

Runway Performance Report **2023**



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Runway performance report **Brussels Airport**

EXECUTIVE SUMMARY

This report yields an overview of Air Traffic Management (ATM) Performance in Brussels Airport for 2023. ATM Performance is driven by four Key Performance Areas (KPAs): safety, capacity, environment, and cost-efficiency. The first three of these four KPAs are covered in this report, providing skeyes' stakeholders and anyone of interest with interesting insights into the operations at Brussels Airport.



Traffic

In 2023, Brussels Airport experienced a total of 192,267 movements, reflecting a notable increase to the previous year (+7% compared to 2022), but not yet reaching pre-pandemic figures with traffic being at 82% of 2019. The increase in passengers (+17% vs 2022) was higher than the increase in movements, which means that the number of passengers per flight increased - speaking for a healthy, continued recovery of the aviation sector after the COVID-19 pandemic. The slight drop in cargo movements is in line with the overall trend in Europe and Brussels Airport continues to play a crucial role for air cargo transport, also strengthening its position with a major investment in the cargo zone in 2023 and the following years.

Overall, daily traffic patterns are showing similar trends in 2023 as in the previous years with a morning peak around 10:00 and an evening peak at year.

19:30/20:00. The most used runways are 25R and 25L, with the latter one being used almost solely for arrivals. Between April and June, the usage of these runways was lower due to the usual wind conditions during these months as well as important renovation works, eliminating cracks in the concrete of runway 25L/07R. Furthermore, due to the renewal and maintenance of the Instrument Landing System (ILS), which became operational as of the 20th of July, runway 19 was sometimes closed throughout the year.

The use of a Communication, Navigation, Surveillance (CNS) drone has been introduced (in its testing phase) in 2023 to monitor the performance of navigation aids. These operations contributed to the total of 6,215 recordings of authorized drone operations in the vicinity of Brussels Airport, which is an increase of 24% compared to the previous

Safety

Safety is an important pillar in air traffic control. As such, safety occurrences and missed approaches are followed up by skeyes' safety unit to analyse the situations, identify trends, and - when necessary conduct a thorough investigation.

The number of missed approaches (a procedure used when the approach cannot be continued for a safe landing) and particularly their cause can indicate which measures are to be taken to improve the safety of air navigation service provision. In 2023, 279 missed approaches were logged, which is an increase of 26% compared to 2022. The rate of missed approaches per 1,000 arrivals increased by 16%. The most common reasons for a missed approach in 2023 are unstable approaches, being too close behind the preceding aircraft, other rea-

sons, or weather conditions. skeyes promotes the increased use of PBN (Performance Based Navigation) procedures, which greatly improve predictability; and therefore also situational awareness.

Concerning the safety occurrences, the reported events on runways and taxiways increased, comparing 2023 to 2022. In particular, there were twelve runway incursions, without ATM contribution. Whereas in previous years, the number of deviations from ATM procedure and air traffic control clearances increased, 2023 witnessed a decrease in these figures, speaking for a successful implementation of the mitigation through updated pushback procedures that were put in place.

Capacity and Punctuality

For Brussels Airport, skeyes has defined a declared capacity for most of the used runway configurations. This declared capacity is calculated based on the airport layout, the traffic in Brussels Airport, and certain assumptions. Thus, it provides a theoretical value of the maximum number of movements the aerodrome can handle within an hour under optimal conditions for the runway configuration in use. At maximum, the declared capacity for Brussels Airport is 75 movements/ hour (for runway configuration 25R – 25L,25R). In practice, this upper limit was never exceeded in 2023. The lower declared capacities for other runway configurations were exceeded on twelve days by maximally eight movements. Brussels Airport is a coordinated airport in Belgium and the declared capacity for slot coordination during the day is a maximum of 74 total movements per hour.

Since 2015 skeyes is subject to an annual target regarding Air Traffic Flow Management (ATFM) arrival delay, delay of a flight caused by a regulation attributable to the terminal and air navigation services of the destination airport. In 2023, only Brussels is considered as a contributing airport and the target is set at 1.08 minutes per flight and 0.12 minutes per flight for delay due to reasons in the CRSTMP category. In 2023, Brussels Tower caused 40,391 minutes of delay in total, of which 3,382 minutes were due to reasons in the CRSTMP category. Translated to delay per flight, this is 0.43 minutes for all reasons and 0.04 for reasons in the CRSTMP category, well under the target.

Environment

Brussels Airport is located in a densely populated area and has to interact with the region surrounding the airport. A preferential runway system (PRS) is in place in Brussels Airport and defines the runways to use in predefined conditions, mainly related to weather. When these conditions are not met, another runway configuration can be used. Such deviations from the PRS were observed 31% of the time in 2023, which is more than the 25% in 2022. The main reasons for deviations were meteorological conditions and non-availability of the runways.

Another environmental objective is the KPI of Continuous Descent Operations (CDO). Since 2023, a CDO flag has been incorporated to optimize the set of flights relevant to CDO monitoring. The update is done for all years to improve the transparency and fairness in the historical comparison of CDO performance. Of all arrivals that are capable of performing a CDO in ideal conditions, 65% did so below flight level 100, and 80% did so below flight level 60. These figures show a positive increase in CDO operations compared to the previous year. In addition, a new KPI has been developed in 2023,

Furthermore, noise is a hot topic in the environmental discussion. To minimize the noise at night (between 23:00 and 06:00), the number of night slots is limited, in accordance with the airport's exploitation permit and regulation. Whereas the traffic during the day increased in 2023, the traffic at night was reduced by 2% (vs 2022) to a total of 16,574 movements. This is 96% of the night traffic in 2019. This development leads to less noise for local residents and was encouraged by new fees, which became effective in April 2023 and also take into account a day/night factor alongside other environmentally friendly incentives (such as higher fees for more aircraft noise and emission).



which monitors the average level-off time per CDO-relevant arrival in different altitude bands. As it does not classify an arrival in a binary way (CDO yes/no), it provides a more fine-grained view of the operations. In addition, skeyes is continuously trying to increase the number of CDOs flown, for example by promoting the use of PBN procedures.

SAMENVATTING

Dit verslag biedt een overzicht van de prestaties inzake luchtverkeersbeheer (ATM, Air Traffic Management) op Brussels Airport voor 2023. Die prestaties worden bepaald door vier prestatiekerngebieden (KPAs, Key Performance Areas): veiligheid, capaciteit, milieu en kostenefficiëntie. De eerste drie van die vier prestatiekerngebieden komen in dit verslag aan bod en hebben tot doel interessante inzichten te verschaffen over de activiteiten op Brussels Airport aan de stakeholders van skeyes en andere belangstellenden.



Verkeer

In 2023 totaliseerde Brussels Airport 192.267 bewegingen, goed voor een opmerkelijke stijging (+7%) in vergelijking met 2022; desondanks bereikte het verkeersvolume nog niet dat van vóór de pandemie, met 82% van het verkeer van 2019. Het aantal passagiers (+17% vs. 2022) nam sterker toe dan het aantal bewegingen, wat betekent dat het aantal passagiers per vlucht toenam. Die tendens illustreert een gezond, voortgezet herstel van de luchtvaartsector na de COVID-19-pandemie. Dat het aantal bewegingen in het vrachtverkeer licht en het onderhoud van het Instrument Landing Sysafnam, is in overeenstemming met de algemene tem (ILS). Dat ILS werd operationeel vanaf 20 juli. trend in Europa. Brussels Airport blijft evenwel een cruciale rol spelen voor het luchtvrachtvervoer, en versterkt ook zijn positie met een grote investering in de cargozone in 2023 en de daaropvolgende jaren.

Over het algemeen vertoonden de dagelijkse verkeerspatronen in 2023 gelijkaardige trends als in de voorgaande jaren, met een ochtendpiek omstreeks 10.00 uur en een avondpiek omstreeks 19.30/20.00

uur. De meest gebruikte start- en landingsbanen waren 25R en 25L, waarbij die laatste bijna uitsluitend werd gebruikt voor aankomsten. Tussen april en juni werden die start- en landingsbanen minder gebruikt, wat te verklaren was door de gebruikelijke windomstandigheden gedurende die maanden en door belangrijke renovatiewerken, waarbij scheuren in het betonoppervlak van baan 25L/07R hersteld werden. Bovendien was baan 19 door het jaar soms gesloten, als gevolg van de vernieuwing

In 2023 werd voor het eerst gebruik gemaakt van een CNS-drone (Communication, Navigation & Surveillance) (in testfase) om de prestaties van navigatiehulpmiddelen te monitoren. Die operaties droegen bij aan het totaal van 6.215 registraties van toegelaten drone-operaties in de nabijheid van Brussels Airport, goed voor een stijging met 24% ten opzichte van het voorgaande jaar.

Veiligheid

Veiligheid is een belangrijke pijler in de luchtverkeersleiding. In dat verband volgt de safety unit van skeves veiligheidsvoorvallen en afgebroken naderingen op om situaties te analyseren, trends in kaart te brengen en, zo nodig, grondig onderzoek te verrichten.

Het aantal afgebroken naderingen (een procedure die wordt gebruikt wanneer de nadering niet kan worden voortgezet met het oog op een veilige landing), en in het bijzonder de oorzaak ervan, kunnen aangeven welke maatregelen moeten worden genomen om de luchtvaartnavigatiedienstverlening veiliger te maken. In 2023 werden 279 afgebroken naderingen geregistreerd, goed voor een stijging met 26% ten opzichte van 2022. Het aantal afgebroken naderingen per 1.000 aankomsten nam toe met 16%. De meest voorkomende oorzaken voor een onafgebroken nadering in 2023 waren onstabiele naderingen, het te kort volgen op het

voorgaande vliegtuig, andere oorzaken of nog de weersomstandigheden. skeyes promoot het toegenomen gebruik van PBN-procedures (Performance Based Navigation), waardoor de voorspelbaarheid aanzienlijk verbetert, evenals het situationeel bewustzijn.

Wat de veiligheidsvoorvallen betreft, namen de gerapporteerde voorvallen op de start- en landings- en taxibanen toe ten opzichte van 2022. Er deden zich in het bijzonder twaalf runway incursions voor waarvan alle zonder ATM-bijdrage. Terwijl in voorgaande jaren het aantal afwijkingen van ATM-procedure en verkeersleidingsklaringen steeg, trad een kentering op in 2023, hetgeen pleit voor een geslaagde implementatie van de mitigerende maatregelen door middel van bijgewerkte pushback-procedures.

Capaciteit en stiptheid

Voor Brussels Airport heeft skeyes een opgegeven capaciteit gedefinieerd voor de meeste van de gebruikte baanconfiguraties. Die opgegeven capaciteit wordt berekend op basis van de plattegrond van de luchthaven, het verkeer op Brussels Airport en bepaalde veronderstellingen. Ze voorziet dus in een theoretische waarde van het maximumaantal bewegingen dat het vliegveld in een uur tijd kan verwerken onder optimale omstandigheden voor de in gebruik zijnde baanconfiguratie. De opgegeven capaciteit voor Brussels Airport bedraagt maximaal 75 bewegingen per uur (voor baanconfiguratie 25R - 25L,25R). In de praktijk werd deze bovengrens in 2023 nooit overschreden. De lagere opgegeven capaciteit voor andere baanconfiguraties werd op twaalf dagen overschreden met ten hoogste acht bewegingen. Brussels Airport is een gecoördineerde luchthaven in België en de opgegeven capaciteit voor slotcoördinatie gedurende de dag is maximaal 74 totale bewegingen per uur.

Sinds 2015 geldt voor skeyes een jaardoelstelling inzake Air Traffic Flow Management-vertraging (ATFM) bij aankomst. Dat is de vertraging die een vlucht oploopt door een regulering die toe te schrijven is aan de eindnaderings- en luchtvaartnavigatiediensten op de luchthaven van bestemming. In 2023 werd enkel Brussels Airport beschouwd als een bijdragende luchthaven en werd de doelstelling vastgelegd op 1,08 minuten per vlucht en 0,12 minuten per vlucht voor vertraging te wijten aan redenen uit de CRSTMP-categorie. In 2023 veroorzaakte de torenverkeersleiding van Brussels Airport in totaal 40.391 minuten vertraging, waarvan 3.382 minuten door redenen uit de CRSTMP-categorie. Omgerekend naar de vertraging per vlucht bedraagt ze 0,43 minuten voor alle redenen en 0,02 minuten voor redenen uit de CRSTMP-categorie, ruim onder de doelstelling.

