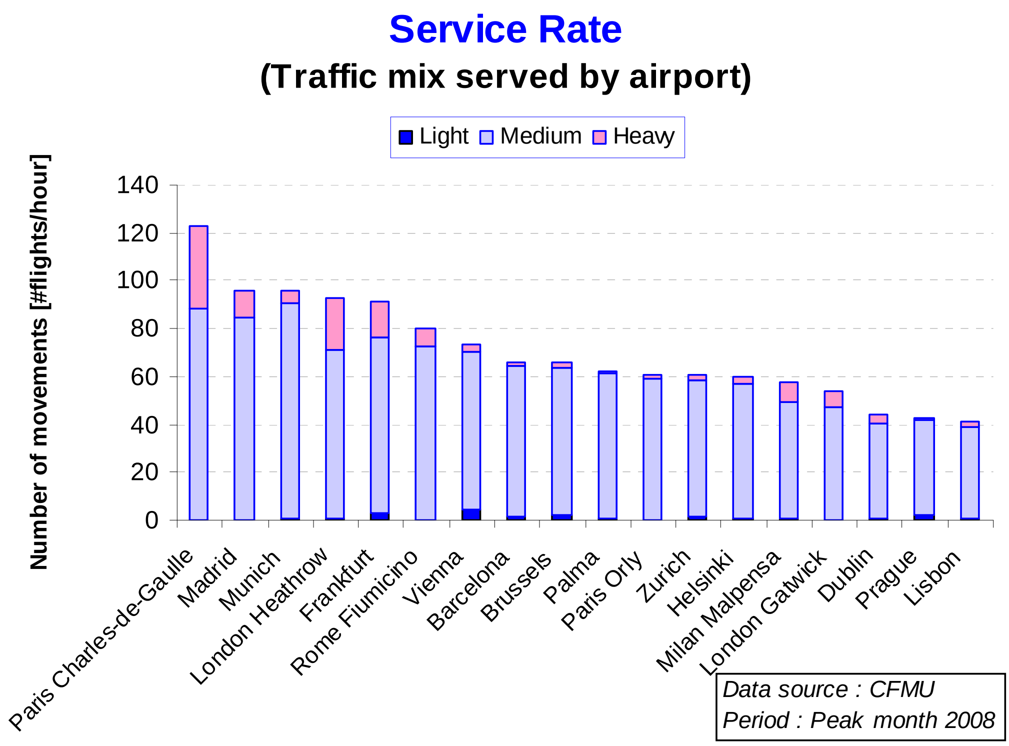


Figure 12: Service rate per airport – Breakdown of aircraft type mix

[16] See definitions of this term later in Section 4.6

4.5.4 Data source

“Airport declared capacity” is usually available through airport coordinators websites.

	Advantages	Limitation
Airport coordinators	Publicly available in websites	None
Airport operators	Available	None

Table 5. Advantages and limitations of data source to compute “airport declared capacity”

The “service rate” could be estimated by using traffic data.

	Advantages	Limitation
Airport operators/ATC	100% traffic	None
CFMU	Centralised data source	98% traffic

Table 6. Advantages and limitations of data source to compute “peak delivered throughput (i.e. handled traffic)”

SECTION II
KPAs/KPIs
Punctuality, Efficiency and Predictability

4.6 KPA Punctuality, Efficiency and Predictability: definition and relationship

This section introduces the concepts of KPAs punctuality, efficiency and predictability, and illustrates their relationships. Airspace users would like to depart and arrive at the time they select and fly the trajectory they determine to be optimum in all phases of flight. Those three KPAs measure the ability to operate efficient and reliable schedules.

Punctuality is the ability to operate scheduled times (i.e. the deviation between actual time and scheduled time). From an airline scheduling point of view, scheduled times are defined having regard to commercial decisions and variation in operational block-to-block time (i.e. from stand to stand). For example, a flight from city A to city B at the morning peak hour every weekday regularly suffering a certain delay will have an adverse impact on the punctuality record. If no other solutions are found, the schedule might be adjusted and this strategic delay might be embedded into the flight scheduling, either at the turnaround or on the block-to-block phase. The scheduled block-to-block time duration between two airports is usually based on the observed travelled block-to-block times of the previous relevant season. A target is set to the distribution of previously flown times[17]; the chosen target varies from airline to airline between the 50th and the 80th percentile of the distribution of block-to-block time. Therefore, if the scatter of flown times increases, and the same target is kept, the scheduled time would increase.

Consequently, although punctuality is considered to be an important starting point for the overall performance of air transport, airport airside and nearby airspace, the “masking” of expected congestion/delays through the inclusion of strategic times into schedules makes it necessary to conduct performance analysis with Predictability and Efficiency.

Efficiency relates to the block-to-block duration starting when the flight is ready to leave the stand. It is assumed that, if the duration of one or more flight phases are improved, the block-to-block time of the next season could be reduced. The portion of time which might be reduced is measured in the KPA Efficiency and is represented by the deviation of this average flight time in relation to an optimum flight time (see green arrow 2 in Figure 13). Predictability deals with the variability of flight operations around an average flight time (see green arrow 1 in Figure 13) comparing a large with a narrow distribution, the former would demand more airline resources to achieve the same punctuality target.

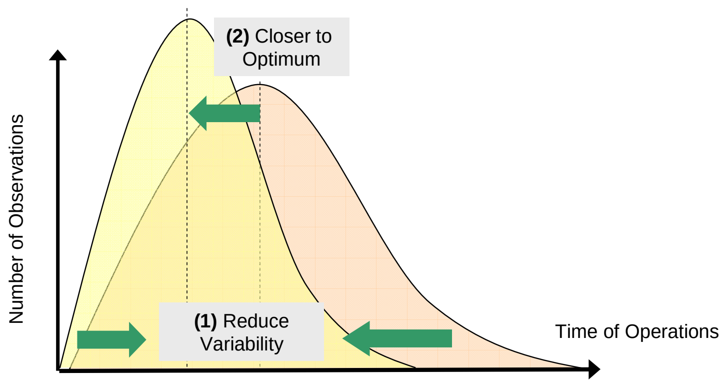


Figure 13: The concepts of efficiency and predictability

[17] Note that other present and future factors might be considered,. (e.g, new airport facilities)

If it were possible to shift the average of the duration distribution towards an optimum reference, without compromising the capacity utilisation, the added value would be significant for airlines as the additional times embedded in the schedule would be reduced, thus their cost of operations.[18]

If it were possible to reduce the variability of the flight duration, the level of predictability of operations would increase, with a positive impact on punctuality. This would in turn increase passenger satisfaction and improve the utilisation of ATC/airport/airline resources.

Figure 14 illustrates one example of the distribution of ASMA duration (from 100Nm until landing) depending on the time of the day using a set of flights of three months in Charles De Gaulle airport (January to March 2008). Note that this type of graph is only one of the several alternatives to present the information about the average duration of the ASMA, the variability of the duration and the unimpeded time.

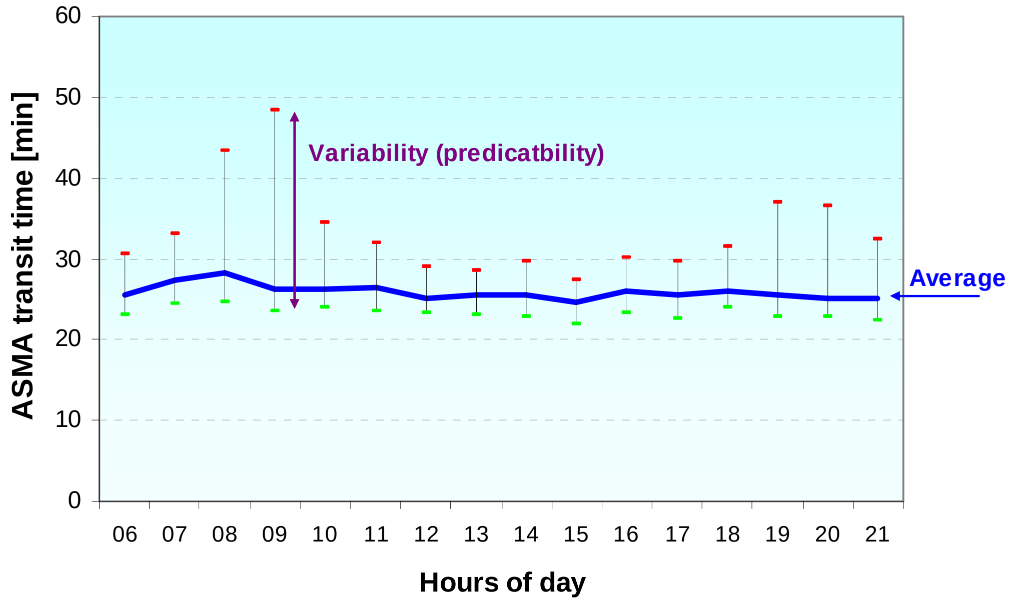


Figure 14: ASMA (airborne arrival times) Time Duration in Charles-de-Gaulle for the period January-March 2008

[18] Usually an airline will approximate the schedule block-to-block time at the nearest 5 minutes. Therefore, considering the block-to-block from departure to arrival, a saving less than 3 minutes may not originate improvements in the schedule.

4.7 KPA: Punctuality

4.7.1 Overview

KPA Punctuality	The ability of the air transport system to deliver on-time services to the passengers by comparing scheduled times to actual observed times.
KPI Names	• On-time arrival/departures • Early arrivals • Departure Delay Causes
Breakdowns	• Arrival Punctuality • Departure Punctuality • On time performance • Departure delay cause
KPI Metrics	• Arrival punctuality: Percentage of flights arriving no more than 15 minutes (alternatively 3 mins) late compared to scheduled arrival times. • Departure Punctuality: Percentage of flights departing no more than 15 minutes (alternatively 3 mins) late compared to scheduled departure/ arrival times. • Early arrivals: Percentage of flights arriving 15 minutes or more ahead of schedule. • Departure delay causes: Percentage of contributory cause to departure delays. • See also Annex L for an additional set of KPIs proposed by Brussels
Data sources	Airport scheduling data or Airline scheduling data (eCODA)

4.7.2 Key Performance Area

Punctuality is a measure of the ability of the air transport system to deliver on-time services to the passengers. From a passenger perspective, safety, price, and adherence to schedule (i.e. punctuality) are among the most important selection criteria. The level of punctuality is defined as the proportion of flights delayed by more than 15 minutes compared to scheduled departure and arrival times. There are many factors contributing to the punctuality of a flight. In reality, air transport punctuality is the “end product” of a complex interrelated system, involving many different stakeholders of the aviation community.

As explained before in Section 4.6, in order to achieve an acceptable level of punctuality, airlines often include time buffers in their schedules in order to account for a predictable level of delay. Hence, the scheduled time for a flight from block-to-block times is not the same as the actual amount of time required to make the trip in normal conditions without constraints. This is conceptually depicted in Figure 15. Punctuality is measured by the percentage of distribution arriving within a certain time window (e.g. before 15 min.). Predictability is measured by the dispersion (i.e. standard deviation) of the data.

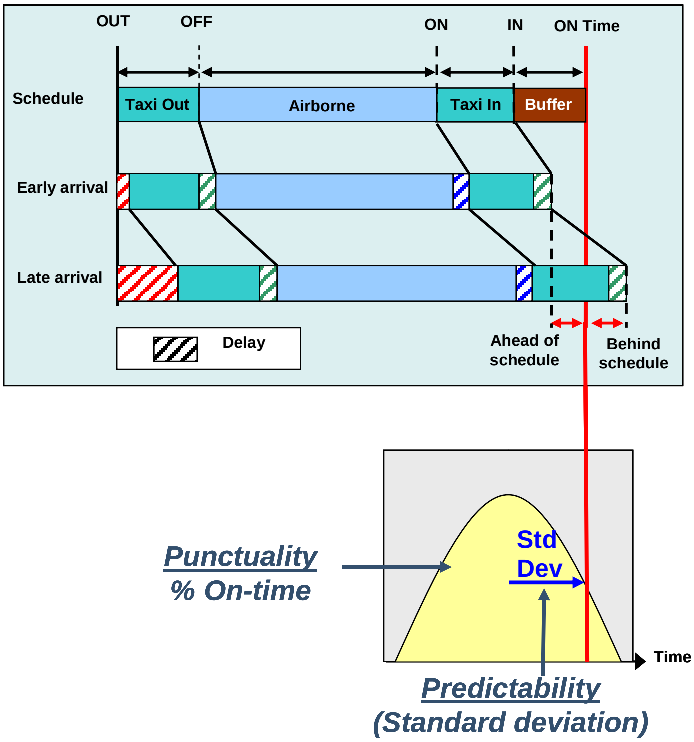


Figure 15 Concept of Punctuality.

4.7.3 Key Performance Indicators

KPI On-time arrivals/departures:

On-time arrivals/departures is the percentage of flights departing/arriving no more than 15 minutes (alternatively 3 mins) late compared to scheduled departure/arrival times:

- Departure punctuality is calculated by the difference between actual off-block time and scheduled off-block time;
- Arrival punctuality is calculated by the difference between actual on-block time and scheduled on-block time.

KPI Early arrivals:

Percentage of flights arriving 15 minutes or more ahead of schedule.

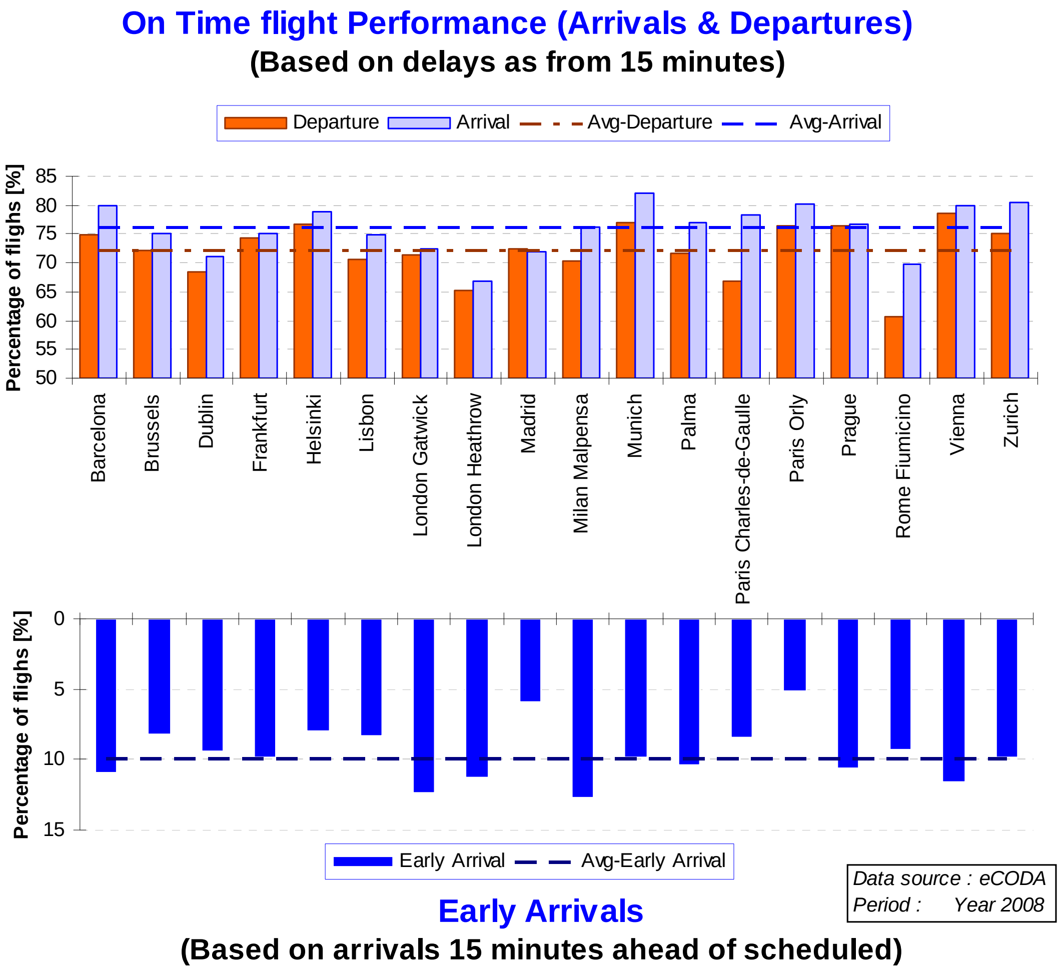


Figure 16: Punctuality per airport: On time arrivals/departures and early arrivals

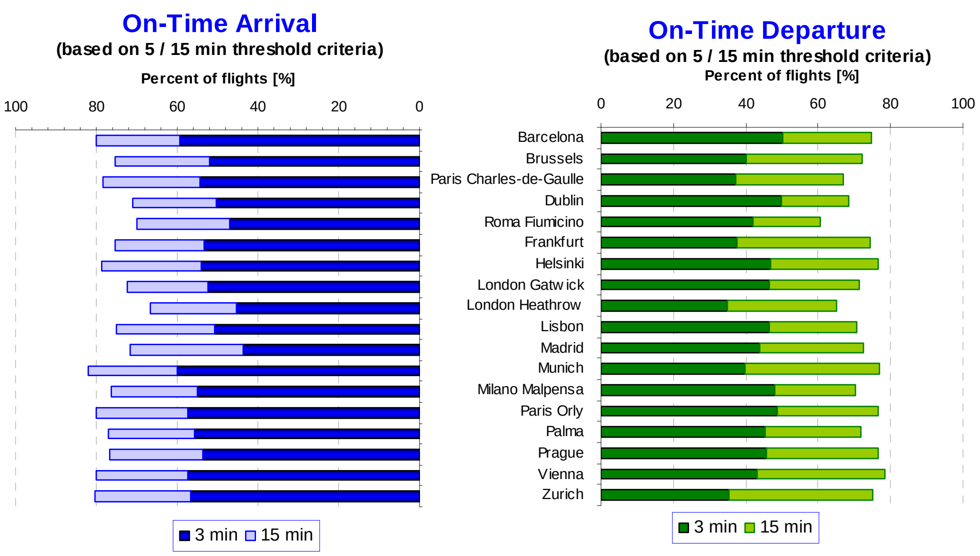


Figure 17: On-time performance based on two threshold criteria (eCODA, 2008)

KPI Departure delay causes:

This KPI analyses the causes for departure unpunctuality (delays compared to scheduled time) as reported by airlines. Figure 18 illustrates the percentage of delay cause over the total amount of minutes delay.

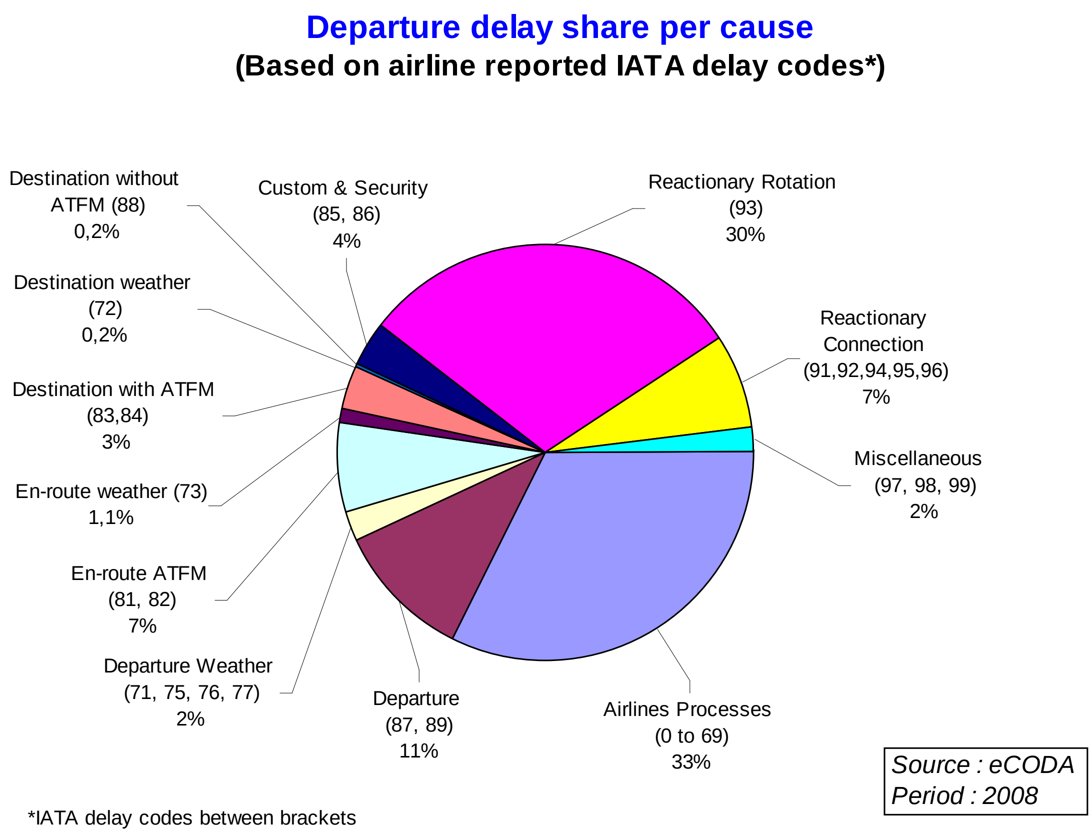


Figure 18: Departure delay causes during the period 2008

The current IATA delay grouping shown in Figure 18 seems to be the most relevant from an airport system perspective. However the grouping might be changed as soon as further knowledge and understanding are gained.

4.7.4 Data source

The most legitimate data source against which to measure punctuality would be "airport scheduling data" as the reference of scheduling operations should be the airport slot as indicated in EC Regulation 95/93. In practice, the best data source is "airline scheduling data" for two reasons: first of all, mismatch between airport and airline data is negligible for performance measurement purposes, second the airline data set contains "delay causes" which are not contained in the airport data set.

There is a high level of consistency between scheduled times submitted by airports and schedule information in the eCODA data. On average, 98.8% of departures and 98.3% of arrivals show no time difference between the two data sets.

	Advantages	Limitation
Airport Scheduling Data	100% flights included	Delay causes are not available
eCODA	Delay cause available	Coverage varies from airport to airport

Table 7; Advantages and limitations for puntuality measures

The AOBT/AIBT provided by airport operators are overall more precise than airline data (eCODA) whenever the AOBT at the airport is recorded automatically. Overall, the average deviation of block times between eCODA and Airport data is small for high level performance analysis (e.g. grouping data at European level), but the deviation could be significant for local analyses at those airports where the recording of events is precise and rigorous.

	Advantages	Limitation
AOBT/AIBT (Airport)	- High level of precision when recorded automatically. - 100% flights included	Less accuracy when recorded manually, unless a rigorous procedure is in place and enforced.
AOBT/AIBT (Airline)	Data source already collected	- 70% of flights - Less accuracy when recorded manually or ACARS set on “door closed”.