Milieu

Brussels Airport ligt in een dichtbevolkt gebied en moet in interactie gaan met zijn omgeving. Op Brussels Airport geldt een systeem van preferentieel baangebruik (Preferential Runway System of PRS) dat bepaalt welke banen moeten worden gebruikt onder vooraf bepaalde voorwaarden, voornamelijk gerelateerd aan de weersomstandigheden. Wanneer niet aan die voorwaarden wordt voldaan, kan een andere baanconfiguratie worden gebruikt. Dergelijke afwijkingen van het PRS werden voor 31% van de tijd waargenomen in 2023, meer dan de 25% van 2022. De belangrijkste redenen voor de afwijkingen waren de weersomstandigheden en de onbeschikbaarheid van de start- en landingsbanen.

Een andere milieudoelstelling is de KPI van de Continuous Descent Operations (CDO). Sinds 2023 wordt een CDO-indicator opgenomen om de reeks vluchten die in aanmerking komen voor CDO-monitoring te optimaliseren; de update wordt voor alle jaren uitgevoerd om de historische vergelijking van de prestaties inzake CDO transparanter en billijker te maken. Van alle aankomende vluchten die in ideale omstandigheden een CDO kunnen uitvoeren, deed 65% dat onder vliegniveau 100 en 80% onder vliegniveau 60. Die cijfers vertonen een positieve groei in CDO ten opzichte van het voorgaande jaar. Daarnaast werd in 2023 een nieuwe KPI ontwik-



keld: hij monitort de gemiddelde horizontale vliegtijd per aankomende vlucht die in aanmerking komt voor CDO in verschillende hoogtebanden. Vermits een aankomende vlucht dan niet op een binaire manier (CDO ja/neen) wordt geclassificeerd, voorziet die KPI in een nauwkeuriger beeld van de operaties. Verder tracht skeyes het aantal gevlogen CDO voortdurend op te krikken door het gebruik van PBN-procedures te bevorderen.

In de milieudiscussie is geluidshinder tevens een belangrijk thema. Om het lawaai 's nachts (tussen 23.00 en 06.00 uur) tot een minimum te herleiden, is het aantal nachtslots beperkt, in overeenstemming met de exploitatievergunning van de luchthaven en de reglementering. Terwijl het verkeer overdag in 2023 toenam, liep het nachtverkeer met 2% terug (vs. 2022), goed voor een totaal van 16.574 bewegingen of 96% van het nachtverkeer in 2019. Die evolutie leidde tot minder geluidsoverlast voor de lokale omwonenden en werd in de hand gewerkt door nieuwe heffingen, die in april 2023 van kracht werden en ook rekening houden met een dag-/nachtfactor, naast andere milieuvriendelijke stimulansen (zoals hogere heffingen voor meer geluidshinder en hogere uitstoot).

SYNOPSIS

Ce rapport donne un récapitulatif des performances de la gestion du trafic aérien (Air Traffic Management (ATM) Performance) à Brussels Airport pour 2023. Les performances ATM reposent sur quatre domaines de performance clés (KPA, KeyPerformanceAreas):lasécurité,lacapacité,l'environnement et l'efficacité économique. Les trois premiers de ces quatre KPA sont traités dans le présent rapport, afin de fournir aux stakeholders de skeyes, et à toute personne qui partage ses intérêts, des informations intéressantes sur les opérations à Brussels Airport.



Trafic

En 2023, Brussels Airport a enregistré un total de servant presque exclusivement pour les arrivées. 192.267 mouvements, ce qui représente une augmentation notable par rapport à l'année précédente (+7% de plus qu'en 2022), mais n'atteint pas encore les chiffres d'avant la pandémie, le trafic se situant à 82% de 2019. L'augmentation du nombre de passagers (+17% de plus qu'en 2022) a été supérieure à celle des mouvements, ce qui signifie que le nombre de passagers par vol a augmenté - ce qui témoigne d'une reprise saine et continue du secteur de l'aviation après la pandémie de COV-ID-19. La légère baisse des mouvements de fret L'utilisation d'un drone de Communication, Naviest conforme à la tendance générale en Europe et Brussels Airport continue à jouer un rôle crucial pour le transport aérien de fret, renforçant également sa position avec un investissement majeur dans la zone cargo en 2023 et les années suivantes. Dans l'ensemble, les tendances du trafic quotidiennes sont en 2023 similaires à celles des années antérieures, avec a un pic le matin aux environs de 10h00 et un pic le soir à 19h30/20h00. Les pistes les plus utilisées sont les 25R et 25L, cette dernière

Entre avril et juin, l'utilisation de ces pistes a été plus faible, à cause des conditions de vent habituelles au cours de ces mois ainsi que d'importants travaux de rénovation visant à éliminer les fissures dans le béton de la piste 25L/07R. De plus, en raison de la rénovation et de la maintenance de l'Instrument Landing System (ILS), qui a été mis en service le 20 juillet, la piste 19 a parfois été fermée tout au long de l'année.

gation, Surveillance (CNS) a été introduite (dans sa phase d'essai) en 2023 pour contrôler la performance des aides à la navigation. Ces opérations ont permis d'enregistrer un total de 6.215 opérations de drones autorisées à proximité de Brussels Airport, ce qui représente une augmentation de 24% par rapport à l'année précédente.

Sécurité

La sécurité est un pilier important du contrôle aérien. C'est pourquoi les événements de sécurité et les approches interrompues font l'objet d'un suivi par la Safety Unit de skeyes pour analyser les situations, identifier les tendances, et – lorsque c'est nécessaire - mener une enquête approfondie.

Le nombre d'approches interrompues (une procédure utilisée lorsque l'approche ne peut être poursuivie pour effectuer un atterrissage en toute sécurité) et en particulier leur cause, peuvent indiquer les mesures à prendre pour améliorer la sécurité de la fourniture des services de navigation aérienne. En 2023, 279 approches interrompues ont été enregistrées, soit une augmentation de 26% par rapport à 2022. Le taux d'approches interrompues pour 1000 arrivées a augmenté de 16%. Des approches instables, une trop grande proximité avec le trafic précédent, d'autres raisons, ou les conditions météorologiques sont les raisons les plus fréquentes d'une approche interrompue

uationnelle.

en 2023. skeyes encourage l'utilisation accrue des procédures PBN (Performance Based Navigation). Ce type d'approche améliore grandement la prévisibilité et par conséquent aussi la conscience sit-

En ce qui concerne les événements liés à la sécurité, les événements signalés, survenus sur les pistes et les taxiways, ont augmenté si on compare 2023 à 2022. En particulier, il y a eu douze incursions de piste, qui ne sont pas imputables à l'ATM. Alors que les années précédentes, le nombre de dérogations aux procédures ATM et aux clearances de contrôle de la circulation aérienne a augmenté, ces chiffres ont diminué en 2023, ce qui témoigne de la réussite de la mise en œuvre des mesures d'atténuation grâce aux procédures de push-back actualisées qui ont été mises en place.

Capacité et ponctualité

Pour Brussels Airport, skeves a défini une capacité déclarée pour la plupart des configurations de pistes utilisées. Cette capacité déclarée est calculée sur base de la configuration de l'aéroport Management) à l'arrivée, c'est-à-dire le retard d'un et du trafic à Brussels Airport, et de certaines hypothèses. Elle fournit donc une valeur théorique du nombre maximum de mouvements que l'aérodrome peut traiter en une heure dans des conditions optimales pour la configuration de piste utilisée. Au maximum, la capacité déclarée pour Brussels Airport est de 75 mouvements/heure (pour la configuration de piste 25R - 25L, 25R). En pratique, cette limite maximale n'a jamais été dépassée en 2023. Les capacités déclarées inférieures pour d'autres configurations de pistes ont été dépassées pendant douze jours par un maximum de huit mouvements. Brussels Airport est un aéroport coordonné en Belgique et la capacité déclarée pour la coordination des slots pendant la journée est de

maximum 74 mouvements totaux par heure. Depuis 2015, skeyes est soumise à un objectif annuel concernant le retard ATFM (Air Traffic Flow vol causé par une régulation imputable aux services terminaux et de navigation aérienne de l'aéroport de destination. En 2023, seul Bruxelles est considéré comme un aéroport contributeur et l'objectif est fixé à 1,08 minute par vol et 0,12 minute par vol pour les retards dus à des raisons relevant de la catégorie CRSTMP. En 2023, la tour de Bruxelles a causé 40.391 minutes de retard au total, dont 3.382 minutes pour des raisons relevant de la catégorie CRSTMP. Converti en retard par vol, ce chiffre est de 0,43 minute pour toutes les raisons et de 0,04 minute pour les raisons relevant de la catégorie CRSTMP, ce qui est bien en decà de l'objectif.

Environnement

Brussels Airport est situé dans une zone densément peuplée et doit interagir avec la région qui l'entoure. Brussels Airport a mis en place un système de pistes préférentielles (PRS, Preferential Runway System) qui définit les pistes à utiliser dans des conditions prédéfinies, essentiellement liées aux conditions météorologiques. Lorsque ces conditions ne sont pas réunies, une autre configuration de piste peut être utilisée. De telles dérogations par rapport au PRS ont été observées pour 31% du temps en 2023, soit plus que les 25% de 2022. Les principales raisons de ces dérogations sont les conditions météorologiques et la non-disponibilité des pistes.

Un autre objectif environnemental est le KPI des Continuous Descent Operations (CDO ou opérations en descente continue). Depuis 2023, un indicateur CDO a été intégré pour optimiser l'ensemble des vols pertinents pour le monitoring des CDO. La mise à jour est effectuée pour toutes les années afin d'améliorer la transparence et l'équité dans la comparaison historique des performances CDO. Sur l'ensemble des arrivées capables d'effectuer une CDO dans des conditions idéales, 65% l'ont fait en dessous du niveau de vol 100, et 80% en dessous du niveau de vol 60. Ces chiffres montrent une augmentation positive des CDO par rapport à



l'année précédente. En outre, un nouveau KPI a été développé en 2023, qui contrôle le temps moyen de mise en palier par arrivée pertinente pour la CDO dans différentes bandes d'altitude. Comme il ne classe pas une arrivée de manière binaire (CDO oui/non), il fournit une vue affinée des opérations. En outre, skeyes s'efforce continuellement d'augmenter le nombre de CDO effectuées, par exemple en encourageant l'usage de procédures PBN (Performance Based Navigation).

En outre, le bruit est un sujet brûlant dans le débat sur l'environnement. Afin de minimiser le bruit la nuit (entre 23h00 et 06h00), le nombre de slots de nuit est limité, conformément au permis d'exploitation de l'aéroport et à la réglementation. Alors que le trafic de jour a augmenté en 2023, le trafic de nuit a été réduit de 2% (par rapport à 2022) pour atteindre un total de 16.574 mouvements. Cela représente 96% du trafic nocturne en 2019. Cette évolution entraîne moins de bruit pour les résidents locaux et a été encouragée par de nouvelles redevances, qui sont entrées en vigueur en avril 2023 et qui prennent également en compte un facteur jour/nuit, parallèlement à d'autres incitations respectueuses de l'environnement (telles que des redevances plus élevées pour les aéronefs qui font plus de bruit et qui produisent plus d'émissions).