Table 8: Advantages and limitations of scheduling data sources

4.8 KPA Efficiency

4.8.1 Overview

KPA Efficiency	Efficiency is acting or producing effectively with a minimum of waste, expense or unnecessary effort (good input to output ratio). Flight efficiency measures the difference between actual and optimum unimpeded aircraft trajectories. Deviations from this optimum make airlines to incur additional times and fuel burn. In this first report the focus of the performance analysis is restricted to time efficiency in a flight phase, this means minimising the difference between the duration of the flight phase respect to an optimum time.
KPI Names	• Additional Time of Inbound Flow. • Additional Time of Outbound Flow.
Breakdowns	• Hourly, daily, monthly, season, year. • Stand-Runway combinations. • Entry sector ASMA – Landing Runway. • Aircraft types.
KPI Metric	• Inbound Flow = ATFM Arrival Delays/number of inbound flights and ASMA Additional time/number of inbound flights • Outbound Flow = Pre-departure delays (IATA codes 87-89) /number of outbound flights and Taxi-out additional time/number of outbound flights
Data sources	CFMU, airport operators, local ATC, eCODA

4.8.2 Key Performance Area

According to the ICAO performance framework, the concept of efficiency addresses the operational and economic cost-effectiveness of gate-to-gate flight operations from a single-flight perspective [5]. Flight efficiency is measured as the difference between actual and optimum unimpeded aircraft trajectories. Airlines sustain larger times and extra fuel burn when deviations from this optimum occur [6]. Within the context of this document, we will restrict the concept of efficiency to time efficiency.

It should be emphasized that time efficiency is measured from a single flight perspective with respect to an unimpeded time. The unimpeded time represents the time necessary to complete a flight phase in absence of any traffic (i.e. flight moving unconstrained after its start-up until take-off in the taxi-out phase or moving unconstrained from the entering point in ASMA region until landing, in the case of ASMA phase).

In practice, runway capacity is a valuable resource and, from a system point of view, a certain level of queuing time is unavoidable and even necessary to maximize runway throughput. The queue of aircraft at several resources serves to supply continuous demand in order to avoid idle periods of the runway use. Consequently, aircraft would spend longer times at the runway before receiving take off clearance, but the use of airport infrastructure is maximized.

The total observed queuing time[19] is, therefore, the difference between the

[19] Queing is commonly understood as the time spent by the aircraft waiting in a physical queue at the runway before departing. However, the concept of optimal queuing time can be extended and applied to every resource the aircraft is using (e.g. during the approach phase an stack of aircraft can be kept at the holding pattern queing in order to maximize the arrival trghoutput to the runway). See references [8], [9], [10] for various approaches to describe the airport system as a netwrok of queuing system.

unimpeded time and the actual time, which is what ATMAP defines as **Additional Time**. This is the combination of an optimal queuing time (which minimizes trade-offs with other objectives) and an extra time due to inefficiencies and constraints at the airport and ATC resources[20]. Figure 19 illustrates notionally this perspective. ATMAP Phase I does not intend to break these two components down, but to measure the total additional time, as an indicator of time efficiency.

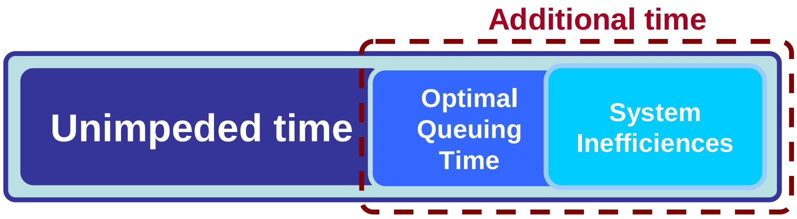


Figure 19: Time Efficiency optimum references

The unimpeded time represents the duration of uncongested flights from A to B as a reference. The additional time is the duration that is supplementary to the unimpeded time. Figure 20 represents the notion of unimpeded time and additional time applied to a data distribution.

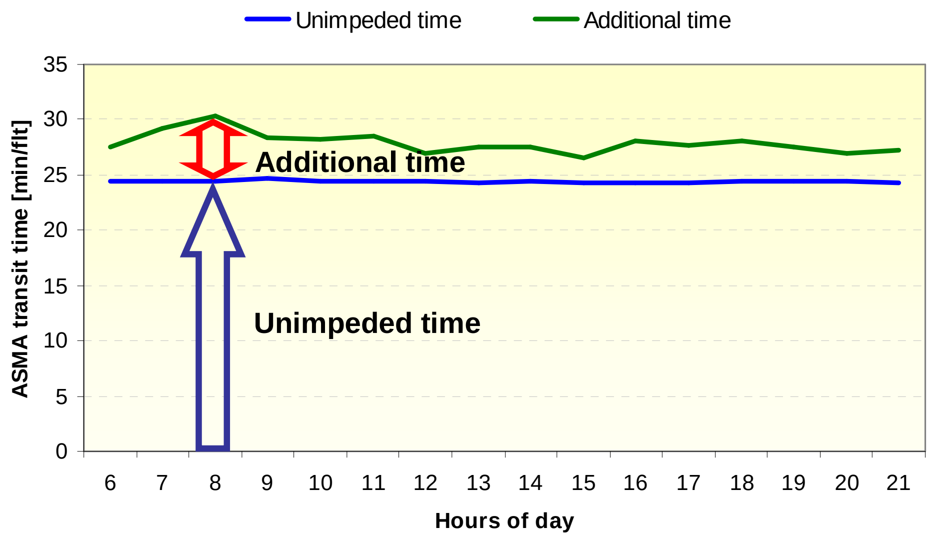


Figure 20: The notion of unimpeded and additional time applied to ASMA transit time

The additional time, meaning the supplementary time beyond the unimpeded time, could be broken down into a component experienced at departure stand (engine off) and another engine-on component from start taxiing on its own power until take off (while on ground) and from ASMA entering point until landing when in-flight (see Figure 21).

[20] Note that a reduction of the optimal queuing time could only come at the expenses of a reduction of runway throughput, but if system inefficiencies are reduced (all the rest indicators equal) this would be a benefit for the airport system (and the airspace users).

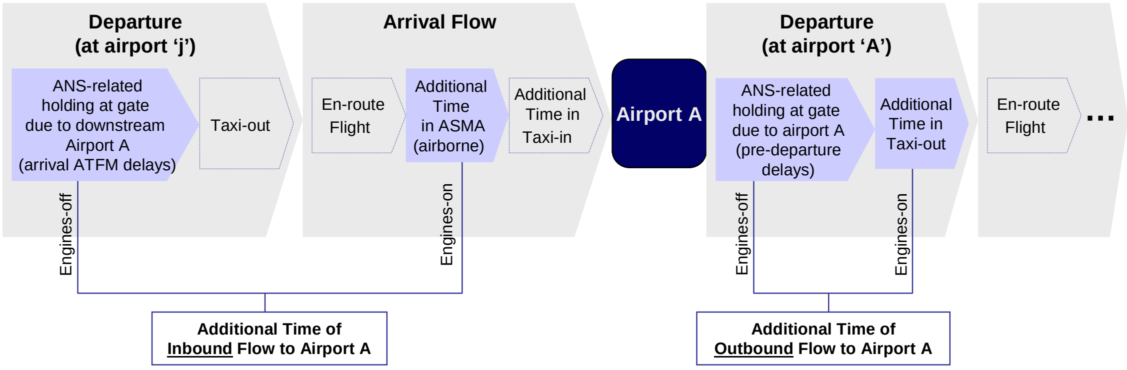


Figure 21: "Additional time" generated at different phases of flight[21]

The arrival flow to a given airport might be impacted by constraints resulting in supplementary times beyond the unimpeded time. These supplementary times can be absorbed at the departure stand, measured by "arrival ATFM delays", or in-flight, measured by the ASMA additional time. Although holding traffic at the departure stand would reduce fuel burn, other considerations make more advisable to spend additional time in-flight (e.g., avoid gaps in the arrival sequence due to fluctuations of traffic supply to the runway or variations of runway capacity). In the case of the departure flow, additional time could be measured with pre-departure delays due to constraints at departure airport[22] plus additional time during taxi-out operations.

Although an initial approach to combine both sources of supplementary times per flow to measure efficiency has been proposed (i.e., measure total additional time for inbound flow as arrival ATFM delay plus ASMA additional time and total additional time for outbound flow as pre-departure delays and taxi-out additional time), there are views that do not consider adequate such an approach. For the time being, this report keeps the two types of inefficiency times separately treated (i.e., delays and additional time), until a consensus is reached among participants, and this is expected to take place in ATMAP II. Therefore, there are four efficiency indicators, two related to the inbound flow and two related to the outbound flow.

It is worth noting that additional time of the En-route and of Taxi-in phases are not measured in this version of the ATMAP measurement framework. While en-route is out of scope of the project objectives, taxi-in phase discussion has not taken place yet, but they are planned in ATMAP phase II.

4.8.3 Key Performance Indicators

Additional Time for the Arrival Flow:

- KPI 1 – ATFM Arrival Delays:

ATFM Arrival Delays due to constraints at the destination airport/number of inbound flights.

ATFM arrival delays are those only attributable to the arrival airport. These are generated at the destination airport and absorbed upstream at the stand at various departure airports. Note that these delays can have various causes (e.g. ATC capacity, staffing, weather, etc.) but all of them are attributable to the arrival airport.

[21] Additional time in the "taxi-in phase" is not measured in ATMAP at this stage
[22] i.e., pre-departure delay with a IATA delay coding 87, 89, 71,75,76

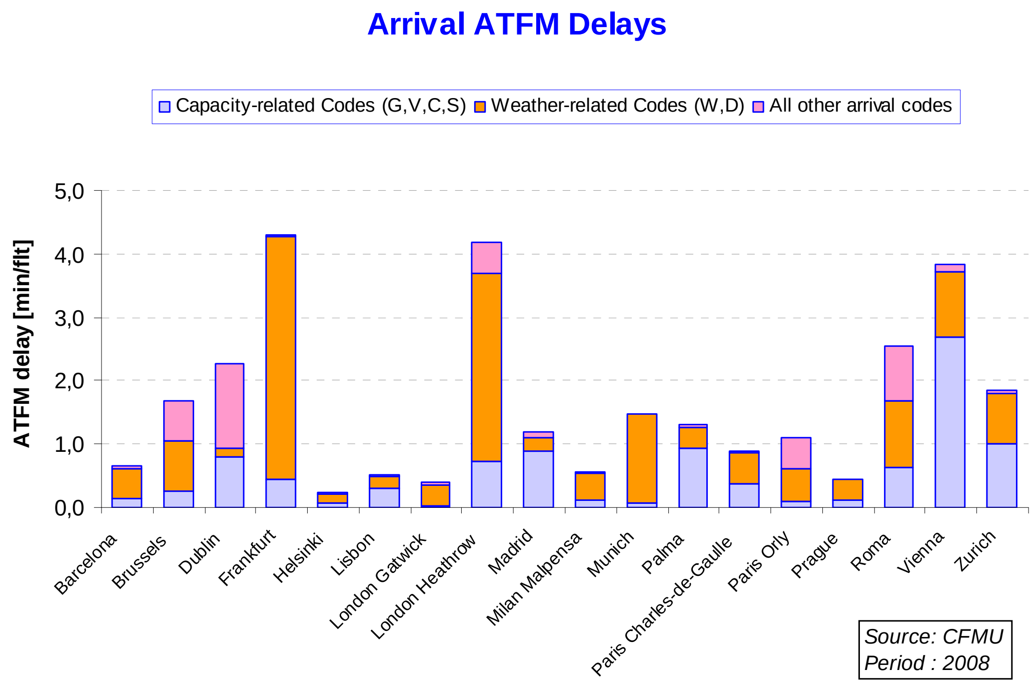


Figure 22: ATFM delays generated at European arrriving airports (CFMU reasons of delays due to the arrival airport)

- KPI 2 – ASMA Additional Time:

ASMA Additional time/number of inbound flights.

In order to estimate additional time, a methodology to compute unimpeded time is selected. The algorithm currently used is described in Annex D. Figure 24 shows the unimpeded and the additional time for each ATMAP airport.

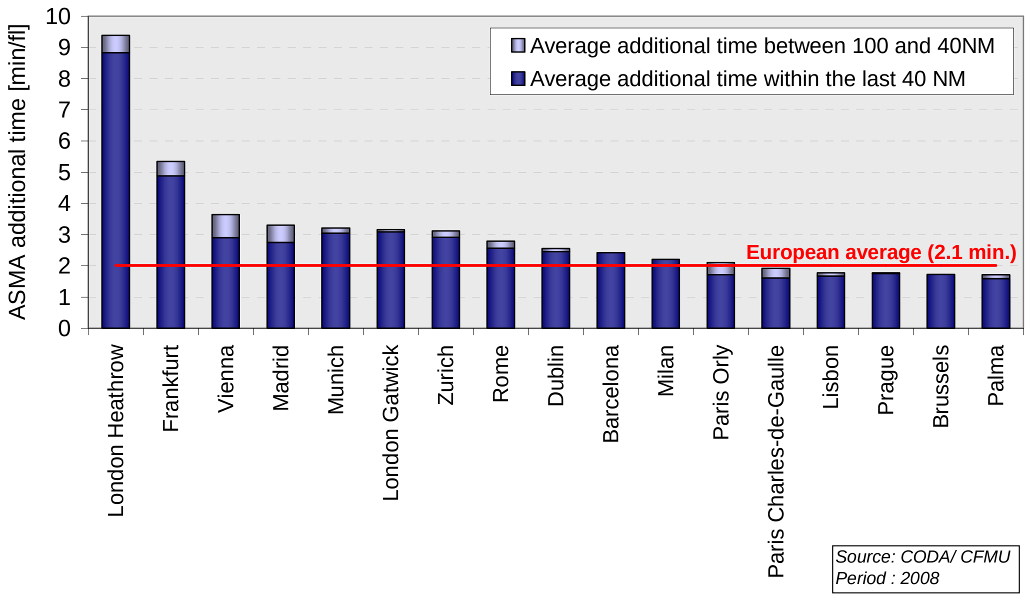


Figure 23 ASMA 40 NM and 10 NM addition time

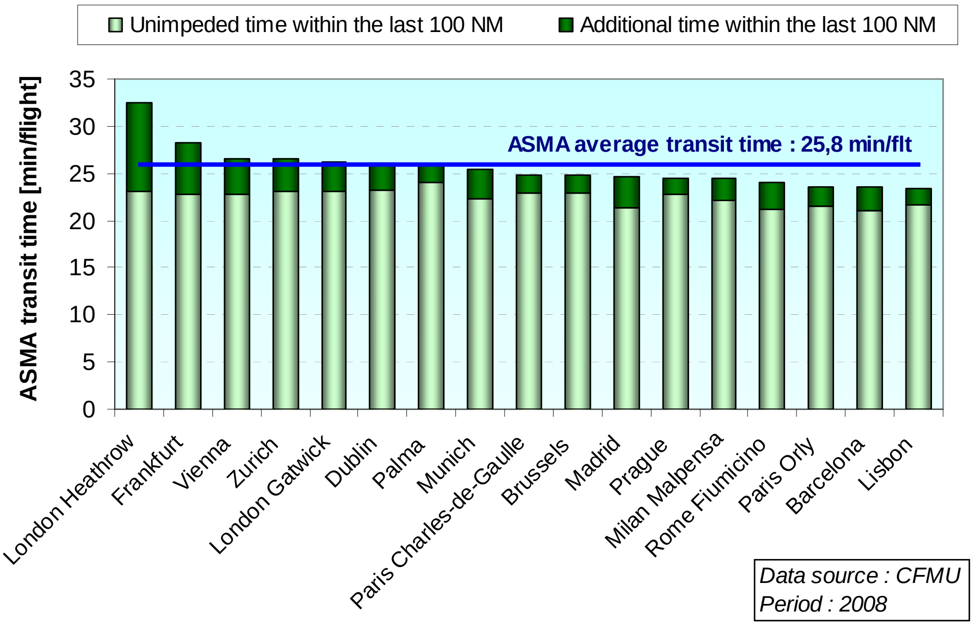


Figure 24: ASMA unimpeded and additional time at European airports

Additional Time for the Departure Flow:

- KPI 1 – Pre-departure Delays:

Pre-departure delays due to departure airport constraints/number of outbound flights

Pre-departure delays originated at the airport of origin when the aircraft is ready to leave. These delays have airport airside causes (IATA codes 87 and 89 for airport facilities and restrictions, respectively) and weather-originated reasons (IATA codes 71, 75, 76).

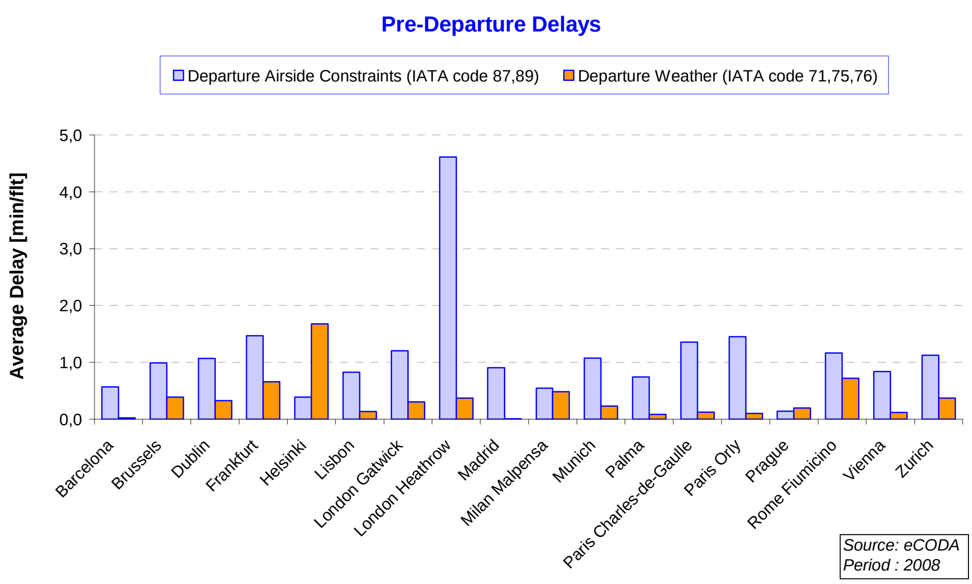


Figure 25:Pre-departure delays (attributable to departure airport)

- KPI 2 – Taxi-out Additional Time:

Taxi-out additional time/number of outbound flights

Taxi-out additional time beyond the unimpeded time for each airport In order to estimate the additional time for the taxi-out time, a methodology based on the same principles as the one applied for ASMA phase and explained in Annex D was used.

The taxi-out phase occurs between AOBT and ATOT whether the aircraft moves on its own power or is moved by a tow-track. When computing additional time, two variables play a major role: the type of aircraft and the distance between the stand and the runway. The type of stand (nose-in/nose-out or nose-in/push-back) does have a major contribution in the duration of the unimpeded time, but not in the amount of additional time.[23]

Figure 26 presents the results of computation of additional time and unimpeded times for the 19 selected airport.

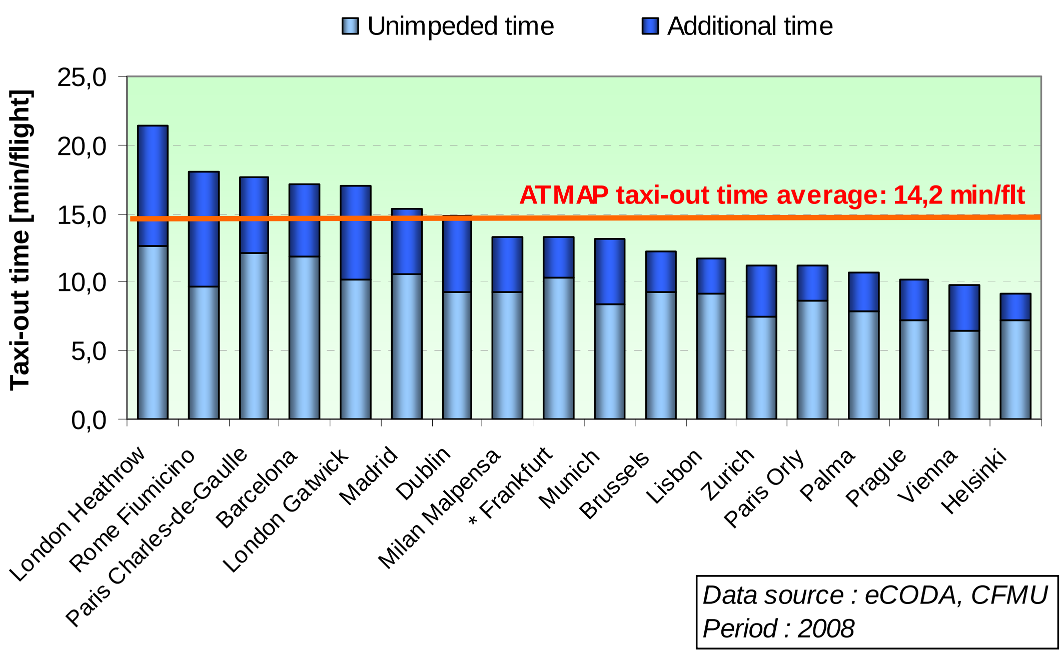


Figure 26: Taxi out unimpeded time and additional time at European airports

4.8.4 Data source

The data required for the computation of ASMA and taxi-out KPIs are presented in Section 6.1.

4.8.5 Relationship between efficiency, declared capacity, service rate and traffic volume

Apart from system inefficiencies (see Figure 19) and external factors (e.g. weather), the level of efficiency can be explained by the following main root categories:

[23] See reference "A comparative study of taxi-out times" PRU, Brussels and Zurich.

- The airport capacity declaration and the ability of the operational capacity to sustain the expected peak throughput;
- The expected quality of service that all stakeholders are willing to accept for optimising the utilization of airport infrastructure;
- The amount of airport slots which are finally used in the day of operations. If airport slots are not all used, the daily efficiency should be better than the one planned or foreseen in the scheduling phase.

The three causes listed above explain why efficiency should be evaluated in perspective of capacity and handled traffic (see par. 4.3 and 4.5). This paragraph provides a view of the work-in-progress that PRU is conducting to analyze these relationships. The KPIs under study are introduced hereunder.

<u>Handled traffic vs Declared Capacity</u>:

This ratio illustrates how much declared capacity is used in the day of operations. The use of two metrics is proposed:

- Airport slot utilization: Ratio of handled traffic divided by declared capacity over a period of time, e.g. in a season.
- Number of hours (or percentage of hours) with average hourly handled traffic above the declared capacity value

The first metric (airport slot utilization) relates the handled traffic and the declared capacity.

$$\textit{Airport slot utilisation:} \quad \frac{\textit{Number of handled movements}}{\textit{Average of available airport slots (declared capacity)}}$$

This indicator is plotted in Figure 27. The closer this indicator is to one (see Y axis), the higher airport slots are used during the selected period.

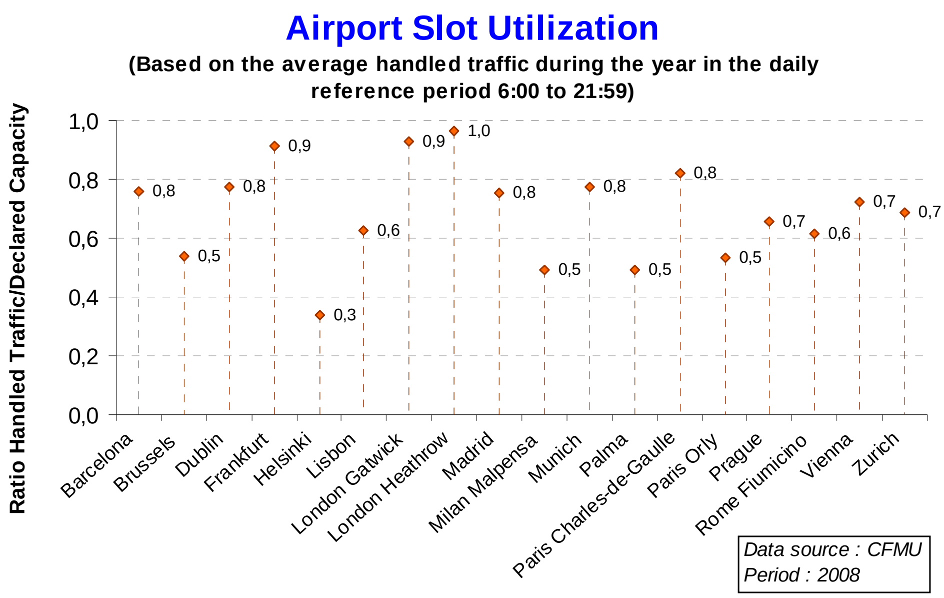


Figure 27: Ratio Handled Movements/Declared capacity during 2008[24]

[24] When analysing a calendar year, airport declared capacity should be weighted with the values of the three seasons, two winters and one summer.