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GLOSSARY

AAE	 Above Aerodrome Elevation	I FL -	— Flight Level
AD	 Aerodrome	FMP -	 Flow Management Position
AIP	 Aeronautical Information Publication	ft –	— Feet
AMC	 Acceptable Means of Compliance	GeoZones –	— Unmanned Aircraft System geogr
AMS	 Airport Movement System	IATA –	 International Air Transport Associa
ANSP	 Air Navigation Service Provider	ICAO -	 International Civil Aviation Organiz
ARR	 Arrival	IFR -	 Instrument Flight Rules
ATC	 Air Traffic Control	ILS –	 Instrument Landing System
ΑΤCΟ	 Air Traffic Control Officer	ISGS –	 Increased Second Glide Slope
ATFM	 Air Traffic Flow Management	KPA –	— Key Performance Area
ATIS	 Automatic Terminal Information Service	KPI –	 Key Performance Indicator
ΑΤΜ	 Air Traffic Management	LIDAR -	 Light Detection And Ranging
BATC	 Brussels Airport Traffic Control	LT –	— Local Time
BCAA	 Belgian Civil Aviation Authority	LVO –	 Low Visibility Operations
BSC	 Belgium Slot Coordination	LRST –	— Local Runway Safety Team
BURDI	 Belgium-Netherlands U-space Reference Design Implementation	MCT –	— Maximum Capacity Throughput
CAA	 Civil Aviation Authority	NM -	— Nautical Mile
CANSO	 Civil Air Navigation Services Organisation	PANS -	 Procedures for Air Navigation Serv
cco	 Continuous Climb Operations	PBN -	 Performance Based Navigation
CDO	 Continuous Descent Operation	PRS –	 Preferential Runway System
CEM	 Collaborative environmental management	PRU -	 Performance Review Unit
CISP	 Common Information Service Provider	RAT -	— Risk Analysis Tool
COVID-19	 Corona Virus Disease (2019)	RI –	 Runway Incursion
CNS	 Communication, Navigation, Surveillance	RMZ –	 Radio Mandatory Zone
CRSTMP	 C-Capacity, R-Routing, S-Staffing, T- Equipment, M- Airspace	RNAV –	 Area Navigation
	Management, P-Special Event	RNP -	 Required Navigational Performant
CSMU	 Corporate Safety Management Unit	ROTA –	 Runway Occupancy Time for Arriv
СТОТ	 Calculated Take-Off Time	RP3 –	 Reference period 3
CTR	 Control Zone of an Airport	RPAS –	 Remotely Piloted Aircraft System
DEP	 Departure	RWY -	— Runway
DSA	 Drone Service Application	SRO –	 Simultaneous Runway Occupancy
EASA	 European Aviation Safety Agency	TMZ –	 Transponder Mandatory Zone
EBAW	 Antwerp Airport ICAO Code	TWY -	— Taxiway
EBBR	 Brussels Airport ICAO Code	UAS –	 Unmanned Aircraft System
EBCI	 Charleroi Airport ICAO Code	USSP –	 U-Space Service Provider
EBKT	 Kortrijk-Wevelgem Airport Code	UTC –	 Universal Time Coordinated
EBLG	 Liege Airport ICAO Code	VFR -	 Visual Flight Rules
EBOS	 Ostend Airport ICAO Code	VHF -	 Very High Frequency
ETOT	 Estimated Take-Off Time	VLL –	 Very low level zones
EU	 European Union	VOR –	 VHF Omnidirectional Range
FABEC	 Functional Airspace Block Europe Central		

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This chapter presents the traffic data of Brussels Airport (International Civil Aviation Organization (ICAO) code: EBBR) as recorded by the Airport Movement System (AMS). This AMS is an in-house developed tower Air Traffic Control (ATC) system and meticulously records aircraft movements within the aerodrome and its Control Zone (CTR). Movements are categorized into movements of aircrafts either crossing the CTR, landing or taking off at the aerodrome. As this report considers runway performance, movements such as crossings of CTRs are not considered.

The numerical data presented in this report thus encapsulates movements in the form of take-offs or landings, encompassing all kind of traffic at the aerodrome, including flights under Visual Flight Rules (VFR) and Instrumental Flight Rules (IFR), helicopters and airplanes, and traffic of any market segment (e.g. commercial, military, or general aviation).

Adhering to the aerodrome movement definition established by the Belgian Civil Aviation Authority (BCAA), each recorded instance is quantified as follows:

- one take-off = one departure movement ٠
- one landing = one arrival movement
- arrival

one touch-and-go = two movements: one departure & one

Traffic Overview

YEARLY FIGURES

In 2023, Brussels Airport experienced a total of 192,267 movements, reflecting a notable increase from the preceding years (+7% compared to 2022). Nonetheless, the number of movements are not yet reaching the pre-pandemic figures of 2019, being at -18% compared to this year. In particular, the number of aircraft movements over the past five years has evolved as follows:

192,267	(189,408 IFR,	2,859 VFR)
178,930	(176,179 IFR,	2,751 VFR)
118,736	(116,072 IFR;	2,664 VFR)
95,813	(93,118 IFR;	2,695 VFR)
234,462	(231,275 IFR;	3,187 VFR)
	192,267 178,930 118,736 95,813 234,462	192,267(189,408 IFR,178,930(176,179 IFR,118,736(116,072 IFR;95,813(93,118 IFR;234,462(231,275 IFR;

The visualization of these numbers in Figure 1.1 shows the discernible drop in movements in 2020 due to the COVID-19 crisis and the ongoing recovery process in the years after. Despite an overall positive development in 2023, the airport's recovery is slower than anticipated (by a forecast of the network manager EUROCONTROL). This hampered development may, in part, be attributed to the socio-economic challenges faced in 2023, such as the consequences of wars, including high indexation rates and expensive fuel prices.

Of the 192,267 movements in 2023, only 1.49% (2,859 movements) stem from flights under visual flight rules (VFR). The high share of traffic under instrument flight rules (IFR, 189,408 movements) is a natural consequence of Brussels Airport's important role as Belgium's biggest commercial passenger airport as well as their non-negligible shares of cargo movements. According to the airport's own statistics, Brussels Airport welcomed 22,200,755 passengers in 2023, which is an increase of 17% compared to the previous year¹. This percentage is higher than the 7% increase in movements, meaning that the number of passenger per flight also increased - according to Brussels Airport to a new record of 141 passengers/flight. Whereas holiday flights and visits to family and friends almost fully recovered, business travel is a little below the pre-Covid year levels due to continued teleconferences, attempts of saving costs, and more environmental awareness. As a major Star Alliance hub in Europe, many passengers furthermore transit from one to another plane at Brussels Airport. Key figures published by the airport itself recorded 60 passenger airlines in 2023 with 185 passenger destinations².

According to the website of Brussels Airport, the mass of cargo transported through the airport in 2023 amounts to 701,000 tonnes and dropped by 10%, which is in line with the overall trend in Europe³. Although there was a decrease in 2022, the airport is expecting to continue to play a crucial role for air cargo transport and is strengthening its position with a major investment in the cargo zone. In 2023, the modernisation of the cargo zone buildings took a big leap forward: Old buildings have been teared down and the works for three new modern and innovative buildings with big cargo halls,

office spaces, parking lots, and also more greenery have started. This will increase the cargo warehouse area by 30% up to a total of 34,000 m². The project is to be finalized by 2025⁴ and will serve the cargo companies Nippon Express, Deny Cargo, Hazgo, EV Cargo, and DSV. In total, the Brucargo area will comprise 83,500 m² area at the heart of the cargo zone⁵.

Further infrastructure improvements are foreseen, strengthening Brussels' Airport interconnectivity even more: Works for a new eight-story parking building with 2,700 parking spaces have started in October 2023, making it more convenient for travellers to reach the airport. Furthermore, Flanders delivered a permit for a tram line from the city of Brussels to the airport, and there are plans from Dutch and Belgian train companies to increase the number of connections across the border, e.g. also between Amsterdam Schiphol and Brussels Airport. New boarding glass-sided aerobridges at Pier B, inaugurated on February 13th, further improve the operational efficiency⁶. A cycle bridge in Melsbroek, inaugurated on April 27th, connects the centre of Vilvoorde with Brucargo and makes the airport more accessible by bike.

Figure 1.1: Yearly traffic overview



^{1.} https://www.brusselsairport.be/en/pressroom/news/results-2023 (URL retrieved on 01/02/2024)

- 2. https://media.brusselsairport.be/bruweb/default/0001/37/9069fa3a6a417645776ca33c28305259529f59a2.pdf https://media.brusselsairport.be/bruweb/ default/0001/37/9069fa3a6a417645776ca33c28305259529f59a2.pdf (URL retrieved on 07/02/2024)
- 3. https://www.ecac-ceac.org/activities/unmanned-aircraft-systems/uas-bulletin/22-uas-bulletin/504-uas-bulletin-2-what-is-u-space (URL retrieved 16/02/2024)
- 4. https://www.made-in.be/vlaams-brabant/oudste-gebouwen-van-cargozone-brussels-airport-maken-plaats-voor-vernieuwing, (URL retrieved on 31/01/2024)
- 5. https://www.aviation24.be/airports/brussels-airport-bru/brucargo/five-key-partners-move-into-new-buildings-at-brucargo-brussels-airport-by-2025/ (URL retrieved on 31/01/2024)
- 6. https://www.aviation24.be/airports/brussels-airport-bru/brussels-airport-inaugurates-new-boarding-bridges-at-pier-b/ (URL retrieved on 01/02/2024)

176,179	189,408	
		IFR VFR
2,751 2022	2,859 VFR 2023	

MONTHLY FIGURES

Figure 1.2 provides information about the monthly evolution of traffic at Brussels Airport for the last five years. Table 1.1 further details these monthly figures per flight rule, whereas Table 1.2 provides a split of these movements into arrivals and departures.

ed in July with 18,576 total movements, which is flights to Israel might have had an impact⁷. Furnot unusual given that this includes the start of the summer holidays in Belgium, leading to a lot summer season - reducing the number of Ryaof holiday-related air travel. The highest number of monthly VFR movements was in May with 304 movements.

movements were observed in the first half of the year of 2023 (+13% from January to June, +3% from July to December). Pinpointing certain reasons for these fluctuations is difficult. The following paragraph gives some general information on changes of airline operators and destinations, possibly having an impact.

The highest amount of traffic in 2023 was record- Since October, for instance, the cancellation of thermore, Ryanair did not reopen its base in the nair's destinations from Brussels Airport from 16 to 12⁸. On the other hand, TUI fly Belgium decided to move its Charleroi flights to Brussels Airport during the winter season of 2023-20249. Other new Compared to 2022, significantly more IFR and VFR connections include non-stop connections between Brussels and Shenzhen in China by Hainan Airlines¹⁰, two new flights per day to New York by United Airlines since the end of March 2023¹¹, and three weekly flights by Royal Jordanian between Amman and Brussels¹².

Table 1.1: Monthly movements per flight rule per year

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ОСТ	NOV	DEC	Total
	2019	16,975	15,259	17,857	19,478	20,759	20,656	22,304	21,414	21,210	20,330	17,829	17,204	231,275
	2020	16,675	16,307	10,729	2,171	2,631	3,689	7,984	8,252	6,866	6,599	5,119	6,096	93,118
	2021	5,499	4,464	4,926	5,598	6,788	9,241	13,406	13,927	13,646	13,473	12,649	12,455	116,072
ЦЦ	2022	10,435	9,712	12,783	14,635	16,196	15,871	17,926	17,655	17,111	16,571	13,807	13,477	176,179
	2023	12,919	12,417	14,533	15,719	17,291	17,227	18,317	17,852	17,248	17,049	14,576	14,260	189,408
	2023 <i>vs</i> 2019	-24%	-19%	-19%	-19%	-17%	-17%	-18%	-17%	-19%	-16%	-18%	-17%	-18%
	2023 vs 2022	+24%	+28%	+14%	+7%	+7%	+9%	+2%	+1%	+1%	+3%	+6%	+6%	+8%
	2019	256	259	269	232	296	239	295	215	323	292	235	276	3,187
	2020	210	231	165	188	228	268	217	222	275	302	179	210	2,695
	2021	181	169	251	281	234	302	225	172	307	268	145	129	2,664
VFR	2022	150	218	346	201	232	239	278	227	266	248	180	166	2,751
	2023	221	247	240	239	304	279	259	217	226	264	207	156	2,859
	2023 <i>vs</i> 2019	-14%	-5%	-11%	+3%	+3%	+17%	-12%	+1%	-30%	-10%	-12%	-43%	-10%
	2023 vs 2022	+47%	+13%	-31%	+19%	+31%	+17%	-7%	-4%	-15%	+6%	+15%	-6%	+4%
	2019	17,231	15,518	18,126	19,710	21,055	20,895	22,599	21,629	21,533	20,622	18,064	17,480	234,462
	2020	16,885	16,538	10,894	2,359	2,859	3,957	8,201	8,474	7,141	6,901	5,298	6,306	95,813
	2021	5,680	4,633	5,177	5,879	7,022	9,543	13,631	14,099	13,953	13,741	12,794	12,584	118,736
Total	2022	10,585	9,930	13,129	14,836	16,428	16,110	18,204	17,882	17,377	16,819	13,987	13,643	178,930
	2023	13,140	12,664	14,773	15,958	17,595	17,506	18,576	18,069	17,474	17,313	14,783	14,416	192,267
	2023 vs 2019	-24%	-18%	-18%	-19%	-16%	-16%	-18%	-16%	-19%	-16%	-18%	-18%	-18%
	2023 vs 2022	+24%	+28%	+13%	+8%	+7%	+9%	+2%	+1%	+1%	+3%	+6%	+6%	+7%