The second metric, number of hours of handled traffic above 90 % of the declared capacity, provides an indication on how many times the handled traffic is close or higher than the declared capacity. This metric can be accompanied by the distribution of handled traffic throughout the day to see the behaviour in peak hours. Figure 28 illustrates graphically the distribution of average handled movements by hour of the day. It shows the hourly traffic and capacity evolution in the period Jan-Mar 2008 for Paris Charles-de-Gaulle. The graphic indicates when the average handled traffic by hour (average throughput per hour) is close to or higher to the hourly airport declared capacity (at 11:00 am and 14:00 pm in the example). Furthermore, the graphic indicates the standard deviation around the average. In this specific example, there are only two hours per day when handled traffic is above 90 % of the declared capacity. The KPA Efficiency is not expected to be at stake unless there are degraded days in the selected period.

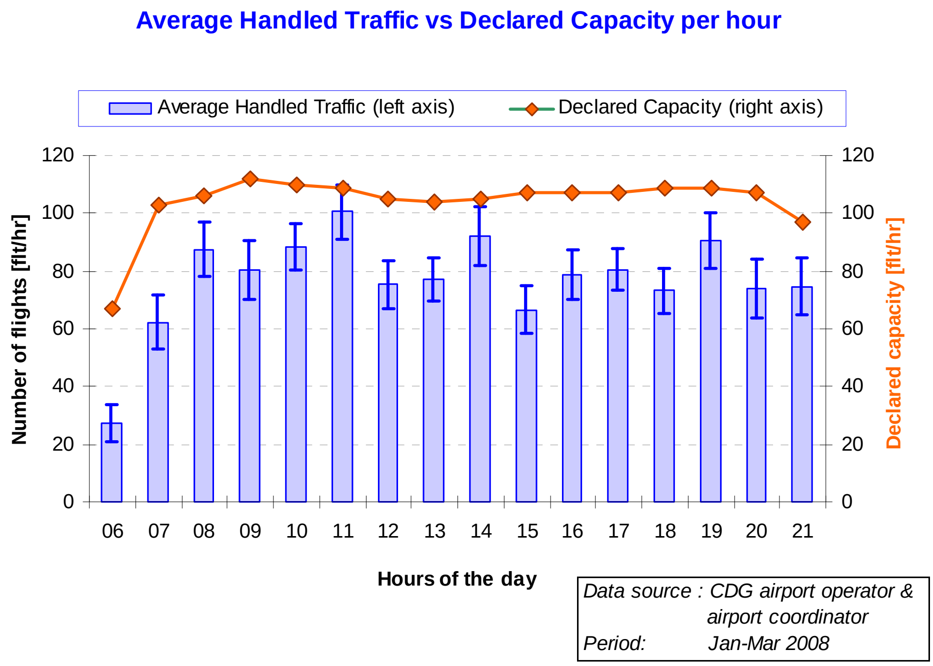


Figure 28: Hourly traffic evolution in airport Paris Charles-de-Gaulle for the period Jan-Mar 2008

The specific proposed metric is the number of **hours the actual handled traffic which is over 90% of declared capacity**[25]. Figure 29 plots the same concept that is presented in Figure 28, but slightly modified and during the peak month of 2008.

[25] An alternative metric may look at the percentage instead of absolute values, which can be derived dividing the plotted hours by 496 hrs.

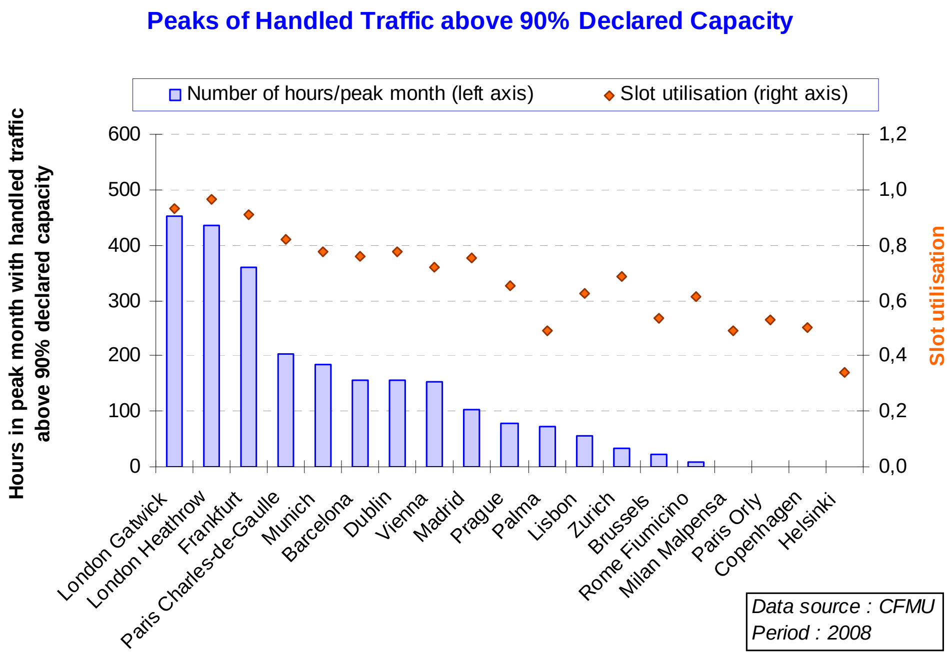


Figure 29: Number of hours over 90% Declared Capacity during the peak-month[26]

It is worth mentioning the observation according to which airports with high slot utilization ratios are those operating more frequently over 90% of the declared capacity. In addition, a relatively small slot utilization combined with a relatively high number of hours over 90% of the declared capacity could be related to high seasonal or daily traffic variation.

Declared Capacity vs Service Rate:

This ratio can provide useful insights whether the operational capacity is able to sustain the throughput foreseen in the capacity declaration phase and, when the ratio is read jointly with the KPA Efficiency the ratio can provide information about the ability to deliver the expected level of efficiency when the throughput is at the level of the declared capacity. More information can be reported by this ratio: for instance how much operational capacity is kept in reserve to accommodate traffic fluctuations without imposing excessive delays or additional times.

$$\textit{Strategic Utilization of Airport Capacity} = \frac{\textit{Declared Capacity (peak)}}{\textit{Service Rate}}$$

Figure 30 shows the ratio Declared Capacity vs Service Rate per each ATMAP airport.

[26] The graph shows data of year, but the metrics can also be calcualted per season.

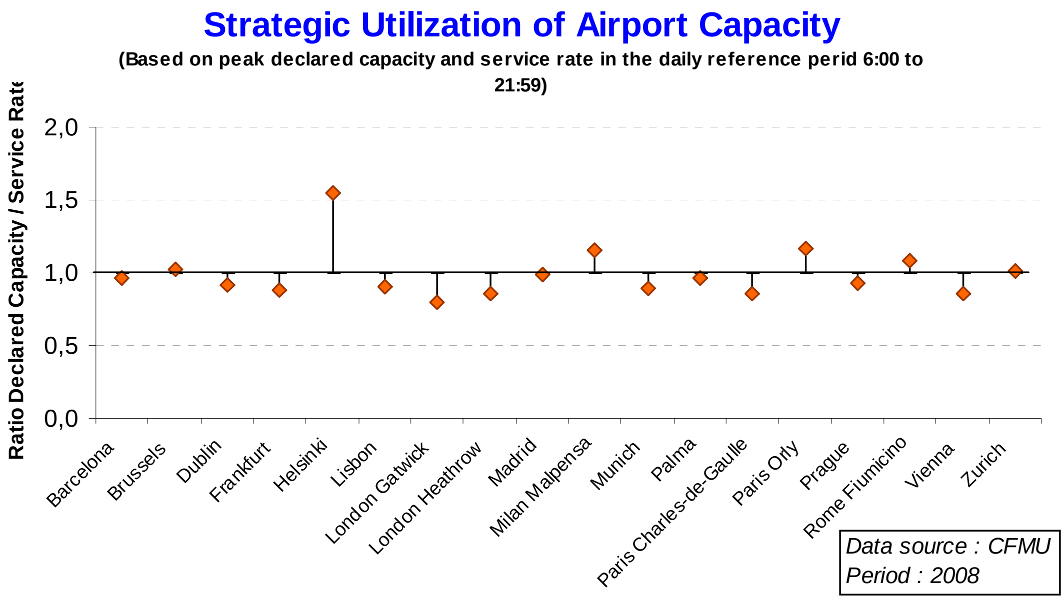


Figure 30: Ratio Declared Capacity/Service Rate

Figure 30 (ratio declared capacity/service rate) as well as Figure 29 (airport slot utilisation) are used to evaluate KPA Efficiency. It is interesting to note that those airports with the highest airport slot utilisation and, at the same time, with a declared capacity/service rate ratio equal or below one are the ones with the lowest efficiency from a single flight perspective.

For instance, Figure 31 suggests that there is a link between the airport slot utilization and the amount of additional time generated in the ASMA and taxi-out phases. The ATFM arrival delays and pre-departure delays do not show this relationship.

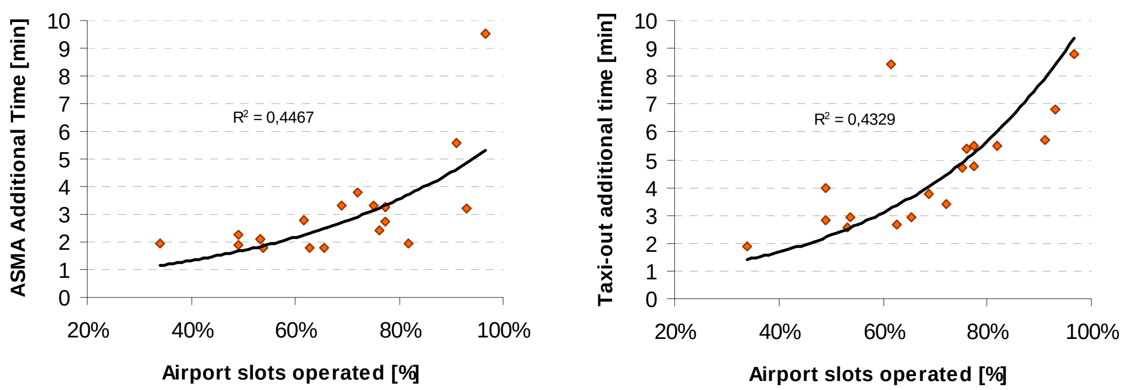


Figure 31: Relationship between ASMA and Taxi-out additional times and airport slot utilization

This is, however, work-in-progress analysis and additional assessment is required to study the relationship and trade-offs between efficiency, capacity and handled traffic, but it seems that the direction taken provides useful insights to evaluate quality of service performance.

4.9 KPA: Predictability

4.9.1 Overview

KPA Predictability	Predictability refers to the ability of the airspace users and air navigation service providers to provide consistent and dependable levels of performance. Predictability is essential to airspace users, as well as to the entire aviation industry, as they develop and operate their schedules [5].
KPI Names	Variability is used as a measure of predictability • Variability of flight segments; • Variability of arrival flow rate.
Breakdowns	• Yearly, Season • Intra-European, Inter-Continental traffic • Flight Phases
KPI Metric	• Variability of flight segments; • Standard Deviation of arrival and departure delays, and flight phase duration (i.e. taxi-out, ASMA), or; • Time Range between the 20th – 80th percentiles of arrival and departure delays, and flight phase duration; • Variability of arriving flow rate: to be defined.
Data sources	CFMU, Airport scheduling data OR Airline scheduling data (eCODA)

4.9.2 Key Performance Area

The concept of predictability refers to the ability of airspace users, airports and ANSPs to build and operate reliable schedules. This is essential for airlines as it impacts on the punctuality of their operations. The predictability of delays is embedded in the flight schedule. Flights may suffer delays and yet be on time if delays (variation in the block-to-block time) are predictable and included in the schedule. Moreover, variability of traffic flows (i.e. arrival rate at airport resources) is of high interest for airports and ASNPs as they have to allocate human and technical resources to serve the expected arrival traffic.

The aim is to measure the level of dispersion in the distribution of historic observations.

From a scheduled flight perspective (same flight in all days of the season), predictability means the same duration for the same flight phase. From the viewpoint of the daily usage of airport infrastructures, predictability means the same amount of traffic with the same characteristics as decided in the scheduling phase.

The current KPIs presented hereunder are yet at very high-level. In ATMAP II, predictability KPIs should be further tested and developed in order to provide meaningful metrics for improving processes.

4.9.3 Key Performance Indicators

KPI Variability of flight segments:

Variability of flight segments is the standard Deviation of arrival and departure delays, as well as flight phase duration (i.e. taxi-out, ASMA).

The computation method is described in Annex E.

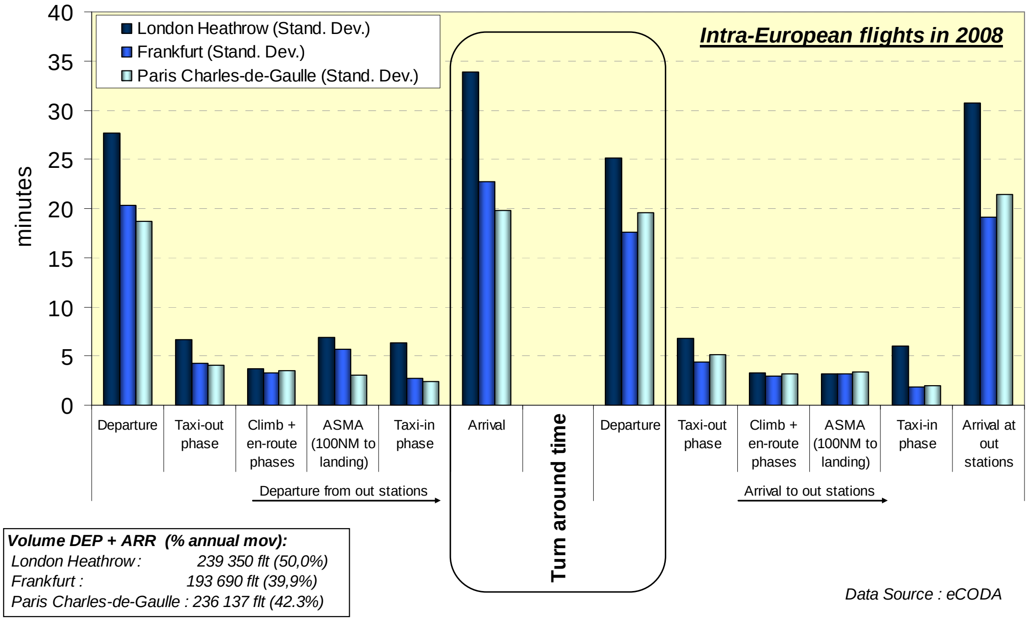


Figure 32: Predictability of flight phases (airport-centric view)

Figure 32 shows that the variability of flight segments is relatively small compared to the variability observed at the arrivals and departures. This graphic can also be read like a series of consecutive events (departure, taxi out, etc.) where each of them has its own variability and together all of them contribute to the level of arrival predictability. There is a shift from a standard deviation of some 20/25 minutes for departures to a standard deviation of some 20/30 minutes for arrival.

It can be concluded that, at European level, the variability is mostly generated in the turn-around phase and then continues deteriorating as flights move until reaching in-block stand. However the splitting between outgoing and incoming variability is not straightforward as a part of the arrival variability at an airport may have been caused by reactionary delays, originated from a late departure from the same airport.

The increased level of variability in the arrival phase demonstrates that off-block delays are not the only drivers of variability. In the block-to-block phase (from off-block to in-block) additional elements contribute to increasing the variability, notably:

- The variation of airport operations (especially the change of runway configuration at asymmetric airports and remote-stand de/anti-icing ops);
- The airport capacity reduction caused by adverse weather (snow, strong winds, fog, etc.);
- The variation of traffic and therefore the level of congestion and delay variability each day of the season;
- En-route weather conditions.

There are various mechanisms to control the impact of variability on punctuality, which have different degrees of success:

- The service provider response in managing congestion and adverse weather conditions;
- The mechanisms for compensating variability (airline buffers, airport capacity declaration parameters, ATFM parameters, etc.).

KPI Variability of arrival flow rate:

Variability of arrival flow rate in the predictability can also be seen from an ANS and airport managing body perspective.

The measure proposed in Figure 33 considers arrival traffic entering the ASMA (when flights are 100NM out) in a time band of 60 minute (static hour from 00 to 59). It then proposes a range between the 20th and 80th percentile as a measure for traffic predictability. It can be noted that the top-20 airports peak hour in the graphic happens at different times.

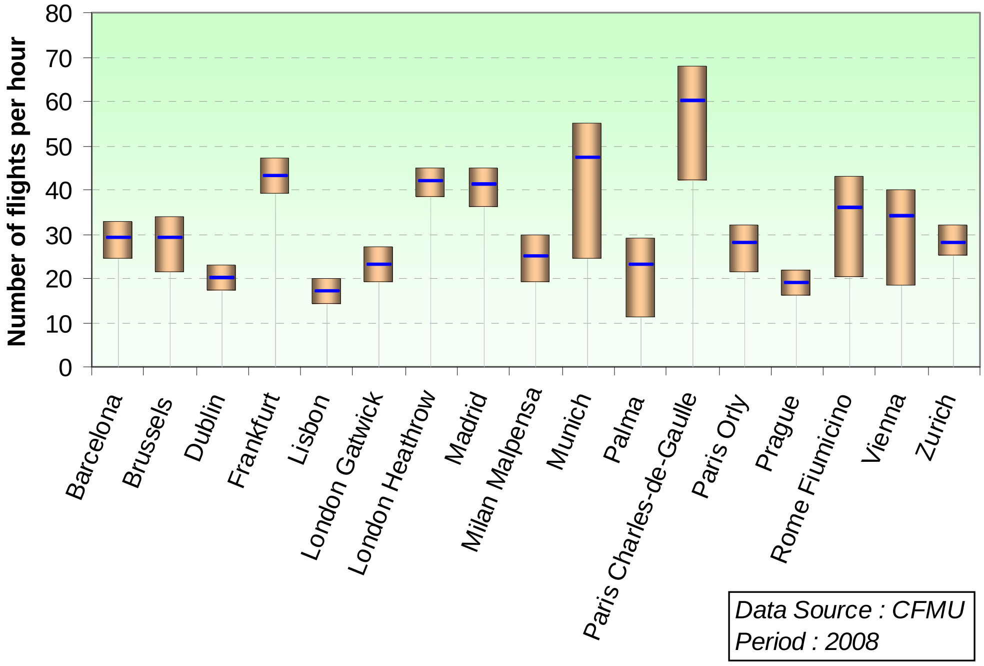


Figure 33: Arrival flow rate predictability/variability entering ASMA (100 NM) at peak hour (20th and 80th percentiles and median)

BAA London has proposed to build predictability metric around the "schedule shift" concept, which will be reviewed and trialled during ATMAP phase II.

4.9.4 Data source

Data required for the computation of these KPIs are presented in Section 6.1.

5 Approaches for assessing airport airside and nearby airspace performance

The purpose of ATMAP Phase II starting in July 2009 will be to combine in a meaningful way the KPIs developed in ATMAP Phase I with affecting factors. This chapter intends to describe possible approaches for assessing airport airside and nearby airspace performance.

As the role of the Performance Review Commission (PRC) is to provide high level performance analyses and recommendations, the ATMAP Phase II should also determine and set boundaries between analyses made by the PRC, by the network manager (e.g. EUROCONTROL CFMU or CND) and by local performance managers.

The chapter presents the following approaches related to airport airside and nearby airspace performance:

1. Fact sheet approach;
2. Relationship between scheduling facts and operational daily performance;
3. Breakdown of airport performance in different airport configurations;
4. Illustration of approaches outlined in 5.2 and 5.3
5. How to use the ATMAP framework to identify best practices;
6. Impact of network effects on performance and vice-versa.

5.1 Fact sheet approach

This approach is illustrated in Annex N. The simple description of facts allows creating some considerations on the status of performance at a given airport, although the ability to link performance with main affecting factors is rather limited by the approach itself.

5.2 Relationship between scheduling facts and operational daily performance

This approach strives to assess whether the daily performance was on line with the scheduling plans. This could typically be applied at airports where delay criteria and declared capacity are declared in advance (e.g. LHR or AMS).

However, given the level of airport saturation, it is possible to observe the achieved performance, even when delay criteria were not agreed.

This approach aims at identifying discrepancies between scheduled and actual performance.

5.3 Breakdown of airport performance in different airport configurations

This third approach is more operational. It strives to decompose the overall performance down to the level of each airport configuration.

5.4 Illustration of approaches outlined in 5.2 and 5.3

The proposed approach is schematised in Figure 34 and is explained hereunder.

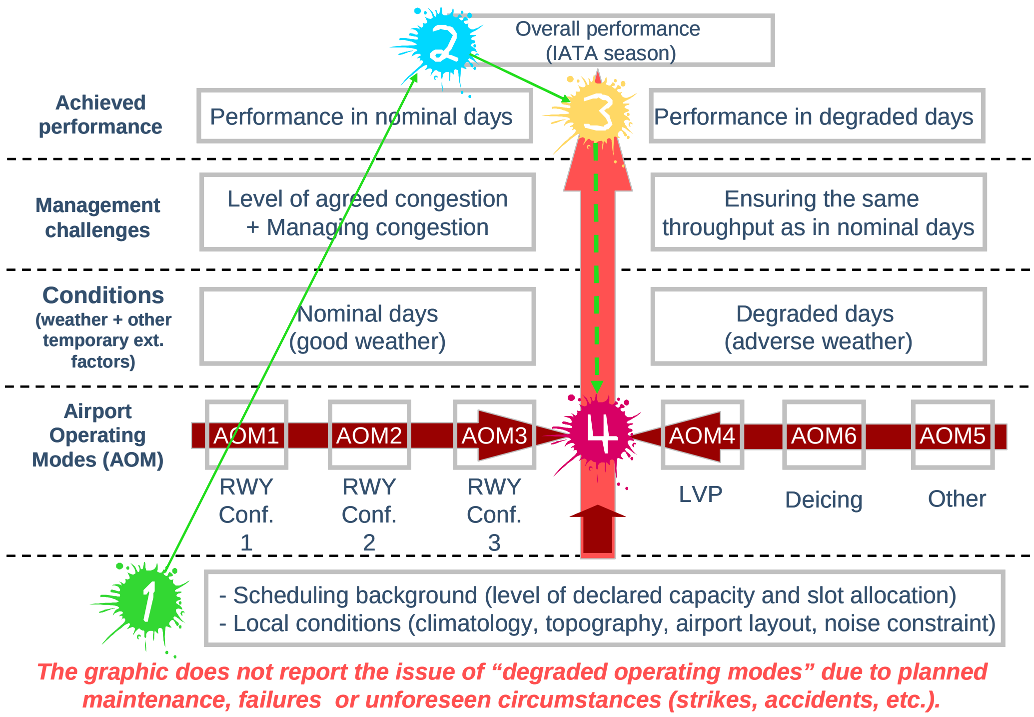


Figure 34: A possible approach for measuring airport airside and nearby airspace performance

Phase 1, at the bottom of the picture, takes into account that airport infrastructure and decisions taken during the scheduling phase largely determine airport performance achieved on the day of operations. Therefore, before presenting any analysis on performance on the day of operations, it is necessary to describe main performance drivers at an airport.