Table 1.2: Monthly arrival and departure movements per year

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	NOV	DEC	Total
	2019	8,607	7,760	9,062	9,862	10,522	10,461	11,291	10,817	10,764	10,304	9,044	8,739	117,233
	2020	8,435	8,277	5,465	1,176	1,428	1,979	4,097	4,240	3,568	3,443	2,652	3,154	47,914
s	2021	2,838	2,311	2,597	2,932	3,515	4,766	6,807	7,059	6,973	6,866	6,404	6,289	59,357
riva	2022	5,298	4,958	6,564	7,414	8,221	8,054	9,099	8,940	8,687	8,411	6,996	6,821	89,463
Ā	2023	6,573	6,331	7,380	7,980	8,808	8,742	9,295	9,031	8,740	8,661	7,381	7,221	96,143
	2023 <i>v</i> s 2019	-24%	-18%	-19%	-19%	-16%	-16%	-18%	-17%	-19%	-16%	-18%	-17%	-18%
	2023 vs 2022	+24%	+28%	+12%	+8%	+7%	+9%	+2%	+1%	+1%	+3%	+6%	+6%	+7%
	2019	8,624	7,758	9,064	9,848	10,533	10,434	11,308	10,812	10,769	10,318	9,020	8,741	117,229
	2020	8,450	8,261	5,429	1,183	1,431	1,978	4,104	4,234	3,573	3,458	2,646	3,152	47,899
Ires	2021	2,842	2,322	2,580	2,947	3,507	4,777	6,824	7,040	6,980	6,875	6,390	6,295	59,379
artu	2022	5,287	4,972	6,565	7,422	8,207	8,056	9,105	8,942	8,690	8,408	6,991	6,822	89,467
Dep	2023	6,567	6,333	7,393	7,978	8,787	8,764	9,281	9,038	8,734	8,652	7,402	7,195	96,124
	2023 vs 2019	-24%	-18%	-18%	-19%	-17%	-16%	-18%	-16%	-19%	-16%	-18%	-18%	-18%
	2023 vs 2022	+24%	+27%	+13%	+7%	+7%	+9%	+2%	+1%	+1%	+3%	+6%	+5%	+7%

Figure 1.2: Monthly movements per year



- 7. https://www.brusselsairport.be/en/pressroom/news/results-2023 (URL retrieved on 07/02/2024)
- 8. https://www.aviation24.be/airlines/ryanair/no-reopening-of-ryanairs-brussels-base-fifty-nine-jobs-at-stake/ (URL retrieved on 07/02/2024)
- 9. https://www.aviation24.be/airlines/tui-aviation/tui-fly-belgium/tui-fly-belgium-to-move-its-charleroi-flights-to-brussels-airport-in-winter 2023-2024-and-later/ (URL retrieved on 07/02/2024)
- 10. https://www.luchtvaartnieuws.nl/nieuws/categorie/2/airlines/hainan-airlines-vliegt-weer-tussen-brussels-airport-en-shenzhen (URL retrieved on 07/02/2024)
- 11. https://www.hln.be/reizen/united-airlines-vliegt-twee-keer-per-dag-tussen-new-york-en-brussel-vanaf-eind-maart~adbcf75c/ (URL retrieved on 07/02/2024)
- 12. https://www.luchtvaartnieuws.nl/nieuws/categorie/2/airlines/eerste-vlucht-royal-jordanian-op-brussels-airport-feestelijk-onthaald (URL retrieved on 07/02/2024)

Mon		421	408	396	419	386	445	425	457	469	454	439	501	500	536	498	517	549	543	559	586	590	556	569	569	603	591	573
Tue		455	434	435	403	431	417	479	458	465	442	469	472	512	568	526	570	574	556	582	606	598	588	581	574	620	595	596
Wed		435	444	441	430	448	458	476	478	479	445	469	492	533	583	552	574	593	577	581	604	609	596	584	607	628	654	642
Thu		469	458	476	474	485	515	504	490	511	503	528	523	563	539	549	595	587	606	607	581	607	613	592	630	606	670	615
Fri		475	466	489	457	458	503	468	523	520	498	527	534	542	537	563	587	598	582	589	555	592	590	585	612	598	679	633
Sat		379	330	341	330	334	340	379	389	386	384	369	383	436	436	439	475	470	469	485	483	515	499	495	495	499	537	531
Sun	358	458	420	416	406	432	431	471	467	458	431	452	454	493	486	491	501	536	517	555	560	561	532	530	564	542	576	591
		Jani	Jarv			Fe	brua	rv			Mar	ch			Δ	pril				May				1.1	ne			

607	620	590	602	570	556	570	567	579	597	574	597	584	557	558	553	473	525	501	480	492	487	497	469	334
591	637	599	601	586	576		598	565	589	598	570	583	579	540	553	480	505	482	493	513	467	476	467	435
635	656	638	608	615	596	618	641	624	620	640	620	614	612	613	619	487	529	546	519	525	528	534	507	473
624	626	614	584	593	588	578	602	608	608	615	633	619	610	588	616	491	530	519	527	480	543	536	527	494
639	629	627	615	609	593	623	626	615	610	614	619	613	550	566	614	543	538	539	525	542	529	560	542	494
524	543	550	521	515	526	540	509	510	494	486	502	493	479	459	477	448	383	383	386	359	371	373	407	388
574	576	581	566	569	575	576	556	561	569	566	563	556	546	527	519	511	471	451	461	448	454	449	373	353
July				Aug	ust			Sept	temb	er		(Octok	ber			Nove	mbe	r		De	cemb	ber	

Figure 1.3: Calendar view of movements per day in 2023

DAILY FIGURES

On average, Brussels Airport witnessed 527 movements per day in 2023.

The calendar view in Figure 1.3 shows the exact distribution of movements per day throughout the year. Hereby, the colour indicates the number of movements per day, revealing some interesting patterns: Saturdays, for instance, are generally less busy. The peak day, which was June 30th, the Friday before the summer holidays, clearly stands out in the visual with its 679 movements. And so does the IATA summer season, starting on the 26th of March 2023 and ending on the 28th of October 2023. For this season, more slots for recreational travel are typically foreseen. October 5th was a day of national strike, yet without skeyes participants and also no big impact on Brussels Airport. Therefore, no drop in traffic occurred. The terror attack in Brussels on the 16th of October led to safety precautions, as e.g. strengthening of access controls and an increased presence of police, but remained without operational impact.

Figure 1.4 further highlights the top ten days with the highest amount of traffic, as well as the ten days with the least traffic. The top ten busiest days are all in the period from June to September – a typical time for summer vacations and including the time of the Tomorrow Land Festival (21st to 30th of July in 2023), which is a major attraction near Brussels attended by over 400,000 people from all over the world. The winter season is a period of generally lower traffic.

Figure 1.4: Top ten and bottom ten days in traffic in 2023





HOURLY TRAFFIC PATTERNS

A look at the average hourly movements reveals how the traffic flows at Brussels airport change throughout the day.

Figure 1.5 provides this hourly distribution for the last five years. Although the traffic was heavily reduced in the years of 2020 and 2021, the general pattern throughout the day remains almost the same from year to year. The peak in the morning and the peak in the afternoon are always at the same time: At 10:00 and 19:30 - in 2023 with 43 movements/hour and 36 movements/hour respectively. In contrast to the previous years, the peak at 15:30 is more pronounced with 32 movements/hour in 2023. During the night hours, between 23:00 and 06:00, the number of movements is generally lower than during the day (see also Chapter 4).

Figure 1.5: Average hourly movements per year



Varying traffic patterns can be observed for different days of the week, which can be seen in Figure 1.6. From Monday morning to Saturday noon, the hourly traffic pattern follow roughly the same hourly distribution. The peak at 19:30 is a lot lower on Saturday (24 movements/hour) than any other day (38-41 movements/hour), likely because neither business trips nor recreational journeys tend to choose the middle of the weekend to travel. Also cargo operations are fewer on weekends. Except for an equally pronounced initial morning peak at 06:30, Sunday mornings witness less movements than any other day - possibly for the same reason of unpreferred travel times. The nights between Friday and Monday have less movements, which is mostly related to less cargo operations on the weekends.

Figure 1.6: Average hourly movements per day of the week in 2023





Runway Use

Brussels Airport has six runways (short: RWY):

RWY 25L & 07R

RWY 25R & 07L

RWY 19 & 01

The ICAO chart in Figure 1.7 shows how these runways are situated within the layout of Brussels Airport.

Figure 1.7: Aerodrome ground movement chart - ICAO AERODROME CHART - ICA ELEV: 175 FT BRUSSELS DVCR/DARE 114,60/CH 83K 8UB NS0 54 08,4 E004 32 17,1 BR 108.90 © AIM BELGIUM AMOT 003/202

The decision, which runways are being used for ar- Clearly, RWY 25R is the most frequently used runrivals and departures, depends on several factors, such as meteorological conditions, airport layout, movements occurred on this runway, which is agreement with the state, etc. (see Chapter 4 for slightly less than in previous years. RWY 25L is ala more elaborate discussion). One very influential factor is the wind direction and speed, which is why some of the following charts also show wind roses as a correlate underneath the runway usage. Figure 1.8 is an example of such a plot, showing which COVID-19, also mostly due to the works on RWY share of movements occurred on which runway per 25R/07L that year. year. Absolute numbers, also split into departure and arrival movements, can be seen in Figure 1.9.

way, mainly so for departures. In 2023, 54% of all most solely used for arrivals and saw 23% of the movements in 2023. The unusually high percentage of movements on RWY 19 in 2020 is, apart from the generally different situation due to the impact of

Figure 1.8: Runway usage per year in share of movements with yearly wind roses



Figure 1.9: Runway usage per year in number of movements per departure/arrival



A monthly overview of the runway usage is provided in **Figure 1.10**. It shows the share of movements per runway in percentages. In April, May, and June predominantly used runways 25R & 25L are less used compared to other months. The wind-roses underneath the bar chart reveal that unlike in the other months, this period was also struck by predominantly North-Easterly winds. It is a known phenomenon in Belgium that winds are typically blowing from the South-West, but that the period from April to June usually encounters predominant North-Easterly winds. Apart from the already mentioned usual North-East winds during April, May and June, there were also less severe North-East winds in January and March, but specially on February, that therefore generated a smaller impact and for which runway 01 was used up to a 10% in February. The strong correlation between the wind direction and the runway usage stems from the aeronautical principle that flights should depart and land with head wind. A larger view on the wind roses can also be found in Chapter 4

Another important factors influencing the choice of runway is the unavailability of runways due to works. In 2023, unexpected cracks in the concrete of RWY 25L/07R led to emergency repairs in June and November, which required to close the runway for several days. This may explain the unusually high usage of RWY 19 in these months. Furthermore, RWY 19 itself was sometimes closed due to the renewal of the Instrument Landing System (ILS), which became operational as of the 20th of July, and some maintenance in December.



Figure 1.10: Runway usage per month in 2023 in share of movements



Drone Activities

The emerging activities of unmanned aircraft systems (UAS) and the variety of their operations is one of the challenges driving the future of Air Navigation Service Providers (ANSP). To enable a reliable and efficient UAS integration, a framework is designed at European Union level: U-space. U-space is a set of specific services and procedures designed to ensure safe and efficient access to airspace for a large number of drones. Implementing U-space airspace requires states to define and designate U-space airspaces with mandatory service provision. For the provision of these mandatory services, the deployment of U-space will entail the integration of two new service providers into the system: the common information service provider (CISP) and the U-space service provider (USSP). The CISP will be in charge of making the common information required available, to enable the operation and provision of U-space services in U-space airspaces wherever it has been designated.13

skeyes is playing a central role in the development of the U-space as manager of UAS geographical zones in Belgium and by actively participating in the BURDI Project. The BURDI project which stands for Belgium-Netherlands U-space Reference Design Implementation, is dedicated to implementing a U-space airspace concept to ensure a reliable and efficient UAS integration.¹⁴ Additionally, since 2023, skeyes has been working on obtaining the certification to become the CISP in Belgium.

The controlled airspace above and around an airport is a UAS geographical zones, also called "GeoZone". UAS geographical zone are zones that are only accessible to drones complying with technical and operational criteria called access conditions, and that can have restrictions with regard to the use of drones. skeyes is the GeoZone manager for controlled airspace above and around the airports of Antwerp, Brussels, Charleroi, Liege, Ostend and the Radio Mandatory Zone of Kortrijk.¹⁵¹⁶

skeydrone, created in 2020 as subsidiary of skeyes, envisages to play a central role in the implementation of U-space as USSP by offering a wide variety of services that enable safe and efficient drone operations in all types of airspace. This is how in 2022, skeydrone, in collaboration with the local development company, facilitated the implementation of the first marine GeoZone at an offshore test platform in the North Sea. Following that success, a project, implicating skeydrone, the port of Ostend and other European partners, was launched. Its aim is to develop offshore logistics solutions to support the transition from fossil fuels to renewable energy sources in the North Sea. In this context, skeydrone's contributions include implementing U-space drone corridors between land and offshore renewable energy platforms and managing offshore drone traffic as a USSP.17

One of the other services proposed by skeydrone is a web application: the Drone Service Application (DSA) to facilitate planning, coordination and information flow between drone operators and Air Traffic Control, especially in controlled airspace. The figures in this report related to UAS are provided by the DSA tool.

Table 1.3 displays the number of drone activities and the level of risk involved in the operations per airport. These categories are defined by the risk the drone activity forms for manned aviation in very low level (VLL) zones. For all airports where a control zone exists, these are defined as:



Table 1.3: Authorized drone activities in 2023 per VLL zone risk level

	Low	Moderate	High	Total
2021	3,759	71	54	3,884
2022	4,700	315	17	5,032
2023	5,823	353	39	6,215
2023 vs 2021	+55%	+397%	-28%	+60%
2023 <i>vs</i> 2022	+24%	+12%	+129%	+24%

13. https://www.ecac-ceac.org/activities/unmanned-aircraft-systems/uas-bulletin/22-uas-bulletin/504-uas-bulletin-2-what-is-u-space (URL retrieved 16/02/2024)

- 14. https://www.sesarju.eu/projects/BURDI (URL retrieved 16/02/2024)
- 15. UAS geographical zone statuses can be seen at https://map.droneguide.be (URL retrieved on 21/04/2022)
- 16. skeyes, "skeyes drone service application, https://www.skeyes.be/en/services/drone-home-page/you-and-your-drone/drone-service-application/ (URL retrieved on 21/04/2022)
- 17. https://www.unmannedairspace.info/uncategorized/west-flanders-drone-ecosystem-expands-with-skydrone-support/ (URL retrieved 21/02/2024)

departure/approach track, visual circuits and rest of the control zone above 400 ft above aerodrome elevation (AAE),

on the edge of the control zone below 400 ft AAE, outside

As per European Union Aviation Safety Agency (EASA) definition¹⁸, activities can furthermore be categorized into a different risk classification scheme that considers the complexity of the operation. The following three classes exist:

OPEN	Presents low risk to third parties. An authorisation from the Civil Aviation Authority (CAA) is not required.
SPECIFIC ——	More complex operations or aspects of the operation fall outside the boundaries of the Open Category. Authorisation is required from the CAA.
FORMER CLASS 1	Very complex operations, presenting an equivalent risk to that of manned aviation.

Table 1.4 provides an overview of the complexity of research, thermography, air measurements, agoperations near Brussels Airport. In addition, Fig**ure 1.11** provides a detailed view of the authorized activities around Brussels Airport in 2023, displaying the reserved flying zones of all UAS. One can identify three main hotspots of attention, which are the city centres of Brussels, Leuven, and Mechelen. Especially parks and famous landmarks (like the Atomium) seem to attract a lot of drone users.

The missions of the activities are oftentimes related to photo- and videography, recreational purposes and training, but also serve security reasons of drones was May with more than 700 operations. (e.g. crowd or road traffic management), scientific

ricultural and mapping purposes, or maintenance and inspection missions (e.g. of power lines, solar panels, wind turbines, air quality), etc. On the map (Figure 1.11) the powerline inspections are well recognizable: As the area one can reserve is limited, the inspectors design their drone airspace as a very narrow tunnel around the powerlines.

Per day in 2023, there were maximally 51 authorized operations, once so on the 21st of April and once on the 11th of August. The busiest month in terms

Figure 1.11: Reserved airspaces of authorized drone activities near Brussels Airport in 2023



Brussels Airport wants to support the multitude of use cases of drones. Therefore, it invests in DronePort, an initiative of several investors wanting to stimulate research and innovation and development in the market of drones and Advanced Air em Mobility, which creates a unique eco-system on a repurposed former military airfield ¹⁹.

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Also skeyes is using drones around the airport: A so-called Communication, Navigation, Surveillance (CNS) drone was introduced in 2023, initially in a testing phase, to monitor the performance of navigation aids. The use of this drone will lead to better

Table 1.4: Authorized drone activities in 2023 per EASA risk category

	Open	Specific	Former Class 1	Total
2021	2,678	1,087	119	3,884
2022	3,404	1,628	0	5,032
2023	4,722	1,493	0	6,215
2023 vs 2021	+76%	+37%	-100%	+60%
2023 vs 2022	+39%	-8%	-	+24%

.edures, providing more accurate cking up signals from the air, which onitored and ver from the ground o helps to reduce orded missions regarding the maintenance of ILS and VHF Omnidi-

rectional Range (VOR) systems.

^{18.} EASA, "Drones - regulatory framework background". https://www.easa.europa.eu/domains/civil-drones/drones-regulatory-framework-background (URL retrieved on 21/04/2022)

^{19.} https://www.aviation24.be/airports/brussels-airport-bru/brussels-airport-focuses-further-on-drone-innovation-and-plans-investment-in-droneport/ (URL retrieved on 01/02/2024)



SAFETY

This chapter is divided into four topics: missed approaches, runway incursions, other noteworthy incidents and improvements and recommendations.

The missed approaches covered in this chapter are based on internal logging. As such, the quality and accuracy of the available information is commensurate with the level of reporting. These logs of missed approaches are not considered as safety occurrences. They are an operational solution allowing to maintain safety margins when the approach cannot be continued for a safe landing. At the same time, particularly during peak hours at busy airports, they also increase the traffic complexity and the residual safety risk. It could be argued that missed approaches are a hybrid leading indicator, and that by analysing the reasons leading to this type of procedure, it is possible to examine if there are any systemic deficiencies in a technical equipment, in a procedure or in manner in which Air Traffic Control Officers (ATCOs) and/or pilots apply these procedures.



The runway incursions are a lagging runway safety indicator. The runway incursions and occurrences discussed in other noteworthy incidents are safety occurrences. These are subject to a risk classification using the Risk Analysis Tool (RAT) methodology to assess the contribution that skeves had in the chain of events (in accordance with EU Reg 376/2014 and EU Reg 2019/317). Within this chapter, the severity classification is derived from the calculated RAT risk for the safety occurrences. The following definitions apply for the severity classification (in accordance with EASA AMC).

Table 2.1: Severity classification

Severity Classification	Description
A – Serious incident	An incident involving circumstances indicating that an accident nearly occurred.
B – Major incident	An incident associated with the operation of an aircraft, in which the safety of the aircraft may have been compromised, having led to a near collision between aircraft, with ground or obstacles (i.e. safety margins were not respected; in this case, not as a result of an ATC instruction).
C – Significant incident	An incident involving circumstances indicating that an accident, or a serious or major incident could have occurred if the risk had not been managed within the safety margins, or if another aircraft had been in the vicinity.
D – Not determined	Insufficient information was available to determine the severity, or inconclusive or conflicting evidence precluded such determination (RAT RF < 70 %).
E – No safety effect	An incident which has no safety effect.
N – No ATM ground contribution	No system, procedure or person involved in the provision of ATC services initiated or contributed to the incident.

Missed Approaches

Missed approaches are performed according to published procedures, under the instructions of the air traffic controller or they are initiated by the pilot when the approach cannot be continued for a safe landing. Besides the discomfort for passengers and crew, the missed approaches increase the air traffic management complexity. The number of missed approaches and particularly their cause can therefore indicate which measures are to be taken to improve the safety of air navigation service provision.

The number of missed approaches at Brussels Airport is closely monitored and followed up by skeyes' safety unit. Trends are analysed and, when relevant, investigated to identify root causes and to implement improvement measures.

In 2023, 279 missed approaches were logged at Brussels Airport, which is an increase of 26% compared to 2022. This increase is higher than the increase in number of arrivals in 2023 compared to 2022 (+7%).

For better comparability between the years, were also two missed approaches in 2023 leading to Figure 2.1 presents the rate of missed approaches per 1,000 arrivals for the last five years. Here, the number of arrivals is provided by the AMS under the BCAA's aerodrome movement definition. Note that rivals, it is not as high as the rate of 3.2 missed apthe rate is provided for each runway as well as all runways together ("Overall"). For runways like RWY 07R, which are less frequently used for arrivals, small variations on the number of missed approaches or the number of movements can create large fluctuations on the rate of missed approaches due to the small sample size (e.g. two missed approaches in 2020 leading to a rate of 14.7, whereas there

Figure 2.1: Rate of missed approaches per 1,000 arrivals per runway per year



Figure 2.2: Missed approaches per day during the last five years



a rate of 2.8). Overall, the rate of missed approaches increased by 17% in 2023 compared to the previous year. Yet, with 2.9 missed approaches per 1,000 arproaches per 1,000 arrivals in 2020. In fact, both of these years faced two particularly difficult days in terms of meteorological conditions, leading to the two spikes on the number of missed approaches per day in Figure 2.2: A heavy storm, called Ciara, on the 9th of February 2020 led to 24 missed approaches that day. In 2023, the storm Ciarán caused 17 missed approaches on the 2nd of November.

All missed approaches are recorded by cause of event, as reported by the ATCOs. **Figure 2.3** shows the missed approaches per cause in 2023. Unstable approaches were the main reason of missed approaches in 2023 at Brussels Airport, accounting for a share of 43%. Oftentimes, unstable approaches occur due to tailwind at higher altitudes or when the aircraft takes a very direct route and is therefore unable to reduce its speed/altitude sufficiently. The second most common reason for missed approaches in 2023 is that an aircraft was too close behind a preceding aircraft, making it unsafe to land due to the insufficient buffer. Thunderstorm/windshear is another common reason in 2023. Sometimes, it also occurs that a missed approach is done deliberately, e.g. for training flights (one occurrence) or for technical flights (sometimes included in the "Other" category).

Figure 2.3: Missed approaches per cause in 2023



A detailed view on all the reasons for missed approaches per runway during the past years can be found in **Figure A.1**, **Figure A.2**, and **Figure A.3** in the **ANNEX**.



Runway Incursions

According to the International Civil Aviation Organization (ICAO Doc 4444 – PANS– ATM), a Runway Incursion (RI) is defined as "any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft".

According to the Acceptable Means of Compliance (AMC) 3 of EU Regulation 2019/317, an incorrect presence is hereby defined as "the unsafe, unauthorized or undesirable presence, or movement of an aircraft, vehicle, or pedestrian, irrespective of the main contributor (e.g. ATC, pilot, driver, technical system)".

A monthly overview of the runway incursions in 2023 can be seen in **Figure 2.4**. The colours of the bar chart indicate the severity as defined in **Table 2.1**. The total number of twelve runway incursions, rather evenly spread throughout the year, are without air traffic management (ATM) contribution.

Figure 2.4: Monthly runway incursions per severity category in 2023



Figure 2.5 gives a yearly overview of the runway incursions for the period from 2019 until 2023. Since 2020, the total number of runway incursions always ranged between ten and twelve. However, putting these figures into perspective by comparing the ratio of runway incursions per 100,000 flights, it becomes evident that there is a trend of improvement (see Figure 2.6). Although the rate of runway incursions was always bigger in the last four years than in 2019, it dropped in recent years and is comparable to 2022 in 2023 with 6.2 occurrences per 100,000 movements.