Phase 2 of the proposed approach aims at measuring the overall performance outputs of airside operations in a given season (punctuality, predictability, delays, etc.). Although it will be possible to get some orientation about the achieved level of performance by the information presented in phase one, only the overall performance is measured, at this stage, without linking it to airport processes.

In **phase 3**, the overall performance can be further divided into two components: the former achieved in nominal days of operations and the latter achieved in degraded days of operations[27]. This splitting could provide a useful indication to determine whether performance mainly depends on nominal or degraded days.

Phase 4 strives to quantify the performance of each operating mode. It is clear that the core processes for delivering airside airport performance on the day of operations are grouped in the airport operating modes. Nevertheless, it is probably too ambitious to apply this phase at European level. The amount of information to collect and to process would exceed the capability of European performance reviewers. Furthermore there is the risk of losing the high-level performance picture.

5.5 Identification of best practices

Identifying best practices should be an essential part of the measurement of airport performance. As airports cannot be compared, the import of best practices shall be done with a significant amount of adaptation to the local reality of the airport. Local

[27] Disrupted days will be counted, but not analysed.

management could decide whether a best practice could be imported and adapted to its own airport.

It is also important to note the definition of best practice: best practice is a set of processes which are clearly linked to a good level of performance. It seems that the ATMAP framework could be used to identify those best practices. Some examples are given hereunder:

Example 1

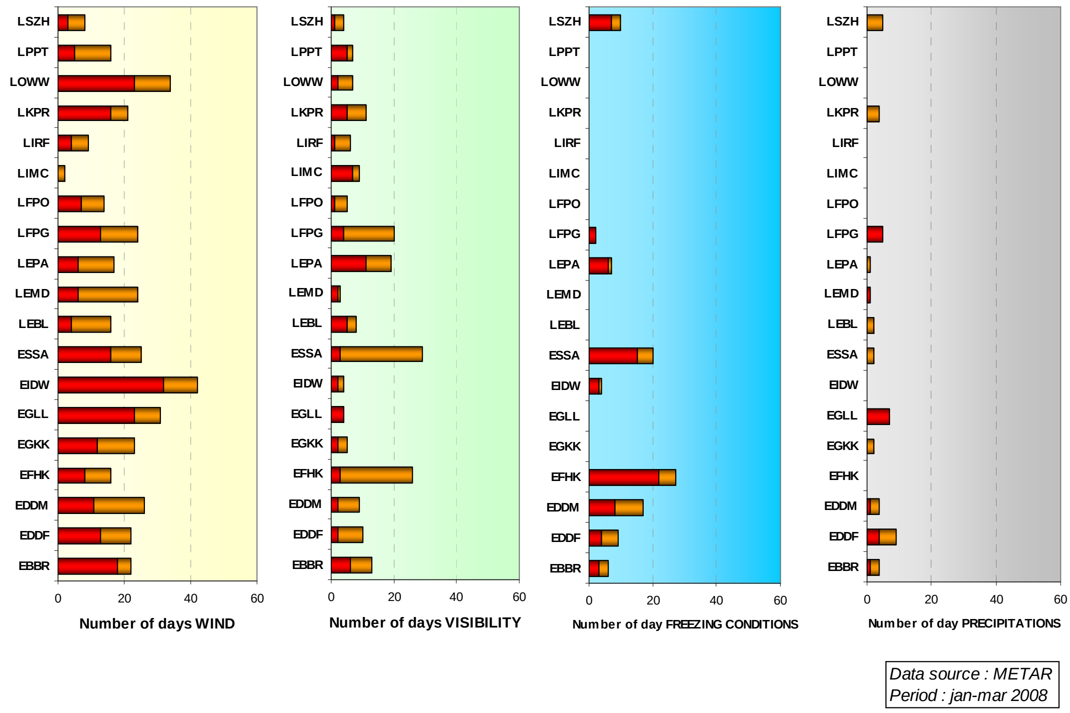


Figure 35: Most affecting adverse weather at ATMAP airports (Data Source: METAR)

Using the ATMAP weather categorisation, it would result that all European airports are mostly affected by severe winds (see column in the left) as these reduce the runway throughput. This can be proved by using the KPI Service Rate during strong wind conditions. The reduction of throughput depends on the fact that separation minima in the air are distance based. Should it be possible to introduce "time based separations" (best practice), an improvement may be observed either in terms of additional airport slots in the scheduling phase or in terms of punctuality on the days of operations.

It is important to underline the fact that wind on final approach (between 1000 and 5000 Ft) is not recorded in METAR data. Therefore, the impact of wind on airport airside and nearby airspace operations is higher than presented in Figure 35. This is certainly the case for Frankfurt.

Example 2

Using the "ATMAP KPA Efficiency" it was noted that, after the introduction of CDM, taxi-out times at Munich were reduced by 1 minute. Following this reduction, no correspondent increase was noted in the IATA delay code 89.

This one-minute improvement provided a major saving when scheduling block-to-block times and an improved aircraft utilisation for those airlines based in Munich.

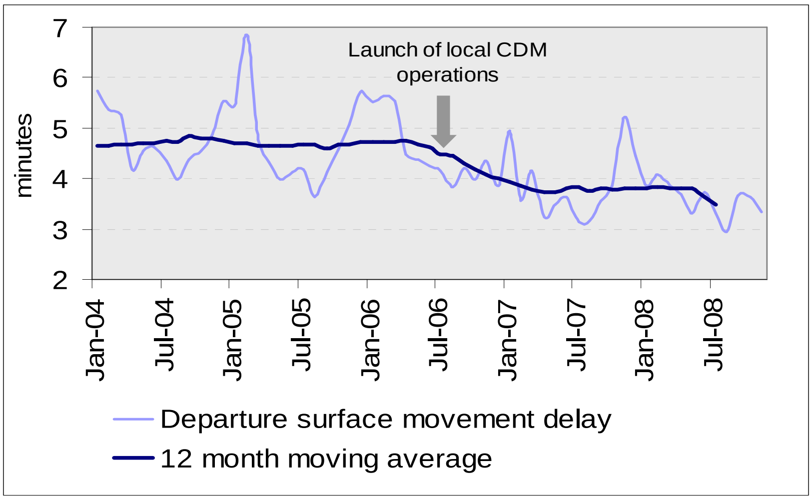


Figure 36: Reduction of taxi-out times at Munich

Example 3

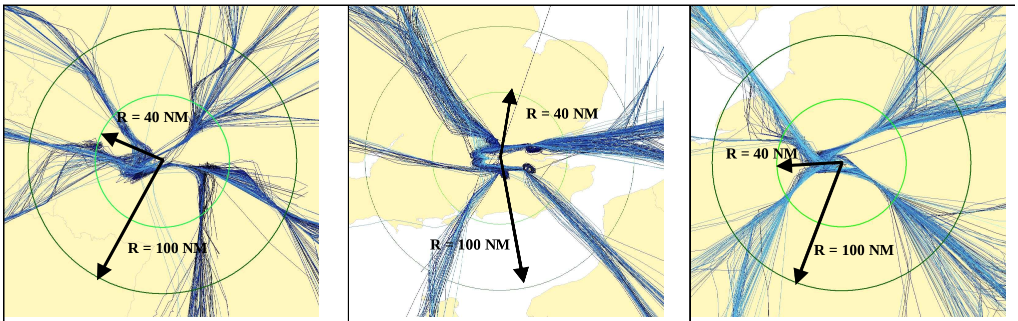
A standard "*Arrival Sequencing and Metering Area*" (ASMA) is defined as a ring of 100NM[28] radius around each airport. This is generally adequate to capture tactical arrival control measures (sequencing, merging, spacing and speed control).

In Europe there are three possible strategies for organising arrival traffic:

- The "Trombone" in Frankfurt;
- The Holding Circulars in LHR;
- The traffic streaming at CDG to absorb additional times before entering the approach area.

The ATMAP KPAs Efficiency and Predictability might provide some contribution in understanding what are the pros and cons of the three strategies.

[28] A second ring of 40 NM radius is used to differentiate between delays in the outer ring (40-100 NM) and the inner ring (40NM-landing), which have a different impact on fuel burn and hence on environmental performance.



Frankfurt (FRA)	London (LHR)	Paris (CDG)

Data Source: CFMU

Figure 37: Impact of local ANS strategies on arrival flows

5.6 Network Effects

A study on network effects is foreseen for the second part of ATMAP (starting July 2009). The study would rely on KPIs described in this report and on en-route KPIs previously developed by the Performance Review Commission.

Two possible approaches exist for studying the impact of the network:

1. impact of airside performance of a given airport on the network; or,
2. impact of network performance on a given airport.

Although a comprehensive approach should be developed, it is obvious that important matters need to be addressed:

- What is the level of network impact on airport performance when a significant number of airport pairs are affected by adverse weather?
- Are en-route centres surrounding an airport providing a good service?

The Performance Review Unit is confident to present an interesting study plan to be discussed beginning of July 2009.

6 Data specification, data availability, validation and data flow organisation

This chapter concentrates on the necessary or useful data for computing KPIs.

The ATMAP project aims at identifying, selecting and testing KPIs for measuring airport airside and nearby airspace performance. The ATMAP group has put in place the following actions to fulfil these objectives:

1. to conceive KPIs using a top-down approach (common performance goals/Key Performance Areas/Key Performance Indicators);
2. to draft a data specification template containing all the essential data to populate KPIs;
3. to collect data by all relevant data sources. Most of the data were already available within EUROCONTROL, except the data collection owned by airport operators;
4. to validate the capability of each data source to provide a robust and reliable measure of Key Performance Indicators;
5. to deliver final data specification template as a result of the validation activity;
6. to propose an approach for data usage and data collection.

The following paragraphs and Annex F document the work which was done with regard to data:

- Paragraph 6.1 provides an overall presentation of data and data sources;
- Paragraph 6.2 describes the results of the data validation;
- Paragraph 6.3 provides an approach for data usage and data collection;
- Annex F contains the detailed data specifications that were requested to airport operators to populate Key Performance Indicators.

6.1 Overall presentation of data for computing KPIs

Table 9 provides an overview of the necessary data to compute ATMAP KPIs. It also lists the additional data required in order to not only enhance the level of accuracy but also to allow deepening further the analysis.

		Data Fields																										
KPA	**KPI metric**	**REG**	**ARCTYP**	**FLTID**	**ADEP**	**ADES**	**ASLT**	**DSLT**	**STD**	**STA**	**AOBT**	**AIBT**	**ATOT**	**ALDT**	**DRWY**	**ARWY**	**ASTND**	**DSTND**	**DSTND-TYP**	**ASMA entry**	**RDLY**	**EOBT**	**BGNTAXI**	**CTOT**	**CNLSTD-STA**	**RCNL**	**Rem de-icing**	**Declared Cap**
Traffic Volume/ Demand	Handled Traffic	■		■	■	■							■	■														
	Coordinated Demand	■		■	■	■	■	■																				
	Cancelled Coordinated Demand	■		■	■		■	■																	■	▨		
Capacity	Airport Declared Capacity																											■
	Service Rate	■	▨	■	■	■							■	■														
Relationship Demand or Handled Traffic vs capacity	Service Rate versus declared capacity	■		■	■	■							■	■														■
	Handled traffic versus declared capacity	■		■	■	■							■	■														■
	Handled Traffic versus Service Rate	■		■	■	■							■	■														
Punctuality	On-Time Flights (Arrivals/Departures)	■		■	■	■			■	■	■	■																
	Early Arrivals	■		■		■				■		■																
	Departure Delay Causes	■		■	■				■		■										■							
Efficiency	Total Additional Time of Inbound Flow	■	■	■		■							■	■		▨	▨			■	■	■		■				
	Total Additional Time of Outbound Flow	■	■	■	■				■		■		■								■		▨				▨	
Predictability	Variability of Flight Segments	■		■	■	■			■	■	■	■	■	■	▨	▨	▨	▨	▨	■								
	Variability of Arrival Flow Rate (KPI tbd)	■		■		■														■								

Required Data ■ Accessory Data ▨

Table 9 Data field required to compute KPI[29]

[29] Waiting time at the holding bay before take off to be added.

The ATMAP framework could use several data sources to obtain the data needed to compute the KPIs. Table 10 shows a traceability matrix that relates data and sources where these data can be found. The main data sources considered within the ATMAP pilot project are as follows:

- **eCODA:** contains data from airlines collected regularly each month. The data collection started in 2002 and the reporting is voluntary. Currently, the coverage is between 65-70% of scheduled commercial IFR flights. Depending on airline participation, the coverage can vary by airport. The collected data includes OOOI[30] data, schedule information and causes of delay using IATA delay codes.
- **CFMU:** The data collected by the CFMU within the Enhanced Tactical Flow Management System (ETFMS) is based on flight plan information which is updated with radar surveillance data (i.e. CPR[31] data) provided by the ANSPs and position report data provided by the aircraft operators. ETFMS uses this data to update the existing information coming from flight plans and flow measures. The reception of this accurate real-time data allows ETFMS to re-calculate the current position and future trajectory of flights adding to the accuracy of the data within ETFMS[32]. The system furthermore contains detailed information on allocated ATFM slots and delays for each IFR flight.
- **Airport Coordinators**: The data include airport capacity declaration (coordination parameters) and airport slots allocated to flights. The information is updated continually in coordinators' databases according to the result of the daily coordination updates. EUACA (the association of European coordinators) and EUROCONTROL are currently working at a Memorandum of Understanding having as objective to create a link between airport coordinators data and EUROCONTROL data.
- **Airport Operator/ATC**: data from airport operator and local ANSP at airports are usually collected by different stakeholders and data may be either centralised (CDM airports) or disseminated across several local databases. Operational data (e.g. information on arriving, departing or cancelled IFR, coordination parameters); and, general information about the airport facilities and environment (e.g. Noise data) are among the data available at the airport. Table 10 shows a general view of availability of data in general. It is worth noting that there are variations in the availability of data airport to airport and in the way some time stamps are recorded among airports. Within the ATMAP pilot project, 15 participating airports provided operational data and general information, as specified in Annex F.

	eCODA	CFMU	Airport coordinator	Airport operator	ATC
REG $^{\Delta\Delta}$					
ARCTYP					
FLTID $^{\Delta\Delta}$					
ADEP $^{\Delta\Delta}$					
ADES $^{\Delta\Delta}$					
ASLT $^{\Delta\Delta}$					
DSLT $^{\Delta\Delta}$					

30 (Off stand, Take Off, Landing, In Stand).
31 Correlated Position Reports (CPR).
32 The CFMU will update flight profiles if the position received deviates by more than a given threshold (vertical 007 FL, horizontal 20 Nm, temporal 5 min.) from the current estimated trajectory.

	eCODA	CFMU	Airport coordinator	Airport operator	ATC
STD $^{\Delta\Delta}$					
STA $^{\Delta\Delta}$					
AOBT$^{\Delta\Delta}$					
AIBT$^{\Delta\Delta}$					
ATOT					
ALDT					
DRWY$^{\Delta\Delta}$					
ARWY$^{\Delta\Delta}$					
ASTND$^{\Delta\Delta}$					
DSTND$^{\Delta\Delta}$					
DSTND TYP					
ASMA entry point					
RDLY					
EOBT					
Begin Taxi (on its own power)					
Waiting Time at the holding bay before take-off					
CTOT					
CNL STD-STA $^{\Delta\Delta}$					
RCNL					
Declared Capacity					
Remote Deicing/anti-icing					

Table 10 Data contained by data source

$\Delta\Delta$ data missing or partially missing within EUROCONTROL which would provide the most added values in term of quality gains.

6.2 Data validation of existing data sources

Despite the fact that some data sources contain the same data fields, the completeness of data and the accuracy of time stamps varies across data sources.

In order to assess the completeness and quality of the available data sources, a validation exercise was performed in the project using data for the first quarter of 2008 (01. January – 31 March 2008). The requested data was received by 15 airports. The main conclusions of that validation exercise conducted by the ATMAP project can be summarized as follows:

1. Ten airports out of fifteen showed that the flight data recorded locally by ATC/airports are the most comprehensive and reliable source of information. The main two reasons for this high level of quality and completeness are:

    - Time stamps are automatically recorded and/or a rigorous procedure exists for manually recording the data;

    - Scheduled data and actual OOOI data are combined and integrated in the same database.

2. Overall the amount and quality of available data within EUROCONTROL (i.e. CFMU, eCODA) showed a good level of consistency with the data supplied by the individual airports enabling high level (seasonal, monthly, etc.) analysis of performance at and around airports, yet with scope for improvement at some airports.

3. CFMU only takes IFR flights into account. Data received from airport communities provide a more complete set of flights including other types of flights (VFR, OAT, other). However, this difference is small (the data sample used accounted for a difference average of 99%). This would mean, for example, that handled traffic KPI using CFMU data would be slightly under-estimated.

4. eCODA data coverage varies considerably between airports, which is mainly due to airline participation to the data collection. This coverage is typically around 70%, but was reduced to only 30% for some airports in the studied sample.

5. Information on runway use, stand allocation, is only available at airports. This information appears to be very useful to further improve the level of detail and accuracy of the performance analysis (i.e. hourly, by stand – runway combination).

6. No information on cancellations is currently available within EUROCONTROL. Information has been collected from some airports. Reasons for cancellations were only available in a limited number of airports.

7. CFMU and ATC radar data are the only sources from which it is possible to extract the ASMA entry time. CFMU accuracy was validated against radar data. The entry time precision in CFMU data set increases with the distance from the airport. For any distance above 40 NM from the airport, more than 95% of the CFMU entry times match the entry times recorded in radar data with a precision of less than one minute. Based on this fact and that ATC data would require considerable post-process, the use of CFMU data is recommended.

8. There is a high level of consistency between the scheduled times submitted by airports and the schedule information in the eCODA data. On average, 98.8% of departures and 98.3% of arrivals show no time difference between the two data sets.

9. When comparing eCODA data with the data received by airport communities, on average, the deviation of AOBT/AIBT between eCODA and Airport data is small for aggregate performance analysis. However, the breakdown by airport revealed considerable differences in the average deviation. Detailed analysis at aircraft level revealed divergences of recorded AOBT by the airport and eCODA, In particular when data are recorded manually. Several reasons accounted for this discrepancy:

- The type of data recording (manual versus automated): As can be expected, the consistency between the two data sets is highest when CODA and Airport data were recorded automatically.

- ACARS and the automatic dock station at the stand are configured to detect slightly different times (e.g. doors closed and breaks released versus moving wheels) and the two values are reported into two different databases (airline and airport). This usually generates a small difference.

- AOBT is manually recorded by two different persons (e.g. the ground handler and the apron manager) and the two values are reported into two different databases (airline and airport). This usually generates a significant difference.

10. The taking-off (ATOTs) and landing times (ALDTs) are available from the CFMU, eCODA and the data received from airport/ATC communities. The three data sets showed a high level of correlation. Overall, the average deviation of ATOT and ALDT between eCODA and airport data was small (-0,3 min and -0,1 min, respectively). The breakdown by airport showed small moderate deviations at airport level, being the maximum deviation of -0,9 min. When comparing CFMU data and airport data, the average deviation was also small (0 min for ATOT and -0,6 min for ALDT). The breakdown by airport showed a small moderate difference, with a maximum average difference at one airport of 0,6 min. The accuracy of actual take-off and landing times in the CFMU data are considered to be satisfactory for aggregate performance analysis but with room for improvement using airport data.

11. Arrival delays are recorded both in the CFMU and eCODA data set. At some airports the arrival ATFM delays were wrongly classified as en-route in the eCODA data set. Using the CFMU data set rather than the eCODA data set would be preferable as the delay assignment between en-route and airport delay could be much easily corrected in the CFMU data set. However, the CFMU data set does not record delays other than those caused by ATFM regulations. Information on the cause of other delays as recorded by airlines is available from eCODA. Some airports were also able to provide information on cause of departure delay. When available, this information usefully complemented the information collected from airline.

6.3 An approach for data collection and usage

The most sensible approach might be the creation of a common data repository, based on EUROCONTROL PRISME that would be populated with the best quality data available from different data sources.

These sources may include not only EUROCONTROL information from CFMU and eCODA, but also surveillance, airport operation data and meteorological information.

Within this conceived environment, EUROCONTROL would partially use the data available in the repository to calculate aggregate KPIs, but access could be granted to network and local performance managers in order to share views with Performance Review and/or to use lower level of data aggregations and sub-indicators for performance management purposes. This conceptual approach is depicted in Figure 38.

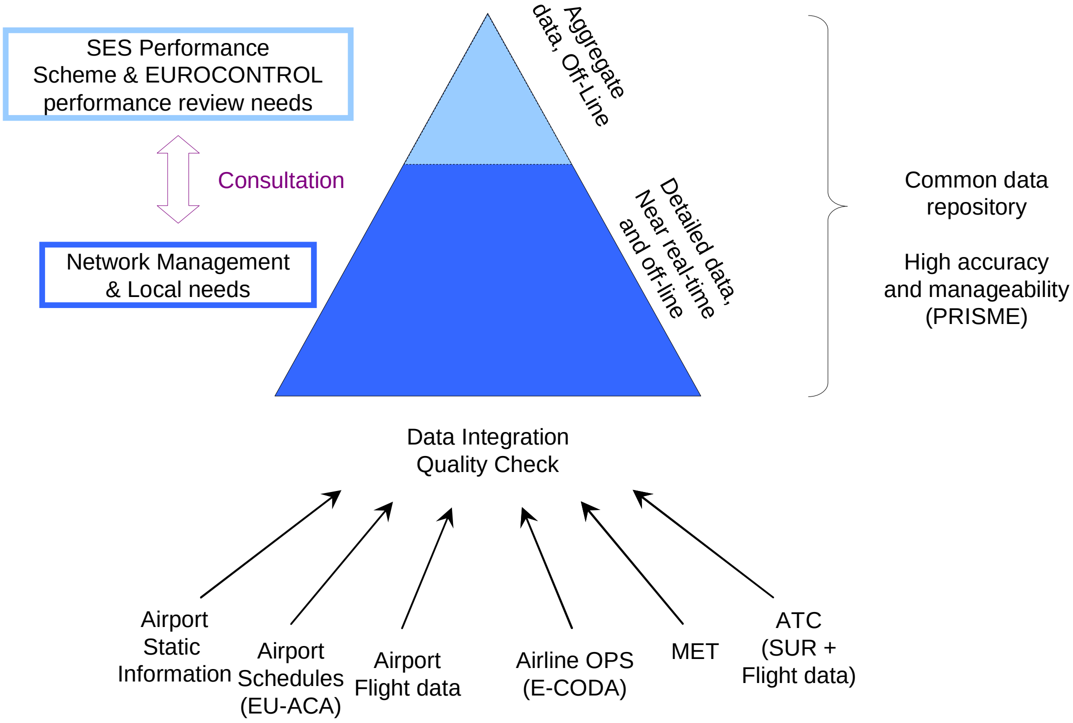


Figure 38 Common data reposity approach for SES Performance Scheme

7 Conclusions

This report has presented a performance measurement framework and data requirements needed for the assessment of the performance system of airport stakeholders accountable for flights operated at airport airside and in nearby airspace.