There are no runway incursions with skeyes' ATM contribution at Brussels Airport in 2023.

Figure 2.5: Yearly runway incursions per severity category



Figure 2.6: Yearly rates of runway incursions per 100,000 movements by ATM contribution



Other Noteworthy Incidents

Figure 2.8: Deviations from ATM procedures and ATC clearance at Brussels Airport by year

Besides incursions of the runway, other events can occur on the runway and, in extent, the taxiway.

Figure 2.7 shows the occurrence of these events per category for the period from 2019 to 2023. The number of these events increased since 2020 and is currently higher than in 2019. This is particularly due to the increase in taxiway incursions, which totalled to a record of 20 occurrences in 2023. skeyes safety team will meet with Brussels Airport to analyse this trend further and see if actions are required. Note that an increase in events also might be caused by increased reporting by the air traffic controllers, which is generally welcomed as it showcases a good safety culture at skeyes. Reasons for the events are various and sometimes linked to nature of movements on the apron (e.g. to maintain the separation, or the limit of ATC guidance on the apron).

Figure 2.7: Yearly runway and taxiway incursions and events



In 2021, a significant increase was seen in the deviations from ATM procedures and the deviations from ATC clearance (see Figure 2.8 and Figure 2.9). This increase continued in 2022. Deviations happened most frequently during pushback operations. As a result of the reports, skeyes updated the pushback procedures and worked alongside the stakeholders to identify and implement mitigations to counter this trend. The decrease of such deviation in 2023 speaks for a successful collaboration between Brussels Airport and skeyes. The two parties will continue to closely monitor such events.



With the traffic increase, the rate of the reports concerning deviations from ATM procedures decreased compared to 2022. At first, it seems like a high rate compared to 2019, but it needs to be taken into consideration that ATCOs started reporting issues related to push-back operations more systematically since 2021. These occurrences account for nine, 35 and 26 of the deviations from ATC clearance reports, respectively in 2021, 2022 and 2023. In the deviations from ATM procedures reports, the push-back related issues amount to 23 in 2021, 27 in 2022, and 19 in 2023. These more regular loggings explain the increase in both rates.

Figure 2.9: Rate of deviations from ATM procedures and ATC clearance er 100,000 movements per year



Recommendations and Awareness

The Local Runway Safety Team (LRST), which meets every two months, is committed to increasing Runway Safety and is composed of pilots, air traffic controllers and safety departments from skeyes and the airport. The main objective is to reduce the number of Runway Incursions based on EUROCONTROL's European Action Plan for The Prevention of Runway Incursions.

That is the place where safety issues are discussed between partners. Also, outcomes of the safety investigations are shared among the partners so that all parties may benefit from the lessons learned. When recommendations are made in an investigation report, these are also discussed with other stakeholders. If a recommendation from skeyes concerns the airport for instance, it will be discussed and agreed upon during an LRST meeting.

The events mentioned above are examples of incidents, which were discussed during the LRSTs so that improvements could be made and awareness raised. Good examples are the joined efforts between skeyes and Brussels Airport Company in bird control operations, the update of skeyes' pushback procedures or working together with the stakeholders to find a solution to reduce the deviations from ATC clearances.

In addition, in 2023, skeyes implemented a common transition layer in all Belgian airspace to ensure 1,000 ft separation between traffic below and above this layer (the transition layer separates traffic which vertical position is defined based on local altitude and traffic which vertical altitude is defined base on Average Sea Level). This is in line with ICAO DOC 7030 EUR and Commission Implementing Regulation (EU) 2020/469 of 14th of February 2020.

skeyes also promotes the increased use of Performance Based Navigation (PBN) procedures. Such approach procedures fit in the on-going transition towards a PBN Environment (EU regulation), and greatly improve predictability, therefore, situational awareness can be improved. More information on the PBN procedures can be found in Chapter 4.

Every two years, Brussels Airport also coordinates a big exercise to train and assess its crisis management capabilities and protocols. In 2023, this emergency exercise included 450 participants and lasted six hours (without disruption of the airport operations)²⁰.

20. https://www.aviation24.be/airports/brussels-airport-bru/large-scale-emergency-exercise-at-brussels-airport-with-some-450-participants/ (URL retrieved on 01/02/2024)





CAPACITY & PUNCTUALITY

This chapter addresses the airport capacity and punctuality.

In the first section on the airport capacity, the declared capacities for different runway configurations are given along with a view on the effective utilisation of this capacity.

In the second section, the punctuality at Brussels Airport is studied. Statistics on the arrival delay, which is the delay due to regulations placed by Brussels Airport on the arrivals, are provide. Furthermore, the delay from the airport's point of view is given the impact on traffic to or from Brussels Airport caused by regulations not only at Brussels Airport, but also in the Belgian en-route airspace and by other ANSPs.



Airport Capacity

The capacity of an aerodrome, i.e. how many oper- For optimal conditions, a theoretical measure of the ations can be handled in a certain amount of time, is influenced by several factors including the airport layout, the fleet mix of the arriving and departing traffic, ATC procedures, weather conditions and technological aids.

capacity is calculated per runway configuration of the airport. This Theoretical Capacity Throughput, which determines the average number of movements (arrivals and/or departures) that can be performed on the runway system within one hour, is calculated considering certain assumptions:

- There is a continuous supply of arrivals and/or departures. •
- Simultaneous Runway Occupancy (SRO) is prohibited (air traffic control rule).
- The Safe Wake Vortex Separation distance between two flights has to respected at all times (air traffic control rule).
- The fleet mix is static (i.e. types of aircraft do not change).
- Approach and departure procedures do not change. .
- Conditions of flying and service provision are optimal (weather, staffing, etc.). •

For the calculation of the Theoretical Capacity Throughput, on top of the above mentioned assumptions, the following parameters have been considered:

- The fleet mix of the busiest month in 2018 is taken as reference. •
- A nominal radar separation of 3NM is considered. •
- A loss factor of 15% is considered for inter-arrival times, which accounts for the fact • that controllers rather want to err on the right side when separating aircraft.
- The average Runway Occupancy Time for Arrival (ROTA) is based on an analysis of • the characteristics of the aircraft landing at Brussels Airport during August 2018.
- The average approach speed is 145 knots (based on measurements). •
- The average headwind differs per runway and is subtracted from the average ap-• proach speed.
- The inter departure time is a function of the time to reach an altitude after being • cleared for take-off.

Since the safe wake vortex separation distance between two flights, which is one of the inputs of the theoretical model, is only declared for IFR flights, the set at 90% of the optimum. As it only represents Theoretical Capacity Throughput also just indicates to the maximum number of IFR movements that an aerodrome can handle per hour with a specific runway configuration under optimal conditions.

In practice, such optimal conditions are rarely reached. Therefore, the declared capacity is the capacity of IFR flights it is also referred to as "Declared IFR Capacity". Table 3.1 shows the declared capacity at Brussels Airport for most of the used runway configurations. Note that this is only a theoretical calculation and currently not used for schedule coordination purposes.

Table 3.1: Declared IFR capacity²¹

Runway Co	nfiguration	Declared IFR Capacity (movements/hour)					
Departures	Arrivals	Only Departures	Only Arrivals	Mixed Fleet			
01	01	38	33	40			
07L,07R	01	34	27	54			
07R	-	34	-	34			
19	19	38	33	39			
19,25R	25R	35	34	45			
25R	25L,25R	41	68	75			
25R	25R	41	34	41			
-	07L	-	32	32			
-	25L	-	34	34			

The variations per runway configuration in the declared capacity add to the complexity of the flight planning, therefore also impacting the performance of other areas, e.g. by deviations from the preferential runway system due to traffic exceeding the capacity of this configuration – or ATFM regulations due to the runway configuration in use at the time.

To get a view on the actual usage of the aerodrome's capacity, the **Effectively Used Capacity** is an important performance indicator for the airport and the air navigation service provider handling the arrivals and departures. For each runway configuration, it compares the theoretical value of the declared capacity to the distribution of the actual number of movements performed within each hour of the year.

Figure 3.1 to Figure 3.8 provide an easy way to visually inspect if the declared capacity has ever been exceeded. In these plots, each dot represents a rolling hour throughout the year of 2023 (with a roll step of one minute), during which the runway configuration was active for at least an hour within the default opening times of the aerodrome and

during which there was at least one movement. The position of the dot indicates the number of arrivals (y-axis) and the number of departures (x-axis). The opacity of the dot indicates if there were many or few hours with this number of arrivals and departures, with more translucency indicating less hours. The histograms on the sides show the distributions of arrivals and departures. The declared capacity is shown by a diagonal red line: At any point on this line, the x-axis value (departures) and y-axis value (arrivals) will add up to the threshold number (total movements). Any dot above this line indicates an hour exceeding the declared capacity. Note that this capacity is usually only declared for IFR movements, yet this plot considers both IFR and VFR movements. This is because only considering IFR flights would give a distorted view on the number of hourly movements – especially for airports with high VFR shares. Helicopter movements are not included, as they don't land on the runways of the configurations, but missed approaches are. The notation for the runway configurations in this reports always mentions the departure runways first and the arrival runways, separated by a hyphen, afterwards.

^{21.} NOTE: Due to the complex dependencies (both ground and air) of runways in configuration 19,25L,25R the theoretical declared capacity could not be calculated analytically. Factors like controller workload need to be accounted for to calculate a theoretical capacity. However, this issue is currently being addressed by an ongoing project with EUROCONTROL.

If the maximum number of movements within an hour exceeds the declared capacity, this can be due to several reasons. For instance, a high share of VFR traffic could be the cause: Since the separation minima do not apply strictly to these flights, more movements can be performed within an hour. Other possible explanations include that the declared capacity was exceeded because of an exceptional deviation from safety margins, that there were many missed approaches (they count as two movements in little time), among other possibilities.

If, on the other hand, the maximum number of movements within an hour does not exceed the declared capacity, it could mean that the airport simply did not need to use its full capacity. However, when there was in fact a high demand of traffic, it could also mean that some of the assumptions for the theoretical calculation of the declared capacity were (temporarily or permanently) impacted and should be revised.

Figure 3.1: Distribution of hourly movements throughout 2023 for runway configuration 25R - 25L,25R

The runway configuration 25R – 25L,25R is the most commonly used runway configuration at Brussels Airport and it also has the highest declared capacity with 75 movements per hour. In 2023, this capacity was never exceeded. In fact, the maximum of 58 movements per hour stayed below the declared capacity by 17 movements.

The second most common runway configuration is 19,25R – 25R. For this configuration, the declared capacity of 45 movements was sometimes exceeded in 2023, reaching a maximum of 53 movements per hour.

Figure 3.2: Distribution of hourly movements throughout 2023 for runway configuration 19,25R – 25R



Number of Departure Movements



Number of Departure Movements



Figure 3.3: Distribution of hourly movements throughout 2023 for runway configuration 07L,07R - 01

Figure 3.4: Distribution of hourly movements throughout 2023 for runway configuration 19,25R – 25L,25R



The maximum of 52 movements per hour for runway configuration 07L,07R - 01 in 2023 is only two movements below the declared capacity. Most movements, however, are below 49.



number of movements per hour observed in 2023 is 45.

For runway configuration 19,25R – 25L,25R a capacity is not declared. The maximum

Figure 3.5: Distribution of hourly movements throughout 2023 for runway configuration 25R –25R



Several hours with more than the declared 41 movements per hour could be observed for runway configuration 25R – 25R. Maximally, the declared capacity was exceeded by eight movements.

Figure 3.6: Distribution of hourly movements throughout 2023 for runway configuration 19 – 19



Also for runway configuration 19 -19, the declared capacity (39 movements per hour) was exceeded during a few hours on the 2nd of November 2023, maximally by three movements.

Figure 3.7: Distribution of hourly movements throughout 2023 for runway configuration 01 – 01



For runway configuration 01 -01, all of the hours exceeding the declared capacity (40 movements per hour) had a rather balanced share of arrivals and departures. The maximum of 44 movements per hour for this configuration exceeds the declared capacity by four movements

Figure 3.8: Distribution of hourly movements throughout 2023 for any other runway configuration



imum is 54 movements per hour.