The performance framework is an output of the "ATM Airport Performance "(ATMAP) project which has been launched by the Performance Review Unit to respond to the request of the Performance Review Commission for elaborating a framework for discharging performance review tasks, including consultation with aviation stakeholders and performance monitoring.

The ATMAP performance framework has been elaborated with the active support of the ATMAP consultation group which included 19 airport communities (airlines, airport operator and ANSP), the EUROCONTROL Agency and IATA.

The ATMAP performance framework proposes measures from an "airport system perspective" without assigning accountability to each stakeholder (airlines, airport operator, Air Traffic Control, Meteo office, ground handlers, de-icing services, etc.) contributing to the level of achieved performance. The framework should further evolve in order to be usable for Air Navigation Service target setting purposes. Updates of this framework version are expected in mid-2010 and in mid-2011. At the same time the two updates will allow to improve the effectiveness and the accuracy of the current framework.

The ATMAP performance framework is made up of the following components:

- The definition of the scope within which the measurement is conducted;
- A list of factors affecting performance which have to be taken into account in order to contextualise performance at each airport;
- Relevant Key Performance Areas to describe the performance objectives of an airport community (i.e. what are the common performance goals that all airport stakeholders try to achieve together);
- Key Performance Indicators (KPIs) to measure Key Performance Areas;
- Data requirements to populate Key Performance Indicators;
- A number of approaches on how to use the Key Performance Indicators in order to assess and evaluate performance.

KPIs have been developed, tested and verified in the following Key Performance Areas:

- Flight Demand and Traffic Volume;
- Airport Capacity and Service Rate;
- Punctuality;
- Efficiency of flight times;
- Predictability of flight schedules.

The main added values delivered by this version of the ATMAP performance framework are:

- The usage of the same KPIs and the same data requirements for all airports. This enables a consistent measurement across European airports;
- The provision of a number of KPIs to measure performance in areas which have not yet been measured at European level: measurements for taxi-out and arrival in-flight additional times;
- The selection of a set of few KPIs that, when seen all together, characterise the performance at airport airside and nearby airspace;
- The assessment of accuracy and completeness of the different data sets which could be used to populate the selected KPIs. This was not yet done at European level;
- The initial elaboration of an algorithm to measure the severity and duration of weather conditions on airport operations. This was not yet done at European level.

The main limitations of this version of the ATMAP performance framework are:

- KPIs for measuring Flexibility and Emissions Key Performance Areas have not yet been elaborated;
- The approaches on how to use the KPIs in combined way for assessing and evaluating performance has been described in this report, but not yet tested;
- The algorithm to measure the severity and duration of weather conditions on airport operations have to be refined;
- The default data for measuring KPIs (CFMU and eCODA) do not grant the best possible accuracy and completeness. When well integrated, data flows from airport operators and local ANSPs are available, their usage would provide for significant improvements, but yet several airports still have to improve their data recordings, collection and storage for being able to provide data of sufficient quality.

Finally, the reader must be aware that the ATMAP performance measurement framework represents a modelled picture of reality. Interpretation of indicators should therefore be done with caution and KPIs should particularly be considered all together and not separately.

8 References

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Annex A List of unpublished deliverables which document the activity in the ATMAP project

A list of unpublished ATMAP project deliverables

A number of ATMAP project deliverables have been prepared and released between end of 2007 and May 2009. Although many deliverables will not be published, they can be made available on request to PRU. The following is the list of most important unpublished deliverables:

- Local performance monitoring methodologies and performance report samples by the following airports:
  - Dublin, London airports, Munich, Frankfurt, etc.

- Trials on Key Performance Indicators:
  - Study on demand, traffic volume and capacity Key Performance Areas made by the Aachen University (the report may be published by Aachen University at a later stage);
  - Definition of the unimpeded time: comparison between various methodologies (ASMA and taxi-out);
  - Comparison between ASMA and ARIES methodology made by NATS (Luke Shadbolt);
  - Comparison between two methodologies for computing taxi-out additional times based on Brussels and Zurich data.

- Data validation reports:
  - Data validation summary report 1.1 (+Annexes);
  - Quality analysis of the three CFMU time stamps: Take Off Time, Landing Time, ASMA Entering Time.

- Software and programming deliverables:
  - Parsing METAR data;
  - SQL queries for computing indicators and data matching for validation;
  - Algorithm to select degraded and nominal weather days.

Annex B Query-logic implementation to classify nominal, moderate degraded and severe degraded conditions

Step 1

The weather phenomena reported in METARs were organised in the following six classes: Visibility, Wind Intensity & Gusts, Freezing conditions, (water) Precipitations, Other Precipitations, and CB/TCU weather. These classes were divided into sub-categories according to the expected impact that the weather might have had on the airport performance.

Step 2

A code number was assigned to each sub-category, which corresponds to the weather situation. Table 11 provides the query-logic applied in order to define the sub-categories of weather classes.

Step 3

The six classes, divided in sub-categories, were used to evaluate whether a given day was degraded or nominal. The intensity of the phenomena and its duration along the day were considered to assess the impact.

Class codes used in the query-logic applied to define Nominal and Degraded categories (based only on weather phenomena) are provided in Table 12, Table 13, Table 14, Table 15, Table 16 and Table 17.

<table>
<tr><th>Wx Status / Wx</th><th>Definition related to the full day time (05-23)</th><th>Visibility, RVR and Ceiling</th><th>Wind Intensity and Gusting wind</th><th>Freezing Conditions</th><th>Precipitations</th><th>Other precipitations</th><th>Convective weather</th><th></th></tr>
<tr><td>Perfect day</td><td>Weather is good or excellent.</td><td>Code 1</td><td>Wind intensity of Code 1; Gusting Wind of Code 1</td><td>Code 1</td><td>Code 1</td><td>Code 1</td><td>Code 1</td><td rowspan="2">Nominal Day</td></tr>
<tr><td>Fair day</td><td>Weather is fair, some weather phenomena of low magnitude.</td><td>Code 2, 3, and 4
< than 4 hour during the busy time of Code 5</td><td colspan="4">= than 2 hours of wind intensity of Code 2;
< than 1 hour of gusting wind of Code 2;
Freezing conditions of Code 2,3, and 4
Light precipitations with duration time less than 6 hours Code 2.
Moderate precipitations with duration time less than 4 hours Code 3.
Severe precipitations with duration time less than 2 hours Code 4.
Other precipitations of Code 1.</td><td>> 1 hour of Code 2 and 3</td></tr>
<tr><td>Moderate Degraded day due to Weather conditions</td><td>Weather is degraded for a significant period of the busy time.</td><td>= than 4 hours during the busy time for Code 5
= than 2 hours of Code 6,
= than 1 hours of Code 7 and of Code 8</td><td colspan="4">Between 2 and 4 hours of Wind intensity of Code 2;
Between 1 and 2 hours of Gusting Wind of Code 2;
> than 4 hours of Freezing conditions of Code 2, 3, and 4;
Between 0,5 and 4 hours of Freezing conditions of Code 5;
= than 2 hours of Freezing conditions of Code 6 and 7;
Light precipitations with duration time more than 6 hours Code 2.
Moderate precipitations with duration time between 4 and 6 hours Code 3.
Severe precipitations with duration time between 2 and 4 hours Code 4.
Between 1 and 2 hours of Other precipitations of Code 2.</td><td>Code 4
Between 1 and 3 hours of Convective weather of Code 5</td><td rowspan="2">Degraded-Day</td></tr>
<tr><td>Severe Degraded day due to Weather conditions</td><td>Weather is more than degraded or severe for a long period of time.</td><td>> than 2 hours during the busy time of Code 6
> than 1 hour of Code 7 and of Code8.</td><td colspan="4">> than 4 hours of Wind intensity of Code 2;
> 2 hours of gusting wind of Code 2;
> than 4 hours of Freezing conditions of Code 5;
> 2 hours of Freezing conditions of Code 6 and 7.
Freezing conditions of Code 8.
Moderate precipitations with duration time more than 6 hours Code 3.
Severe precipitations with duration time more than 4 hours Code 4.
> 2 hours of Other precipitations of Code 2.</td><td>> than 3 hours of Code 5</td></tr>
</table>

Table 11: Query-logic to define sub-categories

Categorisation and coding of weather classes

WEATHER CLASSES ASSESSMENT ALGORITHM FOR VISIBILITY

Code	WX Class [1]	Prevailing Visibility [2] (m)			Runway Visual Range [3] (m)			Ceiling [4] (ft)		
		Min	Max		Min	Max		Min	Max	
1	Excellent	9000	9999 [5]	AND	1500	P2000 [6]	OR	2500	8	Nominal
2	Fair	5000	8000	AND	1500	P2000	OR	2500	8	
3	Reduced Separation Phase 1	3000	4900	AND	1500	P2000	OR	2500	8	
4	Reduced Separation Phase 2	1500	2900	AND	1500	P2000	OR	1500	2400	
5	Reduced Separation Phase 3	0	9999	AND	800	1450	OR	300	1450	Degraded
6	CAT 1	0	9999	AND	550	750	OR	200	250	
7	CAT 2	0	9999	AND	350	500	OR	100	150	
8	CAT 3	0	9999	AND	0	325	OR	0	50	

Table 12: Visibility Class[33]

N.B

[1] Most constraining condition will determine the classification;
[2] Prevailing visibility will be the denominating classifying element when no Runway Visual Range (RVR) is reported or the RVR is1500 meter or more; Visibility values of more than 10 Kilometers are reported as 9999;
[3] RVR will be the denominating classifying element when RVR is reported to be less than 1500 meters; RVR values more than 2000 meter are reported as P2000
[4] Cloud cover of 5 eights or more (BKN and OVC)

Wind and Gusts Class

Code	Name	Description	
1	Wind below 15 knots	Self Explanatory	Nominal
2	Wind equal and above 15 knots	Self Explanatory	Degraded
Code	**Name**	**Description**	
1	No gust	Self Explanatory	Nominal
2	Presence of gust	Self Explanatory	Degraded

Table 13: Wind Intensity and Gusts class

33 Visibility class encompasses Visibility, RVR, and Ceiling. RVR was processed only when general visibility was below or equal 1500 meters.

FREEZING CONDITION CLASS			
Code	**Name**	**Description**	
1	No freezing 1	Temperature above +3°C	Nominal
2	No freezing 2	Temperature between +3°C and -3°C and no visible moisture	
3	No freezing 3	Temperature below -3°C and no visible moisture	
4	No freezing 4	Temperature below -14°C AND no visible moisture	
5	Freezing 1	Temperature between +3°C and -3°C and visible moisture	Degraded
6	Freezing 2	Temperature between -3°C and -14°C and visible moisture	
7	Freezing 3	Temperature between -14°C and -25°C and visible moisture	
8	Freezing 4	Temperature below -25°C and visible moisture	

Table 14: Freezing condition Class

PRECIPITATIONS			
Code	**Name**	**Description**	
1	No Precipitations 1	No precipitations	Nominal
2	Precipitations 2	Light precipitations	Degraded
3	Precipitations 3	Moderate precipitations	
4	Precipitations 4	Severe or precipitations	

Table 15: Precipitations class[34]

OTHER PRECIPITATION			
Code	**Name**	**Description**	
1	No presence of other precipitations	Self Explanatory	Nominal
2	Presence of other precipitations	Self Explanatory	Degraded

Table 16: Other Precipitation Class[35]

[34] It only includes precipitations composed of water

[35] This class refers to any and all forms of liquid not water or solid, which falls from clouds and reaches the ground. It also includes any obscuration phenomena in the atmosphere not composed of water that reduces horizontal visibility

CB/TCU CLASS			
Code	**Overall magnitude of the weather phenomena**	**Description**	
1	Convective weather is absent	CB and TCU not reported	Nominal
2	Low magnitude	FEW and SCT embedded with CB and TCU and no precipitations	
3	Medium magnitude	FEW and SCT embedded with CB and TCU and precipitations	
4	Medium magnitude	BKN and OVC embedded with CB and TCU and no precipitations	Degraded
5	High magnitude	BKN and OVC embedded with CB and TCU and precipitations	

Table 17: Convective Wetaher Class

Annex C Coordinated Cancelled Demand (proposal made by AFR based on IATA Standard Schedules Information Manual

Ref. : IATA - SSIM (Standard Schedules Information Manual)

ATMAP proposal to be discussed	IATA "Family"	cnl code	extract of def.
AIRS		AIRS	Airspace restrictions
ARPT		ARPT	Airfield restriction
Airline Internal		COMM	Commercial reason, demand or lack of demand
Airline Internal		CREW	Crew shortage
Airline Internal		DAMA	Aircraft damage
Airline Internal		EQUI	Equipment shortage
Airline Internal		FUEL	Fuel shortage
Airline Internal		HDLG	Ground handling
INDU		INDU	Industrial dispute
Airline Internal		OPER	Operationa reasons
Airline Internal		PERF	Aircraft performance
POLI		POLI	Political situation
Airline Internal		POSI	Aircraft positioning
Airline Internal		REPO	Aircraft re-positioning
ROTA		ROTA	Aircraft rotation
Airline Internal		RTNS	Return to normal schedule or reinstatement of flight status prior to (withdrawal of ASM change)
RUNW		RUNW	Runway restrictions
Airline Internal		TECH	Technical reason, maintenance, etc.
WEAT		WEAT	Weather conditions

Annex D Data computation of ASMA unimpeded and additional time

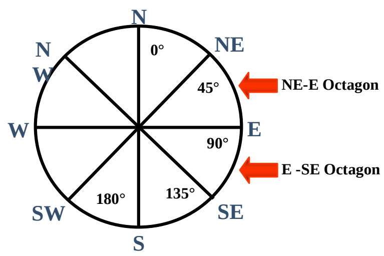
This Annex describes the Methodology used for the calculation of the additional time in the ASMA region within the last 100N. It can be described in four successive steps. This approach might be subject to further review.

Step 1 Grouping of flights:

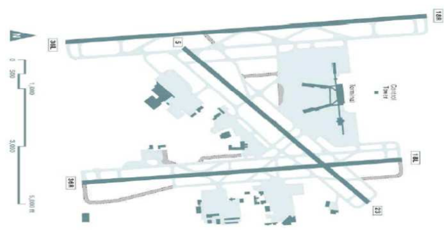
Each flight is categorised according to some key factors affecting ASMA performance:

- Aircraft class: grouping of aircraft type into Jet or Turbo Prop in order to account for speed differences.

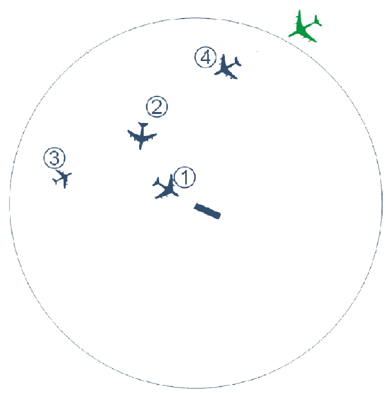
- ASMA entry sector: The ASMA (circle around airport with a radius of 100Nm) is divided into 8 sectors of 45° in order to capture the direction from which the flight entered into the ASMA.



- Runway use: The inclusion of the arrival runway provides useful additional information for airport performance analyses.



- Congestion index: The allocation of a congestion level to each flight is important to remove congestion effects in the calculation of the unimpeded transit times. It is expressed by the number of other aircraft ahead of the categorised flight and by the number of landings of other aircraft between the time the flight entered in the ASMA and the actual landing time of the flight.



Step 2 - Calculation of unimpeded reference time:

For each group with the same characteristics (aircraft class, entry sector, runway, stand, if available or applicable), an unimpeded reference time is calculated by taking the truncated mean (10th-90th percentiles) for all flights within the group with a congestion level corresponding to a level of operation less than half the nominal rate. This condition aims at taking the difference in airport throughput into account. The threshold for the congestion index to be used for the calculation of the unimpeded time is defined as 50% (or alternatively 25%) of the maximum airport throughput using the following formula (max = 25% * max. throughput *12/60). This assumes that the unimpeded transit time is around 12 min. For example, for an airport with a maximum throughput of 40, only the flights with a congestion index of 4 or less would be included in the calculation of the unimpeded transit time.

Step 3 - Additional time calculation for each group

For each group (same aircraft class, entry sector, runway, stand, if available and applicable), the additional time is calculated as the difference between the average transit time (of all flights in this group) and the unimpeded transit time for this group determined in the previous step.

Step 4: Aggregate ASMA additional time calculation

In order to get high level results, the weighted average of all the individual ASMA delay groups (aircraft class, entry sector and runway, if available) is calculated in a final step.

The sensitivity analysis showed that the methodology appears to be robust for high-level performance measurement. Subject to data availability, the methodology can also be adjusted to the level of detail (runway-entry point combination).

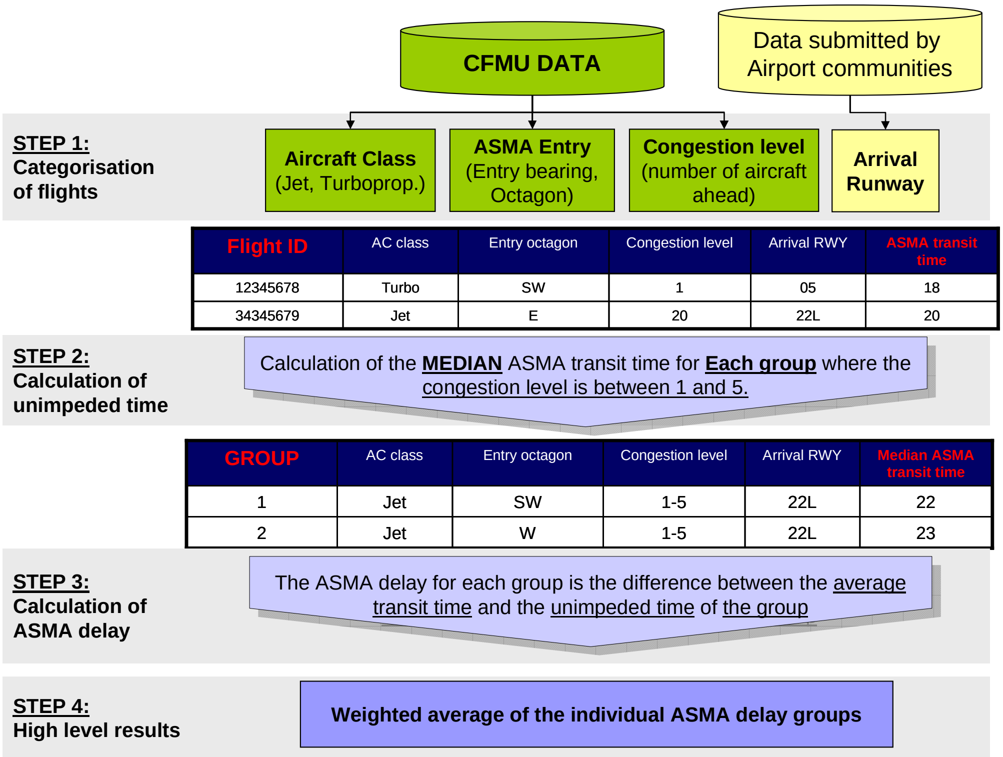


Figure 39: Methodology for the calculation of ASMA delays

This methodology is also applied in the calculation of the taxi-out time. Some differences do exit in step 1: The grouping categories taken into account in the current version of the algorithm are aircraft class, stand-runway combination and congestion index[36]. The rest of the methodology is similar to the ASMA case.

It is worth mentioning that this is the proposed methodology to use, but the calculations reported in this document (i.e. Figure 24, Figure 26) did not considered the grouping explained above because eCODA data were used and the stand and runway information are not available. At the aggregate level, the differences found were, in general, not significant.

[36] A study case with two airports and a sample of three months was carried out to identify whether the type of stand (push-back or nose out) added significant additional time to the computation. The results seem to indicate that most of the additional time is generated when the aircraft is taxiing, and very minor amount during the push back operation. In any case the taxi-out is calculated from AOBT to ATOT.

Annex E Data computation of predictability of flight phases

The calculation of the high-level indicator of variability of flight phases is based on two consecutive steps.

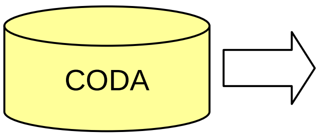
Step 1: Calculation of Intra flight variability

The "intra flight variability" is calculated for flights with identical profiles (minimum of 20 flights) as the standard deviation for each flight segment (actual departure compared to schedule, taxi duration, flight duration, arrival compared to schedule).

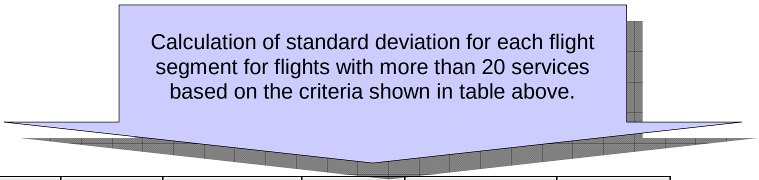
The standard deviation is the most common measure of statistical dispersion, measuring how widely spread the values of a data set are. The standard deviation is defined as the square root of the variance[37]. If many data points are close to the mean, then the standard deviation is small and vice versa. If all values are equal, then the standard deviation is zero.

For the calculation of the predictability KPIs, the standard deviation is used to measure variations in departure and arrival times (compared to schedule) or flight segment duration (e.g. taxi-out time, airborne time variability) for a given set of flights.

The selection criterion for the aggregation is a minimum of 20 flights per year with the same operator, scheduled departure and arrival times, and city pair. For example BA123 from Brussels to London Heathrow scheduled to depart at 10h00 and scheduled to arrive at 11h10.



Operator	STD	STA	ADEP	ADES	Taxi time	Etc.
OPR1	10:00	11:00	EBBR	EGLL		



Service	STD	STA	ADEP	ADES	Std. Dev Taxi time	Count
1	10:00	11:00	EBBR	EGLL	2.2	23

Step 2: High-level predictability indicators

In a second step, the high-level predictability indicators are determined for each flight phase as the weighted average of the intra flight variability of all the "services" (see step 1).

The data used for the calculation of predictability indicators origins from the Central Office for Delay Analysis (eCODA).

[37] Variance is the average of the squared differences between data points and the mean. Standard deviation, being the square root of the variance, therefore measures the spread of data around the mean, measured in the same units as the data.

Annex F Data specifications for measuring airport airside and nearby airspace performance

PART I – GENERAL AND CONTEXTUAL INFORMATION

Part 1 of the Data Specification relates to general and contextual information. Much of this data is already available within EUROCONTROL and will be pre-compiled to provide better view of the airport operational environment while assessing its performance. However, in case of incompleteness of the AIP information available in EUROCONTROL and in order to avoid misinterpretation, airport communities will be invited to validate this data through the Airport Performance Review web site[38].

Airport Information related to performance measurement

Airport Identification Data	
Airport name	Brussels National/Zaventem Airport
ICAO/IATA code	EBBR/BRU
Airport operating hours	06:00L and 22:59L
Slot coordination level	Coordinated
Airport Operator	The Brussels Airport Company
Website address	http://www.brusselsairport.be
Runway Information	
Airport layout	PDF file
TMA chart	PDF file
Active RWYs	3RWYs 25R/07L, 25L/07R, and 02/20
Preferred RWY modes of operations	2 parallel independent segregated runways +1 crossing runway 25L for landing and 25R for take off and landing
RWY operating hours	Same as airport operating hours
Instrument approach procedures	25R and 25L CAT II/III ops, 02 CAT I, 20 No ILS, 07R no ILS, 07L ILS CATII
Stand information	
Total number of stands	e.g. 104
Nose-in/Push-back stands	e.g. 143-165; 205-255 and 601-612
Stands equipped with Docking Guidance Systems (DGS) or similar equipment	e.g. 140-172 and 680-699
Airport CDM implementation level	
Status of CDM implementation	CDM implementation in progress
Sharing of airport data (e.g. common DB)	Common Information Management System
Availability of A-SMGCS	In operation, data not yet shared with airport
Winter operating facilities	
Stands used to de-ice aircraft	All stands
Availability of remote de-icing facilities	e.g. 2 remote de-icing facilities
Noise Constraints	
Noise contour maps	PDF file
Operating restrictions to RWY usage	07R to be avoided for landing
Noise Distribution Plans	PDF file

[38] It is envisaged to set up an Airport Performance Review web site, where the PRC will publish airport performance reports on a seasonal or monthly basis.

Airport data collection and measurement mode

	AOBT	ATOT	ALDT	AIBT
Radar data	☐	☒	☒	☐
Automatic DGS	☒			☒
A-SMGCS	☐	☒	☒	☐
Manual input	☐	☐	☐	☐
Automatic ACARS	☒	☒	☒	☒
Others:				

Airport Slot Coordination Parameters

This information is only collected for airports that are designated as 'coordinated' in accordance with EC Regulation 95/1993 and subsequent amendments.

Declared airport capacity determines how many airport slots are handed out to aircraft operators. Many different infrastructural (terminal, stands, apron, runway), political and environmental factors affect the declared capacity of an airport, of which runway capacity is arguably the most important one.

The declared airport capacity is decided by the coordination committee and airport slots[39] are then allocated to airlines according to rules laid out in EC Regulation 95/1993 and subsequent amendments.

For the review of ATM-related performance, and in accordance with Article 6 "Coordination parameters" of EC Regulation 95/1993 and subsequent amendments, airport operators should provide the seasonal coordination parameters and other relevant information:

- Requested slots (initial submissions);
- All allocated slots, and outstanding slot requests;
- Remaining available slots;
- Service quality parameter agreed in the capacity declaration process (i.e. average airborne holdings, etc.);
- Airport declared capacity.

	Time	10min (static)			30min (rolling)			60min (rolling)		
	[UTC]	ARR	DEP	TOT	ARR	DEP	TOT	ARR	DEP	TOT
Berlin Tegel	06:00-23:00			8						40
Düsseldorf	06:00-21:00			10						40
	21:00-22:00			10						35
	22:00-23:00			10				25	0	25
Frankfurt	06:00-14:00	9	9	16	23	25	43	41	43	80
	14:00-20:00	9	9	16	23	25	43	42	45	82
	20:00-22:00	9	9	16	23	25	43	42	50	82
	22:00-23:00	9	9	16	23	25	43	43	48	78
München	06:00-23:00	12	12	15				58	58	89
Stuttgart	06:00-23:00	6	6	8				30	30	40

Airport Noise Data

Within the Environment KPA, the PRC envisages to collect information on noise emissions at major airports which are addressed in EC Directive 2002/49/EC. In

[39] The term "airport slot" refers to the permission given by a coordinator to use the full range of airport infrastructure on a specific date and time for the purpose of landing or take off.

Annex VI of the aforementioned EC directive, the data which is to be sent to the Commission regarding noise emissions is specified. In this context, the PRC is interested in collecting the following information (as specified in Annex VI of EC Directive 2002/49/EC):

1) Data (Lden):
   - Total area (in km^2) exposed to values higher than 55, 65 and 75dB respectively.
   - Estimated total number of dwellings (in hundreds); and,
   - Estimated total number of people (in hundreds) living in each of these areas. The figures must include agglomerations.

2) Maps (Lden):
   The 55 and 65 dB contours on one or more maps that give information on the location of villages, towns and agglomerations within those contours.

3) The computation or measurement methods that have been used.

4) Noise-control programmes that have been carried out in the past and noise-measures in place.

PART 2 - FLIGHT SPECIFIC OPERATIONAL INFORMATION

Part 2 of the data specifications relates to specific events that affected the normal operations during the measurement period and contains operational flight data to be used for airport performance measurement. A key enabler for successful performance measurement is the common understanding of definitions and terminologies. Hence, the tables below define the data requirements to ensure consistency of the data collection across airports.

Who should submit data?

The continuous review of ANS-related performance at and around airports is foreseen for the major European airports. Airport operators assisted by airport slot coordinators, airline operators and local airport ANS providers are invited to submit data according to these data specifications.

Where no data is available from airport operators to enhance available data sources, the performance measurement will be based on data sources available to EUROCONTROL.

Whenever it is necessary the airport data should be coordinated between the local airport stakeholders (airport operators, ANSP, airlines) before it is submitted to the PRU. Where a CDM system is in place, the data should be derived from the CDM platform.

When and how should the information be provided?

Airport operators are asked to provide the information included in Part I (General and Contextual Information) on a seasonal basis (Summer/Winter), while the information included in Part II (Flight-specific Operational data) should be submitted to ECODA on a monthly basis within a reasonable timeframe but not later than the 21st of the next month.

The PRU will compile the airport General and Contextual Information to the extent possible from the data sources available to EUROCONTROL before the airport operators are asked to validate the information. Part 1 will then be validated each season to reflect changes. As the data in Part 1 is not expected to change frequently, this will require very little effort from airport operators.

Airport operators are asked to submit their monthly Operational data in electronic format such as .csv, .xls, .txt, .xml.

Other data exchange formats may become available following the approval by the European Commission of a standard data exchange format based on the EUROCONTROL Model for Airport Network Information (ANXM), which would ensure interoperability between European airports.

How will the information be used?

The information collected from airports will be used by the EUROCONTROL Performance Review Commission (PRC) to continuously monitor ANS-related performance at and around major European airports in conformity with its terms of Reference which require it to provide advice in order to help "ensure the effective management of the European ANS system through a strong, transparent and independent performance review and target setting system".

The analyses will be carried out using a common framework for analysis of ANS-related performance at and around airports which will ensure fair assessment of operating conditions and performance indicators that have been developed by the PRC/PRU in cooperation with airport operators, airlines and local airport ANS providers.

Airport operators, airlines and local airport ANS providers could further develop their local performance analysis based on the same airport data set. The Eurocontrol data base where airline, airport and ATC data are centralised (PRISME) will be accessible by European airport stakeholders since June 2010 according to access rights being developed by ATMAP members.

What happens if not all requested data items can be provided?

The information collected from airports can be grouped into three categories: (1) data used for matching and quality checking, (2) key data for ATMAP performance monitoring and (3) additional data items which are recorded and stored at the reporting airport.

Data used for matching and quality checking is considered as key data. These data items are not used as input for the ATMAP performance monitoring but are essential for the ETL (Extraction, Transformation and Load) process. These data items are also collected from other sources and allow the received file to be merged into the common European Database (PRISME). The received data is also used for permanent quality check of the data.

Airport data for ATMAP performance data is regarded as key data (2). This key data is almost exclusively collected from airport operators and is essential for the ATMAP performance monitoring.

Additional data items (3) are not used for computing ATMAP Key Performance Indicators, but they are useful to clarify the accountability of the measured KPI.

These data items should be made available whenever they are collected or recorded by the reporting airport operator and/or by local ATC

Data items of group (1) and (2) are essential for the performance monitoring. Data items of group (3) are non essential but still recommended to be provided.

Arrival and departure flight data

The tables below contain flight data specifications for arriving and departing flights. The first column contains the acronyms of the data to be collected. In order to avoid confusion, the acronyms were taken from existing IATA, ICAO or EUROCONTROL definitions and complemented by ATMAP specific acronyms, as necessary. All acronyms are decoded in the second column and briefly explained in the third column. The data format and an example are given in the fourth and fifth columns.

The acronyms indicated in the first column shall be used as headers for data submission in the order they are presented in the tables.

All times willl be given in UTC.

Arrival flights

ACRONYM	DECODING	DATA DESCRIPTION	DATA FORMAT	EXAMPLE	DATA GROUP
REG	Aircraft registration	The alphanumerical characters corresponding to the actual registration of the aircraft (up to 7 characters)	X-X1XX2	D-ABCDE	1
ARCTYP	Aircraft Type	According to ICAO aircraft type designator (up to 4 characters)	X123	B738	1
FLTID	Flight identifier	The Callsign used by flight crew and ANSPs to identify an aircraft in air-ground communication (up to 7 characters)	XXX	IBE3609	1
ADEP	Airport of Departure	The code of the departure airport using the ICAO 4-letter or the IATA 3-letter airport designator	XXXX or XXX	EDDM or MUC	1
ADES	Airport of Destination	The code of the arrival airport using the ICAO 4-letter or the IATA 3-letter airport designator (same for all arrival flights)	XXXX or XXX	LIMC or MXP	1
STA	Scheduled Time of Arrival	Schedule date and Time of Arrival (equivalent to Scheduled In-Block Time)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	1
FLTRUL	Flight Rules	"IFR" for aircraft flying according to instrument flight rules as defined in Annex 2 of the Chicago Convention or "VFR" for aircraft flying according to visual flight rules as defined in the same Annex	XXX	IFR	1
FLTTYP	Flight Type	S—Scheduled, N—Non-scheduled, G—General aviation, M—Military, X—Other types	X	S	1
STATUS	Status	C—Cancelled (Remark: all subsequent fields will be empty, except for ASLT which could be filled in to facilitate matching of flight records in different databases)	X	C	2
STATUS-C.R	Cancelled Flight Reason	Reason for cancellation as reported by the airline to the airport operator	XX	83	3
ASLT	Airport Arrival Slot	The permission given to an aircraft operator by an airport slot coordinator in accordance with Regulation 95/93 to use the full range of airport infrastructure necessary to operate an air service at a coordinated airport on a specific date and time for the purpose of landing (empty for non-coordinated airports)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	2
ALDT	Actual Landing Time	The actual date and time when the aircraft has landed (touch down)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:10:00	3 for IFR and 2 for

					VFRs or OATs
ARWY	Arrival Runway designator	The runway used for landing according to ICAO Annex 14	12X	24L	2
ASTND	Arrival Stand	The designator of the first parking position where the aircraft was parked upon arrival	(X) 123	A69	2
AIBT	Actual In-Block Time	The actual date and time when the parking brakes have been engaged at the parking position	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	2

<u>Departure flights</u>

ACRONYM	DECODING	DATA DESCRIPTION	DATA FORMAT	EXAMPLE	DATA GROUP
REG	Aircraft registration	The alphanumerical characters corresponding to the actual registration of the aircraft (up to 7 characters)	X-X1XX2	D-ABCDE	1
ARCTYP	Aircraft Type	According to ICAO aircraft type designator (up to 4 characters)	X123	B738	1
FLTID	Flight identifier	The Callsign used by flight crew and ANSPs to identify an aircraft in air-ground communication (up to 7 characters)	XXX	IBE3609	1
ADEP	Airport of Departure	The code of the departure airport using the ICAO 4-letter <u>or</u> the IATA 3-letter airport designator (same for all departure flights)	XXXX or XXX	EDDM or MUC	1
ADES	Airport of Destination	The code of the arrival airport using the ICAO 4-letter <u>or</u> the IATA 3-letter airport designator	XXXX or XXX	LIMC or MXP	1
STD	Scheduled Time of Departure	Scheduled date and time of departure (equivalent to Scheduled Off-Block Time)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	1
FLTRUL	Flight Rules	“IFR” for aircraft flying according to instrument flight rules as defined in Annex 2 of the Chicago Convention or “VFR” for aircraft flying according to visual flight rules as defined in the same Annex	XXX	IFR	1

FLTTYP	Flight Type	S—Scheduled, N—Non-scheduled, G—General aviation, M—Military, X—Other types	X	S	1
STATUS	Status	C—Cancelled (Remark: all subsequent fields will be empty, except for DSLT and EOBT which could be filled in to facilitate matching of flight records in different databases)	X	C	2
STATUS-C.R	Cancelled Flight Reason	Reason for cancellation as reported by the airline to the airport operator	XX	83	3
DSLT	Airport Departure Slot	The permission given to an aircraft operator by an airport slot coordinator in accordance with Regulation 95/93 to use the full range of airport infrastructure necessary to operate an air service at a coordinated airport on a specific date and time for the purpose of take-off (empty for non-coordinated airports)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	2
DSTND	Departure Stand	The designator of the last parking position where the aircraft was parked before departing from the airport	(X) 123	A69	2
DSTND TYP	Departure Stand Type	The type of the last parking position where the aircraft was parked before departing from the airport	Nose-in / Drive through / other	Through	3
EOBT	Estimated Off-Block Time	The time indicated in Field 14 of the ICAO Flight Plan complemented with the date of departure (e.g. from DOF/ available in Field 18 of that flight plan)	DD-MM-YYYY HH:MM:SS	11-01-2008 11:10:00	3
TOBT	Initial and Last Target Off-Block Time	The time that an aircraft operator/handling agent estimates that an aircraft will be ready, all doors closed, boarding bridge removed, push back vehicle present, ready to start up / push back immediately upon reception of clearance from the TWR.. Initial and last TOBT are required.	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	3
ARDT	Actual Ready Time	When the aircraft is ready for pushback or taxi immediately after clearance delivery (all doors are closed and the pushback tractor – ordered by the handling agent – is in position)	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	3
AOBT	Actual Off-Block Time	The actual date and time the aircraft has vacated the parking position (pushed back or on its own power)	DD-MM-YYYY HH:MM:SS	11-01-2008 11:10:00	3
RDLY	Reason(s) and delays	IATA delay codes (up to 5) and corresponding minutes of delay	RR/min, RR/min	87/6, 93/12	3

DRWY	Departure Runway designator	The ICAO designator of the runway used for take-off	12X	10L	2
AXOT	Taxi on its own power	When the aircraft starts moving on its own power. AXOT coincides with AOBT when there is no push back procedure to get off the stand.	DD-MM-YYYY HH:MM:SS	11-01-2008 11:10:00	2
JHPT	Join Holding Point Time	The time when an aircraft has arrived at the holding point, or if a preceding aircraft is already at the holding point, then it is when it joins the queue for the holding point.	MM:SS	MM:SS	3
CTOT	Calculated Take-Off Time	The calculated take-off time provided by the CFMU, also known as ATFM slot	DD-MM-YYYY HH:MM:SS	11-01-2008 09:05:00	3
ATOT	Actual Take-Off Time	The date and time that an aircraft has taken off from the runway (wheels-up)	DD-MM-YYYY HH:MM:SS	11-01-2008 11:10:00	3
REMOTE DEICING/ANTI-ICING	Remote de-icing / anti-icing	Indicate whether the departing aircraft was de-iced or anti-iced and if yes, whether de-icing or anti-icing was performed at the stand before AOBT or in any remote position after AOBT.	NIL / STAND / REMOTE	REMOTE	2

Annex G <u>Article 11 European Council Regulation 549/2004 as amended in March 2009</u>

<u>"Article11 (EC 549/2004)</u>

Performance scheme

1. To improve the performance of air navigation services and network functions in the Single European Sky, a performance scheme ***for air navigation services and network functions shall be set up***. It shall include :

   (a) ***Community-wide performance targets on the key performance areas of safety, the environment, capacity and cost-efficiency;***

   (b) ***national plans or plans for functional airspace blocks, including performance targets, ensuring consistency with the Community-wide performance targets; and***

   (c) periodic review, monitoring and benchmarking of performance of air navigation services and network functions.

2. ***In accordance with the regulatory procedure referred to in Article 5(3),*** the Commission may designate EUROCONTROL or another ***impartial and competent body*** to act as a "performance review body". The role of the performance review body shall be to assist the Commission***, in coordination with the NSAs, and to assist the NSAs on request*** in the implementation of the performance scheme referred to in paragraph 1***.*** The Commission shall ensure that the performance review body acts independently when carrying out the tasks entrusted to it by the Commission.

3. ***(a)*** ***The Community-wide performance targets for the air traffic management network shall be adopted by the Commission in accordance with the regulatory procedure referred to in article 5(3), after taking into account the relevant inputs from NSAs at national level or at the level of functional airspace blocks.***

   (b) ***The national or functional airspace block plans referred to in paragraph 1(b) shall be elaborated by NSAs and adopted by the Member State(s). These plans shall include binding national targets or targets at the level of functional airspace blocks and an appropriate incentive scheme as adopted by the Member State(s). Drafting of the plans shall be subject to consultation with air navigation service providers, airspace users' representatives, and, where relevant, airport operators and airport coordinators.***

   (c) ***The consistency of the national or functional airspace block targets with the Community-wide performance targets shall be assessed by the Commission using the assessment criteria referred to in paragraph 6(d).***

   In the event that the Commission identifies that one or more national or functional airspace block targets do not meet the assessment criteria, it may decide, in accordance with the

procedure referred to in article 5(2)¸ to issue a recommendation that the NSA(s) concerned propose revised performance target(s). The Member State(s) concerned shall adopt revised performance targets and appropriate measures which shall be notified to the Commission in due time.

Where the Commission finds that the revised performance targets and appropriate measures are not adequate, it may decide, in accordance with the regulatory procedure referred to in Article 5(3), that the concerned Member States shall take corrective measures.

Alternatively, the Commission may decide, with adequate supporting evidence, to revise the Community-wide performance targets in accordance with the regulatory procedure referred to in Article 5(3).

(d) The reference period for the performance scheme shall cover a minimum of three years and a maximum of five years. During this period, in case the national or functional airspace block targets are not met, the Member States and/or the national supervisory authorities shall apply the appropriate measures they have defined. The first reference period shall cover the first three years following the adoption of the implementing rules referred to in paragraph 6.

(e) The Commission shall perform regular assessments of the achievement of the performance targets and present the results to the Single Sky Committee

4. The following procedures shall apply to the performance scheme referred to in paragraph 1:

(a) collection, validation, examination, evaluation and dissemination of relevant data related to performance of air navigation services and network functions from all relevant parties, including air navigation service providers, airspace users, airport operators, national supervisory authorities, Member States and EUROCONTROL;

(b) selection of appropriate key performance areas on the basis of ICAO Document N°9854 "Global Air Traffic Management Operational Concept", and consistent with those identified in the Performance Framework of the ATM Master Plan, including safety, environment, capacity and cost-efficiency areas, adapted where necessary in order to take into account the specific needs of the single European sky and relevant objectives for these areas and definition of a limited set of key performance indicators for measuring performance;

(c) establishment of Community-wide performance targets that shall be defined taking into consideration inputs identified at national level or at the level of functional airspace blocks;

(d) assessment of the national or functional airspace block performance targets on the basis of the national or functional airspace block plan;

(e) *monitoring of the national or functional airspace block performance plans, including appropriate alert mechanisms;*

The Commission may add procedures to the list of the procedures referred to in this paragraph. These measures designed to amend non-essential elements of this Regulation, by supplementing it, shall be adopted in accordance with the regulatory procedure with scrutiny referred to in Article 5(4).

5. *The establishment of the performance scheme shall take into account that en route services, terminal services and network functions are different and should be treated accordingly, if necessary also for performance-measuring purposes.*

6. *For the detailed functioning of the performance scheme, the Commission shall adopt, at the latest two years following the entry into force of this Regulation and within a suitable timeframe with a view to meeting the relevant deadlines laid down in this Regulation, implementing rules in accordance with the regulatory procedure referred to in Article 5(3). These implementing rules shall cover the following:*

(a) *the content and timetable of the procedures referred to in paragraph 4;*

(b) *the reference period and intervals for the assessment of the achievement of performance targets and setting of new targets;*

(c) *criteria for the setting up by the national supervisory authorities of the national or functional airspace block performance plans, containing the national or functional airspace block performance targets and the incentive scheme shall:*

(i) *be based on the business plans of the ANSPs;*

(ii) *address all cost components of the national or functional airspace block cost base;*

(iii) *include binding performance targets consistent with the Community-wide performance targets;*

(d) *criteria to assess whether the national or functional airspace block targets are consistent with the Community wide performance targets during the reference period and to support alert mechanisms;*

(e) *general principles for the setting up by Member States of the incentive scheme;*

(f) *principles for the application of a transitional mechanism necessary for the adaptation to the functioning of the performance scheme not exceeding twelve months following the adoption of the implementing rules.*"

Annex H Terminology

Additional Time	The time difference between the actual time and the unimpeded time of a flight phase. In the absence of inefficiencies and constraints in airport operations, this time is the minimum queuing time required to feed the airport resources and maximize their throughput.	ATMAP
Aircraft Queue	Aircraft form a queue at airport resources in their inbound and outbound flows to receive a service (e.g. de-icing service or a departure clearance to take-off) and wait for their turn to be served. All airports, in their entirety or broken down into elements, can be viewed as networks of queuing systems. The queue formation is a manifestation of inefficiencies at airport resources, but a certain level of minimum queuing is required to maximize the use of the airport system as a whole, and therefore its throughput, when the resource is operated close to its maximum service capacity. This allows avoiding idle periods of the resource usage that may impact in the airport system performance, i.e. the resource is ready to provide a service, but the aircraft is not.	De Neufville R. & Odoni A. “Airport Systems. Planning, deign and management.” New York: Mc Graw Hill, 2003. Idris, H. “Observations and Analysis of Departure Operations at Boston Logan International Airport,” Ph.D. Thesis, Massachusetts Institute of Technology, Cambridge, MA, September, 2000.
Aircraft stand	A designated area on an apron intended to be used for parking an aircraft.	ICAO Annex 14, Chapter I
Airport Managing body	Managing body of an airport’ shall mean the body which, in conjunction with other activities or otherwise, has the task under national laws or regulations of administering and managing the airport facilities and coordinating and controlling the activities of the various operators present at the airport or within the airport system concerned.	EC Regulation 1995/93
Airport Slot	The scheduled time of arrival or departure available for allocation by, or as allocated by, a coordinator for an aircraft movement on a specific date at a coordinated airport.	IATA Worldwide Scheduling Manual, Dec 2008
Airside	That area of an airport which is in whole or in part under the jurisdiction of the government control authorities. Where this jurisdiction of the government control authorities does not apply, it is that part of an airport terminal building with immediate access to the apron. In both cases the airside area is prohibited to the non-travelling public.	IATA Glossary of Terms, 4 Dec 2001