Last, but not least, Figure 3.8 summarizes the distribution of movements per hour for any other than the previously mentioned runway configurations in 2023. Here, the max**Table 3.2** shows all of the days with an hour exceeding the declared capacity, for all runway configurations. Brussels Airport is a coordinated airport in Belgium and the declared capacity for slot coordination during the day is a maximum of 74 total movements per hour. In 2023, this maximum was never reached, regardless of the runway configuration. The observed maximum of 2023 is 58 movements per hour, as recorded on the 19th of July 2023 between 09:32 and 10:32.

Table 3.2: Days with hours exceeding the capacity per runway configuration in 2023

Runway Configuration		Date	Extra Movements		%	IFR	% Departures		
Departures	Arrivals	2023	min	max	min	max	min	max	
01	01	Jun. 14	1	1	100%	100%	46%	46%	
		Jun. 15	1	4	100%	100%	44%	49%	
19	19	Nov. 2	1	3	100%	100%	57%	61%	
19,25R	25R	Jun. 19	1	2	100%	100%	49%	55%	
		Jun. 20	1	1	100%	100%	61%	61%	
		Jun. 21	1	8	100%	100%	62%	68%	
25R	25R	Apr. 12	1	1	100%	100%	43%	48%	
		Apr. 26	1	8	100%	100%	44%	50%	
		Jun. 25	1	3	100%	100%	60%	74%	
		Jun. 27	1	1	100%	100%	43%	45%	
		Jun. 28	1	1	98%	100%	40%	40%	
		Jul. 11	1	1	93%	93%	55%	55%	



Punctuality

Punctuality is a service quality indicator from a passenger perspective. This section observes one of the factors that influences the punctuality: Air Traffic Flow Management (ATFM) delay. When traffic demand is anticipated to exceed the available capacity, an ATFM measure, or regulation may be put in place by the local Flow Management Position (FMP). Aircraft expected to arrive during a period of congestion are given ATFM delay at their departure airport, under the authority of the Network Manager, in order to regulate the flow of traffic into the constrained downstream en-route sector or airport, thus ensuring safety.

The ATFM delay is calculated as the difference between the estimated take-off time (ETOT) calculated from the filed flight plan including updates and the calculated takeoff time (CTOT) allocated by the central unit of ATFM. The delay is attributed to the most constraining ATC unit. The reason for the regulation is indicated by the responsible FMP which are classified according to the respective causes listed below:

C - ATC Capacity R	- A'
D - De-icing S -	- A'
E - Equipment (non-ATC) T	- E
G - Capacity Aerodrome V	- E
I – Industrial Action (ATC) W	- V
M - Airspace Management NA	4 -
N – Industrial Action (non-ATC) Of	hei

pecial Events TC Routing TC Staffing quipment (ATC) nvironment Weather Not Specified

According to the Functional Airspace Block Europe Central (FABEC) Performance Plan the causes with ANSP contribution are (in the order listed in the Performance Plan):

C - ATC Capacity

- R ATC Routing
- S ATC Staffing
- T Equipment (ATC)
- M Airspace Management
- P Special Events

Hence, in the remainder of the report all causes with ANSP contribution are referred to as "CRSTMP" while "Other Categories" aggregates all categories but CRSTMP and W (weather).

This section addresses the regulated traffic at Brussels Airport where the first part considers the key performance indicator: arrival delay. The Airport Arrival ATFM Delay is an indicator of ATFM delays on the ground due to constraints at the destination airport. In addition, this section gives an overview of the influence of ATFM measures on departing traffic followed by an overview of the influence of ATFM measures on arriving traffic.

Airport arrival ATFM delay

As of the 1st of January, 2015, skeyes is subject to an annual target regarding ATFM arrival delay. ATFM arrival delay is the delay of a flight attributable to the terminal and airport air navigation services and caused by restrictions on landing capacity (regulations) at the destination airport. The average minutes of arrival ATFM delay per flight is a performance indicator in accordance with the European Performance Regulation (EU) no 317/2019, Annex 1, section 1, §3.1(b). This indicator is the average time, expressed in minutes, of arrival ATFM delay per inbound IFR flight and is calculated for the whole calendar year. The indicator includes all IFR flights with an activated flight plan submitted to the Network Manager landing at the destination airport and covers all ATFM delay causes excluding exceptional events.²²

Targets are set on a national level and on an airport level, where the national target is the aggregation of the airport targets. For reference period 2, 2016-2019, the national target was 0.10 minutes/flight, and Brussels Airport and Liège Airport were considered as contributing airport. The target for Brussels Airport on CRSTMP arrival delay was 0.11 minutes/flight. For reference period 3 (RP3), 2020-2024, only Brussels Airport was considered as contributing airport. Initially, the national target was planned to be 1.82 minutes/flight for all causes and 0.17 minutes/flight for CRSTMP causes. However, due to the unexpected impact of COVID-19 on the air traffic, the European Commission requested a revision of Union-wide performance targets for RP3. The current proposal only includes arrival delay targets for Belgium as of 2022 (1.08 minutes per flight for all causes and 0.12 minutes per flight for CRSTMP causes), and the only contributing airport remains Brussels Airport.

For this performance indicator, a comparison is made over the last five years. Table 3.2 gives the amount of arrival delay of Brussels tower and the total number of arrivals per year. Note that the number of arrivals in this section and the arrival delay for each flight is calculated by the Network Manager and has been provided by the Performance Review Unit (PRU / EUROCONTROL)²³.

^{22.} EUROCONTROL, "SES Performance Scheme Reference Period 3 (2020-2024), 2022, https://www.eurocontrol.int/prudata/ dashboard/metadata/rp3/ (URL retrieved on 19/04/2023)

^{23.} Hence the difference with figures in Chapter 1, where movements are counted using the AMS and the BCAA criteria. EUROCONTROL only account for flights with a registered flight plan.

Figure 3.9: Yearly arrival delay KPI (rate of ATFM delay per IFR arrival) target and actual

In 2023, the capacity at Brussels airport was impacted by a multitude of causes. This is reflected in the total ATFM arrival delay as a total of 40,391 minutes of arrival delay was registered. The main reasons for the delay were adverse weather conditions (17,755 minutes) and a reduced aerodrome capacity (18,828 minutes). The reduced aerodrome capacity resulted from scheduled works on the ILS of one of the runways²⁴, maintenance works that were necessary after a thorough inspection by the airport²⁵ and repair works on the runway surface. Delay attributed to the CRSTMP category which presents the causes with skeyes contribution was 3,382 minutes of delay in 2023. An increase of 97% compared to 2022. ATC capacity and ATC staffing were the main contributing reasons in this category.

To celebrate the National Day on the 21st of July, a Fly-Past and COL (Com Ops Land, Belgian Land Component) Demo, with military air assets (Belgian Air and Land Component ACFT, drones and foreign ACFT), was executed over the Royal Park in Brussels on the 21st of July 2023 as part of the integrated ground and air parade. Regulations were put in place during the event and the rehearsals to ensure a safe execution. The resulting delay is attributed in the CRSTMP category as a special event.

Table 3.3: Number of IFR arrivals and minutes of arrival ATFM delay per reason and per year (considering IFR arrivals with an activated flight plan submitted to the Network Manager)

	IFR Arrivals				
Year	CRSTMP	Weather	Other categories	(with flight plan)	
2019	7,276	76,310	19,721	103,307	114,643
2020	1,575	15,557	0	17,132	45,662
2021	725	1,538	45	2,308	57,069
2022	1,714	7,423	483	9,620	87,118
2023	3,382	17,755	19,254	40,391	93,796

As mentioned before, the key performance indicator (KPI) is the average CRSTMP arrival delay per arrival at the airport. Translated into the key performance indicator delay per arrival, this results in a total arrival delay of 0.43 minutes per arrival in 2023 and a CRST-MP arrival delay of 0.4 minutes per arrival. This can be also be seen in Figure 3.9, which shows the arrival delay rates for the past five years.

25. https://www.brusselsairport.be/en/pressroom/news/maintenance-work-on-runway-25I-07r (URL retrieved 02/02/2024



In order to keep the average CRSTMP arrival delay per arrival below the target established by the Network Manager in the following years, skeyes is currently working on an update of the buffering absences, a procedure to optimize the use of available resources in case of absences, ensuring a safe traffic flow to/from Brussels airport.

All ATFM impact on traffic at Brussels Airport

Flights departing from and arriving at an airport can be delayed by ATFM measures in any of the sectors they cross on their route. Besides being delayed by Brussels tower, flights to or from Brussels Airport can therefore also be delayed by ATFM measures in any ATC sector along their flight route; i.e. enroute or at the other departure or arrival airport.

Figure 3.10 and Figure 3.11 show the delay on departing and arriving traffic over the last five years. In 2023, 33,159 departing flights from Brussels Airport were delayed, resulting in a total 368,891 minutes of delay. 5% (17,324 minutes) of that delay is attributable to skeyes while 95% (351,567 minutes) is attributable to other ANSPs. Of all arriving traffic, 17,754 inbound flights at Brussels Airport were delayed with a total of 277,817 minutes of ATFM de-

lay. Thereof, 19% (52,955 minutes) is attributable to skeyes while 81% (224,862 minutes) is attributable to ATFM measures placed by other ANSPs.

The impact of all these regulations give the total ATFM delay of traffic at Brussels Airport. Traffic at Brussels Airport was mainly impacted by ATC disruptions due to weather related reasons, lack of ATC Capacity and ATC staffing, and industrial actions in France. Noteworthy events that impacted the punctuality in Brussels Airport were the implementation of 4-Flight in France and the implementation of iCAS in Germany. Both are new integrated control systems that will be used by the respective ANSPs. Regulations were put in place to protect that airspace and also the neighbouring from an overload in France and Germany.

^{24.} https://www.batc.be/en/news/skeyes-renews-the-instrument-landing-system-of-rwy19 (URL retrieved 02/02/2024

Figure 3.10: ATFM delay for IFR departures per year and delay origin



Figure 3.11: ATFM delay for IFR arrivals per year and delay origin



To give a view of the severity of the impact, the delayed flights can be categorised based on the length of the delay. There are four categories:

- Between 1 and 15 minutes •
- Between 16 and 30 minutes
- Between 31 and 60 minutes
- More than 60 minutes. •

The graph in Figure 3.12 and Figure 3.13 show that 75% of the delayed departures, and 62% of the delayed arrivals were delayed for a maximum of 15 minutes. 2% of the departure flights in 2022 and 2% of the arrivals had a delay above one hour.

Figure 3.12: Delayed IFR departures per category of delayed time in 2023



Figure 3.13: Delayed IFR arrivals per category of delayed time in 2023



	Other ANSP skeyes	
704		
2% 60+ min		

	Other AN skeyes
2%	
60+ min	

Preferential Runway System (PRS) Continuous Descent Operations (CDO) Night Movements Wind Pattern

Considerations and Improvements



ENVIRONMENT

The first part of this chapter is dedicated to the runway configuration scheme used at Brussels Airport. The airport is geographically located in a densely populated area, which makes the runway use information very important for the neighbouring communities. Besides the monthly and yearly overview of the use of the Preferential Runway System (PRS), there are the ongoing processes that aim to ensure a continuous dialogue with all the stakeholders and more and more clarity in the runway configuration choice. Considering that wind is a predominant factor in the choice of runway use, wind data is also provided in this section.

The second part focuses on Continuous Descent Operations (CDO). The objective of CDOs is to reduce aircraft noise, fuel burn and emissions by means of a continuous descent, to fly the approach glide path at an appropriate altitude for the distance to touchdown. skeyes therefore puts in place indicators to monitor the use of CDOs. Note that both PRS and CDO data can also be found on the Brussels Airport Traffic Control (BATC) website: www.batc.be.

As part of its noise reduction policy, Brussels Airport implements measures imposed by the government. One of these, as part of their exploitation permit, is to limit the number of night slots. The last section of this chapter therefore provides a view on the number of night movements.