Apron	A defined area, on a land aerodrome, intended to accommodate aircraft for purposes of loading or unloading passengers, mail or cargo, fuelling, parking or maintenance.	ICAO Annex 14, Chapter I
Apron Taxiway	A portion of a taxiway system located on an apron and intended to provide a through taxi route across the apron	ICAO many Annexes such as Annex 2
ATFM Delay	The duration between the last take-off time requested by the aircraft operator and the take-off slot given by the CFMU. It is expressed in minutes. ATFM delays are calculated as the difference between the Calculated take-off time (CTOT) and the Estimated take-off time (ETOT).	EUROCONTROL EATM Glossary of Terms
ATFM en-route delay	ATFM delay caused by regulations applied by the CFMU at the request of the FMP to protect en-route ATC sectors from overload.	Capacity Workshop, 12 April 2002
ATFM regulation	When traffic demand is anticipated to exceed the declared capacity in en-route control centres or at the departure/arrival airport, ATC units may call for “ATFM regulations”.	
Best Practice	A set of processes which are clearly linked to a good level of performance	
Capacity	The maximum number of aircraft that can be accommodated in a given time period by the system or one of its components.	ICAO AN-CONF/11-WP/4
Congestion	Congestion is a condition on any network or part of it when demand of network resources increases and exceeds the capacity of any of its limiting components in a certain time period.	ATMAP?
Coordinated Airport	Any airport where, in order to land or take off, it is necessary for an air carrier or any other aircraft operator to have been allocated a slot by a coordinator, with the exception of State flights, emergency landings and humanitarian flights	EC Regulation 1995/93
Declared Capacity	The number of aircraft movements per hour that an airport can accommodate at a reasonable level of service. There is neither generally accepted definition nor standard methodology for setting it. The approaches used for this purpose vary from country to country, and even airport to airport. It is the airport capacity which is declared months in advance of the day of operations according to the airport scheduling process described in the IATA scheduling manual. Declared capacity is also referred as “coordination parameters” in the EC Regulation 95/93. The airport capacity declaration usually depends on the most airport constraining factor (terminal passengers, stands, runway capacity).	De Neufville R. & Odoni A. “Airport Systems. Planning, deign and management.” New York: Mc Graw Hill, 2003. IATA Worldwide Scheduling Manual, Dec 2008 EC Regulation 95/93
De-icing	The process which removes ice, snow, slush or frost from aeroplane surfaces. This may be	ICAO Doc 9640

	accomplished by mechanical methods, pneumatic methods or through the use of heated fluids.	
Delay	The difference between an actual time and an ideal time.	ICAO Doc 9740
Demand	The number of aircraft requesting to use the airport system in a given time period.	ICAO AN-CONF/11-WP/4
Departure Surface Movement	Movement of an aircraft on the surface of an aerodrome (under its own power or not) between the stand until the take off	ATMAP
Efficiency	Effective operation as measured by the comparison between actual and optimum operation. Normally. Efficiency is considered as flight efficiency and measures the difference between actual and optimum unimpeded aircraft trajectories. Deviations from the optimum trajectory generate additional flight time, fuel burn, and costs to airspace users. It is worth noting that this optimum trajectory is seen from a single-flight perspective, and might not be always an achievable or desirable goal due to trade-offs with other performance areas. On the other hand, if the focused of analysis is time efficiency and this is seen from an airport system perspective (e.g. as it is the case when the objective is to maximize runway throughput), the unimpeded trajectory time is not the most desired objective either. A minimal queue size is added to the unimpeded time to avoid idle periods of runway usage and ensure maximum usage of the airport system. This is translated into an additional time (buffer) to be added to the unimpeded time as to obtain the optimum.	Performance Review Report 2007
Gate	A point of passenger access to the apron/aircraft from the terminal building and vice versa.	(IATA Glossary of Terms, 4 Dec 2001)
Ground Handling	The Ground Handling covers a complex series of processes that are required to separate an aircraft from its load (passengers, baggage, cargo, and mail) on arrival and combine it with its load prior to departure)	www.iata.org
Instrument meteorological conditions (IMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, less than the minima specified for visual meteorological conditions.	PANS RAC, Part I, Doc 4444
Landside	The area of an airport or terminal building to which the public has access. That area of an airport and buildings to which the non-travelling public has free access	(IATA Glossary of Terms, 4 Dec 2001). (ICAO International Civil Aviation Vocabulary Doc 9713)

Manoeuvring Area	That part of an aerodrome to be used for the take-off, landing, and taxiing of aircraft, excluding aprons	ICAO Annex 14, Chapter I
Movement Area	That part of an aerodrome to be used for the take-off, landing and taxiing of aircraft, consisting of the manoeuvring area and the apron(s). Note.— For A-SMGCS, the movement area does not include passive stands, empty stands and those areas of the apron(s) that are exclusively designated to vehicle movements.	ICAO Annex 14, Chapter I, but the note to the above official definition appears only in Doc 9850
Peak	A defined period during which the highest traffic activity occurs (or is expected to occur) at an airport or in an airport terminal.	IATA Glossary of Terms, 4 Dec 2001
Predictability	Predictability is the ability of airlines, air navigation service providers and airports to build and operate reliable and efficient schedules, which impacts both their punctuality and financial performance. Predictability is essential information in building schedules: a high level of punctuality can be ensured to passengers if delays are predictable and incorporated in schedules. Schedule predictability is strongly affected by the variability of operations which is measured as the standard deviation of flight phases.	Performance Review Report 2007
Punctuality	Punctuality is the ability of the air transport system to deliver services to the passengers by comparing scheduled times to actual observed times.	PRU
Pushback	Airport procedure during which an aircraft is pushed backwards away from an aircraft stand by external power. The starting time of pushback coincides with the door close, release of breaks and it is pushed by external tractor, and it ends once the aircraft start taxiing with its own power. Note that not every departure requires pushback.	
Ramp Parking Stand	See Aircraft Stand	ICAO Annex 14, Chapter 1
Runway visual range	The range over which the pilot of an aircraft on the centre line of a runway can see the runway surface markings or the lights delineating the runways or identifying its centre line.	ICAO Annex 14, Chapter I
Runway Waiting Time	Queuing time at the runway before taking-off that aircraft waits for its turn to received the clearance to take off.	
Scheduled Air Service	An air service open to use by the general public and operated according to a published timetable or with such a regular frequency that it constitutes an easily recognizable systematic series of flights	ICAO Doc 9626
Scheduling Season (IATA)	Either the Summer or Winter season, i.e. Northern Summer to commence on the date of Daylight Saving Time introduction in the EU; Northern Winter to commence on the last Sunday in October.	IATA Worldwide Scheduling Time, Dec 2008

Service Rate	For a runway, the service rate is the maximum throughput for a given set of conditions, e.g. traffic mix and average separation. If the definition is extended to the whole airport system with multiple runways, the service rate can be defined as the maximum number of movements per hour which can be handled by the airport without violating ATM rules, assuming continues aircraft demand. The service rate is usually described in other sources as the maximum throughput capacity. It must be noted that this definition needs to know the specific conditions under which the airport operates, and that there is no reference to the level of service provided.	NATS ACS Report 080, 2008 De Neufville R. & Odoni A. “Airport Systems. Planning, deign and management.” New York: Mc Graw Hill, 2003.
Stand	See Aircraft Stand	
Taxi-In Time	Movement of an aircraft on the surface of an aerodrome under its own power, between the landing and the in-block position at the aircraft stand	ATMAP
Taxiing	Movement of an aircraft on the surface of an aerodrome under its own power, excluding take-off and landing.	ICAO Annex 2
Taxi-Out Time	Movement of an aircraft on the surface of an aerodrome between puch back from a given position in the movement area until take off. Therfore, the taxi-out time is calculated from the pushback time (door closed and break released) and the wheels-off time.	ATMAP
Taxiway	A defined path on a land aerodrome established for the taxiing of aircraft and intended to provide a link between one part of the aerodrome and another, including : a. Aircraft stand taxilane b. Apron taxiway c. Rapid exit taxiway.	ICAO Annex 14, Chapter I
Threshold	The beginning of that portion of the runway usable for landing.	ICAO Annex 14, Chapter I
Throughput	It is the traffic volume passing through a network (or an element of it). When congestion occurs throughput approaches the capacity of the network (or an element of it). In a more generic sense *throughput* is the amount of output that be produced by a system or component in a given period of time. The term is used in a variety of contexts. For example, in a transportation system it can refer to the amount of freight or passengers that is carried by a railroad line or the amount of a liquid or gas (e.g. petroleum or natural gas) passing through a pipeline during some specified time period. In an airport system, the runway throughput is the number of aircraft movements that are handled in a period of time (normally one hour).	http://www.bellevuelinux.org/throughput.html

Traffic Volume (or traffic load)	The number of movements of air traffic handled by an ATS unit or part thereof during a given period of time.	ICAO Doc 9426
Turnaround Activities	The activities associated with the handling of an aircraft arriving under one flight number (terminating flight) and departing from the same operational stand under a different flight number (originating flight).	IATA Glossary of Terms, 4 Dec 2001
Unimpeded Time	The time duration of a flight phase operation when it is executed without any other traffic constraint, meaning undelayed transition time as if a single aircraft was present.	
Visual Meteorological Conditions (VMC)	Meteorological conditions expressed in terms of visibility, distance from cloud, and ceiling, equal to or better than specified minima.	PANS-RAC, Part I, Doc 4444

Annex I Acronyms

ACRONYM	DECODING
ACARS	Aircraft Communications, Addressing and Reporting System
ADEP	Airport of Departure
ADES	Airport of Destination
AEA	Association of European Airlines
AIBT	Actual In-Block Time
ANS	Air Navigation Service
ANSP	Air Navigation Service Provider
AOBT	Actual Off-Block Time
AOM	Airport Operating Mode
ARCTYP	Aircraft Type
ARWY	Arrival Runway designator
ASLT	Airport Arrival Slot Time
ASMA	Arrival Sequencing and Merging Area
A-SMGCS	Advanced Surface Movement Guidance and Control Systems
ASTND	Arrival Stand
ATFM	Air Traffic Flow Management
ATM	Air Traffic Management
ATMAP	Air Traffic Management Airport Performance
ATOT	Actual Take-Off Time
BGN TAX	Beginning of Taxi Time
CAT	Category
CAVOK	Clouds and Visibility OK
CDM	Collaborative Decision Making
CFMU	Central Flow Management Unit
CPR	Correlated Position Reports
CTOT	Calculated Take-Off Time
CTOT	Calculated Take-off Time
DMAN	Departure Manager
DME	Distance Measurement Equipment
DRWY	Departure Runway designator
DSLT	Airport Departure Slot Time
DSTND	Departure Stand
DSTND TYP	Type of Departure Stand Operation (Nose-out/Pushback)
EC	European Commission
eCODA	Enhanced Central Office for Delay Analysis
EOBT	Estimated Off-Block Time
ETFMS	Enhanced Tactical Flow Management System
ETOT	Estimated Take-Off Time

EUACA	European Union Airport Coordinators Association
FLTID	Flight identifier
FLTRUL	Flight Rules
FLTTYP	Flight Type
IATA	International Air Transport Association
IFR	Instrumental Flight Rules
ILS	Instrument Landing System
KPA	Key Performance Area
KPI	Key Performance Indicator
METAR	Meteorological Aerodrome Report
NOTAM	Notice to Airmen
OAT	Operational Air Traffic
OOOI	On stand, take off, landing in, In stand
PRC	Performance Review Commission
PRU	Performance Review Unit
RCNL	Reason(s) for cancellation
RDLY	Reason(s) for delays
REG	Aircraft registration
Rem De-Icing	Remote De-Icing procedure (Yes/No)
RWTH	Aachen University
RWY	Runway
SADIS	Satellite Distribution System
SID	Standard Instrument Departure
SMR	Surface Movement Radar
STA	Scheduled Time of Arrival
STAR	Standard Arrival Route
STD	Scheduled Time of Departure
TAR	Terminal Area (surveillance) Radar
TMA	Terminal Movement Area
TOBT	Target Off-Block Time
UTC	Universal Time Co-ordinates
VFR	Visual flight Rules
VOR	VHF Omni-directional Radio Range

Annex J Standard IATA Delay Codes

Others

00-05	AIRLINE INTERNAL CODES
06 (OA)	NO GATE/STAND AVAILABILITY DUE TO OWN AIRLINE ACTIVITY
09 (SG)	SCHEDULED GROUND TIME LESS THAN DECLARED MINIMUM GROUND TIME

Passenger and Baggage

11 (PD)	LATE CHECK-IN, acceptance after deadline
12 (PL)	LATE CHECK-IN, congestions in check-in area
13 (PE)	CHECK-IN ERROR, passenger and baggage
14 (PO)	OVERSALES, booking errors
15 (PH)	BOARDING, discrepancies and paging, missing checked-in passenger
16 (PS)	COMMERCIAL PUBLICITY/PASSENGER CONVENIENCE, VIP, press, ground meals and missing personal items
17 (PC)	CATERING ORDER, late or incorrect order given to supplier
18 (PB)	BAGGAGE PROCESSING, sorting etc.

Cargo and Mail

21 (CD)	DOCUMENTATION, errors etc.
22 (CP)	LATE POSITIONING
23 (CC)	LATE ACCEPTANCE
24 (CI)	INADEQUATE PACKING
25 (CO)	OVERSALES, booking errors
26 (CU)	LATE PREPARATION IN WAREHOUSE
27 (CE)	DOCUMENTATION, PACKING etc *(Mail Only)*
28 (CL)	LATE POSITIONING *(Mail Only)*
29 (CA)	LATE ACCEPTANCE *(Mail Only)*

Aircraft and Ramp Handling

31 (GD)	AIRCRAFT DOCUMENTATION LATE/INACCURATE, weight and balance, general declaration, pax manifest, etc.
32 (GL)	LOADING/UNLOADING, bulky, special load, cabin load, lack of loading staff
33 (GE)	LOADING EQUIPMENT, lack of or breakdown, e.g. container pallet loader, lack of staff
34 (GS)	SERVICING EQUIPMENT, lack of or breakdown, lack of staff, e.g. steps
35 (GC)	AIRCRAFT CLEANING
36 (GF)	FUELLING/DEFUELLING, fuel supplier
37 (GB)	CATERING, late delivery or loading
38 (GU)	ULD, lack of or serviceability
39 (GT)	TECHNICAL EQUIPMENT, lack of or breakdown, lack of staff, e.g. pushback

Technical and Aircraft Equipment

41 (TD)	AIRCRAFT DEFECTS.
42 (TM)	SCHEDULED MAINTENANCE, late release.
43 (TN)	NON-SCHEDULED MAINTENANCE, special checks and/or additional works beyond normal maintenance schedule.
44 (TS)	SPARES AND MAINTENANCE EQUIPMENT, lack of or breakdown.
45 (TA)	AOG SPARES, to be carried to another station.
46 (TC)	AIRCRAFT CHANGE, for technical reasons.
47 (TL)	STAND-BY AIRCRAFT, lack of planned stand-by aircraft for technical reasons.
48 (TV)	SCHEDULED CABIN CONFIGURATION/VERSION ADJUSTMENTS.

Damage to Aircraft & EDP/Automated Equipment Failure

51 (DF)	DAMAGE DURING FLIGHT OPERATIONS, bird or lightning strike, turbulence, heavy or overweight landing, collision during taxiing
52 (DG)	DAMAGE DURING GROUND OPERATIONS, collisions (other than during taxiing), loading/off-loading damage, contamination, towing, extreme weather conditions
55 (ED)	DEPARTURE CONTROL
56 (EC)	CARGO PREPARATION/DOCUMENTATION
57 (EF)	FLIGHT PLANS

Flight Operations and Crewing

61 (FP) FLIGHT PLAN, late completion or change of, flight documentation
62 (FF) OPERATIONAL REQUIREMENTS, fuel, load alteration
63 (FT) LATE CREW BOARDING OR DEPARTURE PROCEDURES, other than connection and standby (flight deck or entire crew)
64 (FS) FLIGHT DECK CREW SHORTAGE, sickness, awaiting standby, flight time limitations, crew meals, valid visa, health documents, etc.
65 (FR) FLIGHT DECK CREW SPECIAL REQUEST, not within operational requirements
66 (FL) LATE CABIN CREW BOARDING OR DEPARTURE PROCEDURES, other than connection and standby
67 (FC) CABIN CREW SHORTAGE, sickness, awaiting standby, flight time limitations, crew meals, valid visa, health documents, etc.
68 (FA) CABIN CREW ERROR OR SPECIAL REQUEST, not within operational requirements
69 (FB) CAPTAIN REQUEST FOR SECURITY CHECK, extraordinary

Weather

71 (WO) DEPARTURE STATION
72 (WT) DESTINATION STATION
73 (WR) EN ROUTE OR ALTERNATE
75 (WI) DE-ICING OF AIRCRAFT, removal of ice and/or snow, frost prevention excluding unserviceability of equipment
76 (WS) REMOVAL OF SNOW, ICE, WATER AND SAND FROM AIRPORT
77 (WG) GROUND HANDLING IMPAIRED BY ADVERSE WEATHER CONDITIONS

ATFM + AIRPORT + GOVERNMENTAL AUTHORITIES

AIR TRAFFIC FLOW MANAGEMENT RESTRICTIONS

81 (AT) ATFM due to ATC EN-ROUTE DEMAND/CAPACITY, standard demand/capacity problems
82 (AX) ATFM due to ATC STAFF/EQUIPMENT EN-ROUTE, reduced capacity caused by industrial action or staff shortage, equipment failure, military exercise or extraordinary demand due to capacity reduction in neighbouring area
83 (AE) ATFM due to RESTRICTION AT DESTINATION AIRPORT, airport and/or runway closed due to obstruction, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights
84 (AW) ATFM due to WEATHER AT DESTINATION

AIRPORT AND GOVERNMENTAL AUTHORITIES

85 (AS) MANDATORY SECURITY
86 (AG) IMMIGRATION, CUSTOMS, HEALTH
87 (AF) AIRPORT FACILITIES, parking stands, ramp congestion, lighting, buildings, gate limitations, etc.
88 (AD) RESTRICTIONS AT AIRPORT OF DESTINATION, airport and/or runway closed due to obstruction, industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights
89 (AM) RESTRICTIONS AT AIRPORT OF DEPARTURE WITH OR WITHOUT ATFM RESTRICTIONS, including Air Traffic Services, start-up and pushback, airport and/or runway closed due to obstruction or weather[4], industrial action, staff shortage, political unrest, noise abatement, night curfew, special flights

Reactionary

91 (RL) LOAD CONNECTION, awaiting load from another flight
92 (RT) THROUGH CHECK-IN ERROR, passenger and baggage
93 (RA) AIRCRAFT ROTATION, late arrival of aircraft from another flight or previous sector
94 (RS) CABIN CREW ROTATION, awaiting cabin crew from another flight
95 (RC) CREW ROTATION, awaiting crew from another flight (flight deck or entire crew)
96 (RO) OPERATIONS CONTROL, re-routing, diversion, consolidation, aircraft change for reasons other than technical

Miscellaneous

97 (MI) INDUSTRIAL ACTION WITH OWN AIRLINE
98 (MO) INDUSTRIAL ACTION OUTSIDE OWN AIRLINE, excluding ATS
99 (MX) OTHER REASON, not matching any code above

SOURCE: IATA – Airport Handling Manual (Chapter AHM 011)

Annex K CFMU Reasons for Regulations

Reasons for Regulations	CODE	Example
ATC Capacity	C	Demand exceeds capacity (departure, arrival, or en-route)
ATC Ind Action	I	Controllers' Strike
ATC Routeing	R	Phasing in of new procedures
ATC Staffing	S	Illness, traffic delays on the highway
ATC Equipment	T	Radar failure; RTF failure
Accident/Incident	A	Runway closed due to accident
Aerodrome Capacity	G	Lack of parking; taxiway closure; areas closed for maintenance; demand exceeds declared capacity (departure or arrival airport)
De-Icing	D	De-icing
Equipment non-ATC	E	Runway lighting failure
Ind Action non-ATC	N	Fire-fighters' strike
Military Activity	M	Brilliant invader
Special Event	P	Europe footfall cup
Weather	W	Thunderstorm; low visibility
Environmental Issues	V	Noise restrictions
Other	O	Security alert

Annex L KPI Punctuality improvement/degradation by airport process

Brussels airport is proposing to include KPIs that focus on the gain or loss of punctuality when flights operate in the airport movement area and during the turnaround phase. This proposal will be considered in ATMAP Phase II, possibly with the organisation of a workshop.

The KPIs aim at providing information about punctuality, which at its turn could be influenced:

- Either by the improvement or deterioration of delays or variability in day of operations.
- Or by the adaptation of scheduling block-to-block times to real operations

In particular, Brussels approach aims at measuring how aircraft punctuality improves or deteriorates in four airport ground processes, summarised as follows:

- Inbound process (from landing to in-block);
- Turnaround process (from in-block to off-block);
- Outbound process (from off-block to take-off);
- Total Airport process (from landing to take-off).

By measuring punctuality at each of the four key events (i.e. touchdown, in-block, off-block, and take-off) and comparing them among themselves, it becomes clear during what process punctuality is gained or lost at the airport. Punctuality is calculated by comparing scheduled times of each aircraft with the actual times at these four events. The following table summarizes these times.

Event	Actual Time	Scheduled Time
Landing (Touchdown)	ALDT	Scheduled touchdown
Take-off	ATOT	Scheduled take-off
In-block	AIBT	STA
Off-block	AOBT	STD

The approach considers that the Scheduled Landing and Take Off times can be derived from the STA and STD, respectively, because these times are not actually scheduled by airlines. The current approach uses standard taxi-in and taxi-out times for the airport in order to do so. An alternative might consider other parameters to select more accurate taxiing times in this derivation, such as aircraft type, runway configuration, or stand-runway combination.

With these eight event times, punctuality figures at each event can be derived using either a 15-minute or 3-minute criteria and then compared by airport process. For example, an hypothetical operational situation at airport A could result in 80% of flights punctual at the touchdown event and 85% of flights punctual at the in-block event during a given time period. This would result, by direct comparison of percentages of punctual movements, in a punctuality improvement of 5% of the inbound process at this airport. This approach could be further refined tracking punctuality in a flight-by-flight basis, e.g. using aircraft identification. In that case, for each aircraft punctuality could be derived at each point and then compared by pairs of events to see if punctuality deteriorates, improves, or remain the same during a process. Finally, the number of times punctuality improves, deteriorates or remains constant can be aggregated to calculate the percent of improvement/deterioration over the total number of movements in each process.

Four KPIs would result from this proposal:

- Punctuality improvement/degradation of inbound process (in-block punctuality minus landing punctuality);
- Punctuality improvement/degradation of turnaround process (off-block punctuality minus in-block punctuality);
- Punctuality improvement/degradation of outbound process (take-off punctuality minus off-block punctuality);
- Punctuality improvement/degradation of total airport process (take-off punctuality minus landing punctuality).

The application of the rough approach to the Brussels National airport is presented in Figure 40.

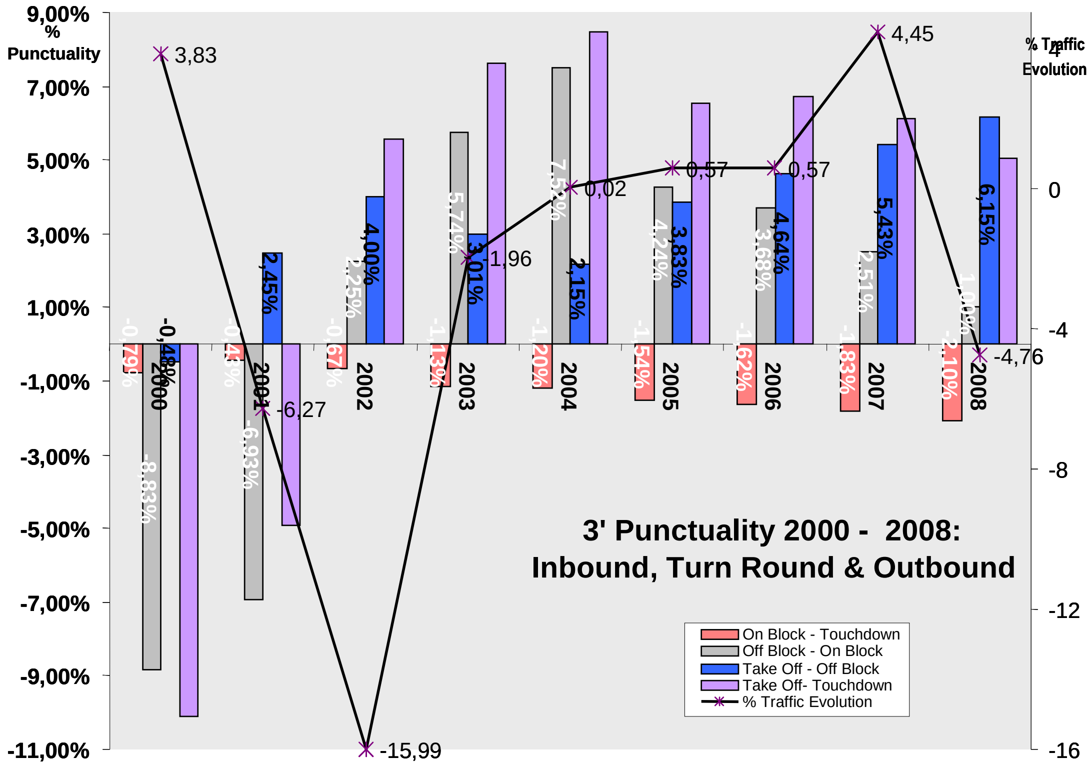


Figure 40. Punctuality variation by airport process (Inbound, Turnaround, Outbound, Total) at Brussels airport.

As all punctuality indicators, a variation of the proposed KPIs is not directly linked to the processes which have generated the variation (e.g. does a deterioration of taxi-out punctuality depend on a change of stand-runway combination or on an increased time in the taxiing?), but the advantage of Brussels proposal is that it locates the problem to a given flight phase.

Handled Traffic in eCODA and CFMU in 2008

AIRPORT	eCODA	CFMU	ratio eCODA/CFMU (%)
Barcelona	200.721	321.334	*62%*
Brussels	181.922	234.185	*78%*
Copenhagen	191.340	264.098	*72%*
Dublin	57.182	208.234	*27%*
Frankfurt	371.282	478.730	*78%*
Helsinki	113.995	173.676	*66%*
Lisbon	58.625	144.136	*41%*
London Gatwick	193.108	264.147	*73%*
London Heathrow	355.527	485.234	*73%*
Madrid	385.654	469.445	*82%*
Milan Malpensa	152.000	218.097	*70%*
Munich	352.714	429.382	*82%*
Palma	144.877	192.879	*75%*
Paris Charles-de-	430.474	559.645	*77%*
Paris Orly	168.008	251.692	*67%*
Prague	139.739	185.262	*75%*
Rome Fiumicino	266.278	346.470	*77%*
Vienna	220.181	289.557	*76%*
Zurich	195.435	262.855	*74%*
TOTAL	**4.179.062**	**5.779.058**	**72%**

Data source : eCODA, CFMU
Period : 2008

Annex N ATMAP Cockpit and Airport Fact sheet template

The following tables summarise in a concise manner the calculation of KPIs in its current stage of development for every airport participating in the study.

KPA	KPI	ATMAP	units	
Traffic volume / Demand	Handled Traffic	**5.000.000**	*mov/year*	2
		13720	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**1245**	*slots/hr*	4
	Declared Capacity (peak hour)	**1290**	*slots/hr*	4
	Number of Available Airport Slots	**21000**	*slots/day*	4
	Service rate	**1271**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,7**		2
	Declared capacity vs Service rate (Peak month)	**1,0**		2
	Nbr hours (peak month) > 90% decl.capacity	**2471**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**76,3**	*%*	1
	On-time departures (<15 min)	**72,1**	*%*	1
	Early arrivals (<-15 min)	**10,0**	*%*	1
Efficiency	ASMA additional time	**3,4**	*min/flight*	2
	ATFM arrival delay	**1,9**	*min/flight*	2
	Predeparture delay	**1,6**	*min/flight*	1
	Taxi-out additional time	**4,8**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**-**	*flight/hr*	2

Data sources :

1. eCODA (2008)
2. CFMU (2008)
3. Airport Operator (Jan-Mar 2008)
4. Slot Coordination (2008)

Barcelona (BCN)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**284.546**	*mov/year*	2
		777	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**25,6**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**64**	*slots/hr*	4
	Declared Capacity (peak hour)	**64**	*slots/hr*	4
	Number of Available Airport Slots	**1024**	*slots/day*	4
	Service rate	**66**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,8**		2
	Declared capacity vs Service rate (Peak month)	**1,0**		2
	Nbr hours (peak month) > 90% decl.capacity	**157**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**80,0**	*%*	1
	On-time departures (<15 min)	**74,8**	*%*	1
	Early arrivals (<-15 min)	**10,9**	*%*	1
Efficiency	ASMA additional time	**2,4**	*min/flight*	2
	ATFM arrival delay	**0,7**	*min/flight*	2
	Predeparture delay	**0,6**	*min/flight*	1
	Taxi-out additional time	**5,4**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**4,0**	*flight/hr*	2

Brussels (BRU)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**226.000**	*mov/year*	2
		617	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**29,1**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**72**	*slots/hr*	4
	Declared Capacity (peak hour)	**74**	*slots/hr*	4
	Number of Available Airport Slots	**1145**	*slots/day*	4
	Service rate	**68**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,5**		2
	Declared capacity vs Service rate (Peak month)	**1,1**		2
	Nbr hours (peak month) > 90% decl.capacity	**21**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**75,2**	*%*	1
	On-time departures (<15 min)	**72,3**	*%*	1
	Early arrivals (<-15 min)	**8,2**	*%*	1
Efficiency	ASMA additional time	**1,8**	*min/flight*	2
	ATFM arrival delay	**1,7**	*min/flight*	2
	Predeparture delay	**1,4**	*min/flight*	1
	Taxi-out additional time	**2,9**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**5,0**	*flight/hr*	2

Dublin (DUB)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**185.258**	*mov/year*	2
		506	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**41**	*slots/hr*	4
	Declared Capacity (peak hour)	**46**	*slots/hr*	4
	Number of Available Airport Slots	**652**	*slots/day*	4
	Service rate	**45**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,8**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**155**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**71,1**	*%*	1
	On-time departures (<15 min)	**68,5**	*%*	1
	Early arrivals (<-15 min)	**9,4**	*%*	1
Efficiency	ASMA additional time	**2,7**	*min/flight*	2
	ATFM arrival delay	**2,3**	*min/flight*	2
	Predeparture delay	**1,4**	*min/flight*	1
	Taxi-out additional time	**5,5**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**3,0**	*flight/hr*	2

Frankfurt (FRA)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**436.589**	*mov/year*	2
		1193	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**20,1**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**82**	*slots/hr*	4
	Declared Capacity (peak hour)	**83**	*slots/hr*	4
	Number of Available Airport Slots	**1316**	*slots/day*	4
	Service rate	**93**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,9**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**359**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**75,2**	*%*	1
	On-time departures (<15 min)	**74,4**	*%*	1
	Early arrivals (<-15 min)	**9,8**	*%*	1
Efficiency	ASMA additional time	**5,6**	*min/flight*	2
	ATFM arrival delay	**4,3**	*min/flight*	2
	Predeparture delay	**2,1**	*min/flight*	1
	Taxi-out additional time	**2,9**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**4,0**	*flight/hr*	2

Helsinki (HEL)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**156.867**	*mov/year*	[2]
		429	*mov/day*	[2]
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	[3]
Capacity	Declared Capacity (avg per hour)	**79**	*slots/hr*	[4]
	Declared Capacity (peak hour)	**80**	*slots/hr*	[4]
	Number of Available Airport Slots	**1268**	*slots/day*	[4]
	Service rate	**51**	mov/hour	[2]
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,3**		[2]
	Declared capacity vs Service rate (Peak month)	**1,5**		[2]
	Nbr hours (peak month) > 90% decl.capacity	**0**	*hr*	[2]
Punctuality	On-time arrivals (<15 min)	**78,8**	*%*	[1]
	On-time departures (<15 min)	**76,7**	*%*	[1]
	Early arrivals (<-15 min)	**8,0**	*%*	[1]
Efficiency	ASMA additional time	**-**	*min/flight*	[2]
	ATFM arrival delay	**0,2**	*min/flight*	[2]
	Predeparture delay	**2,1**	*min/flight*	[1]
	Taxi-out additional time	**1,9**	*min/flight*	[1,2]
Predictability	Variability of arrivals in ASMA	**-**	*flight/hr*	[2]

Lisbon (LIS)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**131.948**	*mov/year*	[2]
		361	*mov/day*	[2]
	Nbr of cancelled flt vs handled flt	**14,7**	*can/1000 flt*	[3]
Capacity	Declared Capacity (avg per hour)	**36**	*slots/hr*	[4]
	Declared Capacity (peak hour)	**36**	*slots/hr*	[4]
	Number of Available Airport Slots	**576**	*slots/day*	[4]
	Service rate	**40**	mov/hour	[2]
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,6**		[2]
	Declared capacity vs Service rate (Peak month)	**0,9**		[2]
	Nbr hours (peak month) > 90% decl.capacity	**55**	*hr*	[2]
Punctuality	On-time arrivals (<15 min)	**74,9**	*%*	[1]
	On-time departures (<15 min)	**70,5**	*%*	[1]
	Early arrivals (<-15 min)	**8,3**	*%*	[1]
Efficiency	ASMA additional time	**2,3**	*min/flight*	[2]
	ATFM arrival delay	**0,5**	*min/flight*	[2]
	Predeparture delay	**1,0**	*min/flight*	[1]
	Taxi-out additional time	**2,7**	*min/flight*	[1,2]
Predictability	Variability of arrivals in ASMA	**6,0**	*flight/hr*	[2]

London Gatwick (LGW)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	239.109	mov/year	2
		653	mov/day	2
	Nbr of cancelled flt vs handled flt	4,3	can/1000 flt	3
Capacity	Declared Capacity (avg per hour)	45	slots/hr	4
	Declared Capacity (peak hour)	51	slots/hr	4
	Number of Available Airport Slots	717	slots/day	4
	Service rate	55	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	0,9		2
	Declared capacity vs Service rate (Peak month)	0,8		2
	Nbr hours (peak month) > 90% decl.capacity	452	hr	2
Punctuality	On-time arrivals (<15 min)	72,4	%	1
	On-time departures (<15 min)	71,5	%	1
	Early arrivals (<-15 min)	12,4	%	1
Efficiency	ASMA additional time	3,2	min/flight	2
	ATFM arrival delay	0,4	min/flight	2
	Predeparture delay	1,5	min/flight	1
	Taxi-out additional time	6,8	min/flight	1,2
Predictability	Variability of arrivals in ASMA	4,0	flight/hr	2

London Heathrow (LHR)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	451.238	mov/year	2
		1233	mov/day	2
	Nbr of cancelled flt vs handled flt	27,5	can/1000 flt	3
Capacity	Declared Capacity (avg per hour)	80	slots/hr	4
	Declared Capacity (peak hour)	89	slots/hr	4
	Number of Available Airport Slots	1286	slots/day	4
	Service rate	93	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	1,0		2
	Declared capacity vs Service rate (Peak month)	0,9		2
	Nbr hours (peak month) > 90% decl.capacity	434	hr	2
Punctuality	On-time arrivals (<15 min)	66,7	%	1
	On-time departures (<15 min)	65,2	%	1
	Early arrivals (<-15 min)	11,3	%	1
Efficiency	ASMA additional time	9,5	min/flight	2
	ATFM arrival delay	4,2	min/flight	2
	Predeparture delay	5,0	min/flight	1
	Taxi-out additional time	8,8	min/flight	1,2
Predictability	Variability of arrivals in ASMA	3,0	flight/hr	2

Madrid (MAD)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**416.964**	*mov/year*	2
		1139	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**17,7**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**95**	*slots/hr*	4
	Declared Capacity (peak hour)	**98**	*slots/hr*	4
	Number of Available Airport Slots	**1514**	*slots/day*	4
	Service rate	**96**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,8**		2
	Declared capacity vs Service rate (Peak month)	**1,0**		2
	Nbr hours (peak month) > 90% decl.capacity	**102**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**71,8**	*%*	1
	On-time departures (<15 min)	**72,5**	*%*	1
	Early arrivals (<-15 min)	**5,9**	*%*	1
Efficiency	ASMA additional time	**3,3**	*min/flight*	2
	ATFM arrival delay	**1,2**	*min/flight*	2
	Predeparture delay	**0,9**	*min/flight*	1
	Taxi-out additional time	**4,7**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**4,0**	*flight/hr*	2

Milan Malpensa (MXP)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**197.642**	*mov/year*	2
		540	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**25,7**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**69**	*slots/hr*	4
	Declared Capacity (peak hour)	**69**	*slots/hr*	4
	Number of Available Airport Slots	**1104**	*slots/day*	4
	Service rate	**60**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,5**		2
	Declared capacity vs Service rate (Peak month)	**1,2**		2
	Nbr hours (peak month) > 90% decl.capacity	**1**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**76,3**	*%*	1
	On-time departures (<15 min)	**70,3**	*%*	1
	Early arrivals (<-15 min)	**12,7**	*%*	1
Efficiency	ASMA additional time	**2,2**	*min/flight*	2
	ATFM arrival delay	**0,6**	*min/flight*	2
	Predeparture delay	**1,0**	*min/flight*	1
	Taxi-out additional time	**4,0**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**5,0**	*flight/hr*	2

Munich (MUC)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**406.895**	*mov/year*	2
		1112	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**23,8**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**90**	*slots/hr*	4
	Declared Capacity (peak hour)	**90**	*slots/hr*	4
	Number of Available Airport Slots	**1440**	*slots/day*	4
	Service rate	**96**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,8**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**183**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**82,1**	*%*	1
	On-time departures (<15 min)	**77,1**	*%*	1
	Early arrivals (<-15 min)	**9,8**	*%*	1
Efficiency	ASMA additional time	**3,3**	*min/flight*	2
	ATFM arrival delay	**1,5**	*min/flight*	2
	Predeparture delay	**1,3**	*min/flight*	1
	Taxi-out additional time	**4,8**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**8,0**	*flight/hr*	2

Palma (PMI)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**171.992**	*mov/year*	2
		470	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**24,8**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**60**	*slots/hr*	4
	Declared Capacity (peak hour)	**60**	*slots/hr*	4
	Number of Available Airport Slots	**960**	*slots/day*	4
	Service rate	**62**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,5**		2
	Declared capacity vs Service rate (Peak month)	**1,0**		2
	Nbr hours (peak month) > 90% decl.capacity	**72**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**77,1**	*%*	1
	On-time departures (<15 min)	**71,6**	*%*	1
	Early arrivals (<-15 min)	**10,4**	*%*	1
Efficiency	ASMA additional time	**1,9**	*min/flight*	2
	ATFM arrival delay	**0,6**	*min/flight*	2
	Predeparture delay	**0,8**	*min/flight*	1
	Taxi-out additional time	**2,9**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**6,0**	*flight/hr*	2

Paris Charles-de-Gaulle (CDG)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**497.506**	*mov/year*	2
		1359	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**22,9**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**104**	*slots/hr*	4
	Declared Capacity (peak hour)	**112**	*slots/hr*	4
	Number of Available Airport Slots	**1664**	*slots/day*	4
	Service rate	**122**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,8**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**205**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**78,3**	*%*	1
	On-time departures (<15 min)	**66,9**	*%*	1
	Early arrivals (<-15 min)	**8,4**	*%*	1
Efficiency	ASMA additional time	**1,9**	*min/flight*	2
	ATFM arrival delay	**0,9**	*min/flight*	2
	Predeparture delay	**1,5**	*min/flight*	1
	Taxi-out additional time	**5,5**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**8,0**	*flight/hr*	2

Paris Orly (ORY)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**223.919**	*mov/year*	2
		612	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**72**	*slots/hr*	4
	Declared Capacity (peak hour)	**72**	*slots/hr*	4
	Number of Available Airport Slots	**1152**	*slots/day*	4
	Service rate	**62**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,5**		2
	Declared capacity vs Service rate (Peak month)	**1,2**		2
	Nbr hours (peak month) > 90% decl.capacity	**1**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**80,1**	*%*	1
	On-time departures (<15 min)	**76,4**	*%*	1
	Early arrivals (<-15 min)	**5,2**	*%*	1
Efficiency	ASMA additional time	**2,1**	*min/flight*	2
	ATFM arrival delay	**1,1**	*min/flight*	2
	Predeparture delay	**1,5**	*min/flight*	1
	Taxi-out additional time	**2,6**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**4,0**	*flight/hr*	2

Prague (PRG)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**156.960**	*mov/year*	2
		429	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**5,1**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**41**	*slots/hr*	4
	Declared Capacity (peak hour)	**44**	*slots/hr*	4
	Number of Available Airport Slots	**652**	*slots/day*	4
	Service rate	**44**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,7**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**78**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**76,8**	*%*	1
	On-time departures (<15 min)	**76,4**	*%*	1
	Early arrivals (<-15 min)	**10,6**	*%*	1
Efficiency	ASMA additional time	**1,8**	*min/flight*	2
	ATFM arrival delay	**0,4**	*min/flight*	2
	Predeparture delay	**0,3**	*min/flight*	1
	Taxi-out additional time	**2,9**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**3,0**	*flight/hr*	2

Rome (FCO)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**316.519**	*mov/year*	2
		865	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**88**	*slots/hr*	4
	Declared Capacity (peak hour)	**88**	*slots/hr*	4
	Number of Available Airport Slots	**1408**	*slots/day*	4
	Service rate	**81**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,6**		2
	Declared capacity vs Service rate (Peak month)	**1,1**		2
	Nbr hours (peak month) > 90% decl.capacity	**9**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**69,9**	*%*	1
	On-time departures (<15 min)	**60,6**	*%*	1
	Early arrivals (<-15 min)	**9,3**	*%*	1
Efficiency	ASMA additional time	**2,8**	*min/flight*	2
	ATFM arrival delay	**2,5**	*min/flight*	2
	Predeparture delay	**1,9**	*min/flight*	1
	Taxi-out additional time	**8,4**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**7,0**	*flight/hr*	2

Vienna (VIE)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**269.521**	*mov/year*	2
		736	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**-**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**64**	*slots/hr*	4
	Declared Capacity (peak hour)	**66**	*slots/hr*	4
	Number of Available Airport Slots	**1020**	*slots/day*	4
	Service rate	**75**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,7**		2
	Declared capacity vs Service rate (Peak month)	**0,9**		2
	Nbr hours (peak month) > 90% decl.capacity	**154**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**80,0**	*%*	1
	On-time departures (<15 min)	**78,5**	*%*	1
	Early arrivals (<-15 min)	**11,6**	*%*	1
Efficiency	ASMA additional time	**3,8**	*min/flight*	2
	ATFM arrival delay	**3,8**	*min/flight*	2
	Predeparture delay	**1,0**	*min/flight*	1
	Taxi-out additional time	**3,4**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**6,0**	*flight/hr*	2

Zurich (ZRH)

KPA	KPI		units	
Traffic volume / Demand	Handled Traffic	**253.177**	*mov/year*	2
		692	*mov/day*	2
	Nbr of cancelled flt vs handled flt	**12,3**	*can/1000 flt*	3
Capacity	Declared Capacity (avg per hour)	**63**	*slots/hr*	4
	Declared Capacity (peak hour)	**68**	*slots/hr*	4
	Number of Available Airport Slots	**1006**	*slots/day*	4
	Service rate	**62**	mov/hour	2
Ratio (traffic volume/demand/ capacity)	Handled traffic vs declared capacity	**0,7**		2
	Declared capacity vs Service rate (Peak month)	**1,0**		2
	Nbr hours (peak month) > 90% decl.capacity	**33**	*hr*	2
Punctuality	On-time arrivals (<15 min)	**80,4**	*%*	1
	On-time departures (<15 min)	**75,0**	*%*	1
	Early arrivals (<-15 min)	**9,8**	*%*	1
Efficiency	ASMA additional time	**3,3**	*min/flight*	2
	ATFM arrival delay	**1,8**	*min/flight*	2
	Predeparture delay	**1,5**	*min/flight*	1
	Taxi-out additional time	**3,8**	*min/flight*	1,2
Predictability	Variability of arrivals in ASMA	**4,0**	*flight/hr*	2

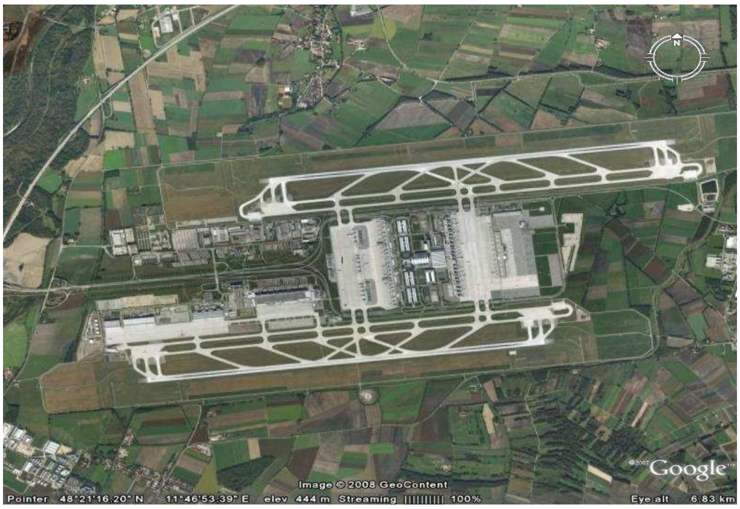
It is planned to present this information in a more compelling way, using the following template:

PERFORMANCE REVIEW UNIT
ATMAP Airport Factsheet

Period:

AIRPORT INFORMATION

Runway & Layout



Notes

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Traffic mix

Notes

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TRAFFIC VOLUME & CAPACITY

Traffic Volume

Notes

Capacity

Notes

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QUALITY OF SERVICE

Punctuality

Notes

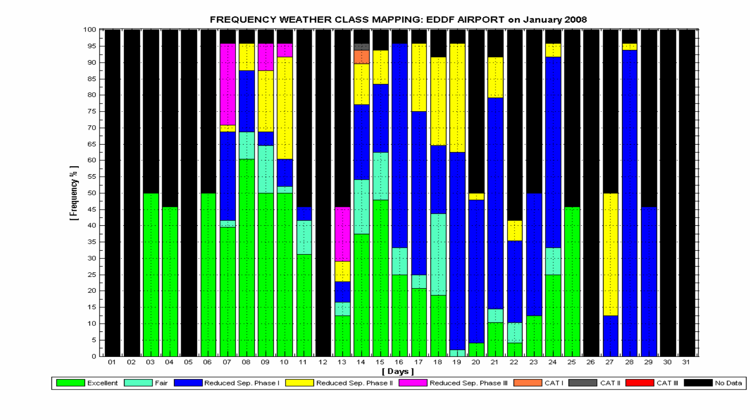
• to be developed

Predictability

Notes

• to be developed

	Efficiency		**Notes** • to be developed
	Emissions		**Notes** •

PERFORMANCE AFFECTING FACTORS	Weather conditions		
	Special events		
	Environmental Restrictions		