Preferential Runway System (PRS)

should take off and land against the wind direction. In addition to the speed and surface wind direction, there are many more factors to consider when choosing the runway in use, such as environmental regulations, runway length, available navigation aids for approach and landing, the weather conditions, the available instrument approach procedures, or simply the availability of runways and taxiways. For environmental reasons, a PRS is in place at Brussels

A basic aerodynamic principle is that an airplane Airport. This system defines the runways to be used depending on the weekday and the time of day. Table 4.1 shows this runway configuration scheme as listed in the Aeronautical Information Publication (AIP). When the conditions to safely use the indicated runways in the configuration schema are not met, skeyes may deviate from this schema and choose a more suitable alternative runway configuration to maintain the safety of operations.

Table 4.1: Runway Configuration Scheme published in the Belgian AIP (Part 3, EBBR, AD 2.20, Ch. 4.2.1)

		0500 to 1459 (0400 to 1359)	1500 to 2159 (1400 to 2059)	2200 to 0459 (2100 to 0359)
MON 0500 (0400)	TKOF	25	ōR	25R / 19 ⁽¹⁾
till TUE 0459 (0359)	LDG	25L /	25R / 25L ⁽²⁾	
TUE 0500 (0400)	TKOF	25	5R	25R / 19 ⁽¹⁾
till WED 0459 (0359)	LDG	25L /	25R / 25L ⁽²⁾	
WED 0500 (0400)	TKOF	25	5R	25R / 19 ⁽¹⁾
till ⊤H∪ 0459 (0359)	LDG	25L /	25R / 25L ⁽²⁾	
THU 0500 (0400)	TKOF	25	25R / 19 ⁽¹⁾	
till FRI 0459 (0359)	LDG	25L /	25R / 25L ⁽²⁾	
FRI 0500 (0400)	TKOF	25	25R ⁽³⁾	
till SAT 0459 (0359)	LDG	25L /	25R	
SAT 0500 (0400)	TKOF	25R	25R / 19 ⁽¹⁾	25L ⁽⁴⁾
till SUN 0459 (0359)	LDG	25L / 25R	25R / 25L ⁽²⁾	25L
SUN 0500 (0400)	TKOF	25R / 19 ⁽¹⁾	25R	19 ⁽⁴⁾
till MON 0459 (0359)	LDG	25R / 25L ⁽²⁾	25L / 25R	19

(1) RWY 25R only for traffic via ELSIK, NIK, HELEN, DENUT, KOK and CIV / RWY 19 only for traffic via LNO, SPI, SOPOK, PITES and ROUSY; aircraft with MTOW between 80 and 200 T can use RWY 25R or 19 (at pilot discretion); aircraft with MTOW > 200 T shall use RWY 25R regardless the destination

2) Arrival on RWY 25L at ATC discretion only.

(3) No airport slot will be allocated for take-off between 0000 (2300) and 0500 (0400) (EBBR AD 2.20, §1). (4) No airport slot will be allocated for take-off between 2300 (2200) and 0500 (0400) (EBBR AD 2.20, § 1)

Table 4.2: PRS use in hours (hh:mm) per month and per reason in 2023

PRS not in use with Reasons / PRS in use	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	ост	ΝΟΥ	DEC	Total
PRS not in use	194:14	145:28	202:10	326:06	437:39	579:47	60:21	153:52	118:31	160:35	227:06	105:06	2710:55
Meteorological conditions at the airport	189:23	126:21	99:48	191:21	293:00	245:18	25:46	63:22	82:13	102:54	81:48	93:40	1594:54
Non-availability RWY/TWY	02:50	00:21	86:25	81:30	49:07	245:22	04:35	65:52	06:52	39:15	136:10	01:19	719:38
Meteorological conditions near the airport in the departure and/or approach path	-	16:48	10:37	39:35	68:50	72:56	10:59	19:38	21:29	-	04:04	-	264:56
Planned maintenance of airport and/or ATC equipment	-	01:22	05:05	02:10	12:43	12:52	02:59	05:00	-	07:00	-	-	49:11
Traffic demand exceeds capacity of PRS	02:01	-	00:15	00:18	01:16	02:40	10:06	-	07:57	03:19	04:51	02:34	35:17
Special activities	-	-	-	11:12	-	-	05:56	-	-	08:06	-	-	25:14
Other	-	-	-	-	12:43	-	-	-	-	00:01	-	07:33	20:17
Unplanned non-availability (U/S) of airport and/or ATC equipment	-	00:36	-	-	-	00:39	-	-	-	-	00:13	-	01:28
PRS in use	549:46	526:32	541:50	393:54	306:21	140:13	683:39	584:08	588:42	567:25	492:54	638:54	6014:18

Figure 4.1 shows the percentage of time the preferred runway configuration was in use per year since 2019. Over the whole year, the PRS was in use 69% of the time, which is slightly less than in the previous year (75% in use in 2022). In **Figure 4.2** it can be seen that there is a lower use of the PRS in April, May, and June. Strong North-East winds are a common phenomenon that is observed every year around this period. Such meteorological conditions are the predominant reason for PRS deviations. In addition to the meteorological conditions, the preferred runways were oftentimes unavailable - especially so in June and November due to repair works

Figure 4.1: Yearly PRS use (in percentage of time)



Figure 4.2: Monthly PRS use in 2023 (in percentage of time)



(see Chapter 1), but also for more than 38 hours in March, April, May, August, and October. This can be seen in **Figure 4.2** which attributes the reasons to the times of deviations per month. Table 4.2 also provides the figures of the total time when the PRS was not in use per reason and month, which is displayed in Figure 4.3. In addition, it shows the total time the PRS was in use. Overall, in 2023, the three main reasons for not using the PRS are meteorological conditions at the airport (59%) and near the airport (10%) together with non-availability of the runway or taxiway (27%).



Figure 4.3: Overview of reasons for PRS not in use per month in 2023

Non-availability RWY/TWY

Meteorological conditions at the airport

Continuous Descent Operations (CDO)

A CDO is an aircraft operating technique - enabled by airspace design, instrument procedure design, and facilitated by air traffic control - to allow aircraft to follow an optimum flight path that delivers environmental and economic benefits (reduced fuel burn, gaseous emissions, noise, and fuel costs) without any adverse effect on safety. A CDO allows arriving aircraft to descend continuously from an optimal position with minimum thrust. By doing so, the intermediate level-offs are reduced and more time is spent at more fuel-efficient higher cruising levels, hence reducing fuel burn (i.e. lowering emissions and fuel costs) and producing less noise²⁶.

A descent is considered as a CDO if no level off lasting more than 30 seconds is detected. A level off is considered as a segment during which the aircraft has a rate of descent of less than 300 ft/minute. Based on the recommendations made by EUROCONTROL, two CDO performance indicators were developed in 2016:

- CDO Fuel: binary indicator (yes/no) indicating if a CDO was flown from FL100 to 3000 ft. •
- CDO Noise: binary indicator (yes/no) indicating if a CDO was flown from FL60 to 3000 ft. •

For CDO statistics, a new 'CDO flag' has been incorporated, in order to consider only 'CDO-relevant' flights. The following criteria have been defined to flag a movement as CDO relevant:

- It is an IFR arrival. •
- The aircraft is not categorized as "light", meaning its maximum take-off weight (MTOW) is above 7000 kg. •
- It is not a helicopter. •
- It is not a military flight. •
- It is not a Touch-and-Go, i.e. the flight does not involve landing briefly and taking off again. •
- The observed altitude during the flight must be at or above FL 60 (6,000 ft or 1.8 km). •

The total of CDO-relevant arrivals is therefore different than the number of arrivals provided in Chapter 1.

In an effort to increase data consistency, historical and CDO Noise arrivals have increased along with CDO data is being updated on an annual basis. This measure ensures that all the CDO data, displayed in this report, has been calculated with the same CDO algorithm, providing more fairness and transparency in the historical evolution of CDO performance.

the CDO-relevant arrivals in the past years. In relative numbers, i.e. the percentage of arrivals with a CDO over all CDO-relevant arrivals, the CDO Noise operations have also continuously and steadily increased from 77% in 2019 to 80% in 2023. The CDO Fuel operations in 2023 are at 64% of all CDO-relevant arrivals, which is the same level as in 2022, higher than the 59% in 2019, and slightly lower than the peak of 65% in 2021.

As shown in **Figure 4.4**, there were a total of 92,445 arrivals of CDO-relevant flights in 2023. Of these, 73,538 arrivals performed a CDO Noise and 59,317 a CDO Fuel. In absolute numbers, the CDO Fuel

^{26.} EUROCONTROL, "Continuous climb and descent operations," [Online]. Available: eurocontrol.int/concept/continuous-climb-and-descent-operations (URL retrieved on 19/04/2023)



Figure 4.5: 'CDO Noise' flown per runway per year as percentage of CDO-relevant arrivals



These relative numbers are further analysed per runway in Figure 4.5 and Figure 4.6 for CDO Noise and CDO Fuel operations over the CDO-relevant arrivals per year and runway.

An increase in CDO Noise operations can be seen on the most frequently used runways 25L and 25R. Also runway 07L, 07R and 01 witnessed an increase in the last years. Only on runway 19 the rate of CDO Noise operations decreased. The small sample size (runway 19 was in used for 5% of the all movements in 2023) is to be kept in mind.

CDO Fuel operations also increased on runway 25L and 25R, the main runways (in use for 77% of all movements in 2023). On the lesser used runways a decrease in the rate of CDO Fuel operations can be observed.



Figure 4.6: 'CDO Fuel' flown per runway per year as percentage of CDO-relevant arrivals



Figure 47Error! Reference source not found. shows a view per month of CDO Fuel and Noise rates. Hereby, the CDO Noise rate ranges between 76% and 83%, fluctuating over the months. The CDO Fuel rate reaches its maximum in August with 69% and was at its lowest in April (61%), May (59%), and June (56%) - a period of unusual winds and different runway usages, as pointed out in Chapter 1. In fact, a multitude of external factors influence CDO statistics, such as:

- Pilots' CDO flying experience
- Pilots' experience with the airport
- ATC experience
- Equipment of the runway
- Aircraft type and equipment
- Military airspace being open or closed
- Traffic flows and traffic streams that can have an impact on the arriving traffic (often linked to the time of the day)

As a result, it is difficult to identify a single cause for an increase or decrease of the CDO statistics over a period.

Figure 4.7: Monthly rate of CDO Fuel and CDO Noise arrivals over all CDO capable arrivals in 2023



In addition to the CDO definition used in the previous figures, skeyes introduces a **new** CDO indicator in 2023: considering the average level-off time below a certain altitude. While 'CDO Fuel' and 'CDO Noise' categorize arrivals in a binary way (as CDO yes/no), the new indicator considers CDO performance by non-binary means, delving into the duration during which an aircraft operates in level-off segment(s). The characteristics of a binary and non-binary definition of the CDO performance indicator is illustrated in Figure 4.8.

Figure 4.8: Binary/non-binary CDO indicator illustration



The 'Average level-off time below certain altitude' indicator provides a value representing the average time a descending aircraft spends flying level-off within specific altitude ranges. In particular, three distinct altitude ranges are monitored:

- 10,000 ft to Ground (GND) The upper boundary aligns with the altitude ceiling of 'CDO Fuel'
- 6,000 ft to GND • The upper boundary aligns with the altitude ceiling of 'CDO Noise'
- 3,000 ft to GND •

This altitude range focuses on level-off segments in low altitudes, which are excluded from 'CDO Fuel' and 'CDO Noise'.

The development of this new indicator is based on recommendations from the European CCO/CDO Action Plan and EUROCONTROL ENV Transparency Working Group, emphasizing its alignment with industry best practices and standards.²⁷

The monthly development in 2023 of this new performance indicator can be seen in Figure 49, showing the monthly evolution of average level-off time per CDO-relevant arrival per altitude band in 2023 at Brussels Airport. The baseline of CDO-relevant arrivals is also provided as a bar chart in the same Figure. Whereas the average level-off time per CDO-relevant arrival remains rather stable below 3,000 ft and also below 6,000 ft with slight fluctuations throughout the months, the altitude band from ground level to 10,000 ft shows a notable peak in June with 122 seconds per CDO-relevant arrival. This could be related to the different weather conditions during this season, as previously pointed out, and also the different runway usage during these months (see Chapter 1).

Figure 4.9: Monthly average level-off time per CDO-relevant arrival per altitude band



Figure 4.10, shows the yearly average of level-off times per CDO-relevant arrival per runway. The less frequently used runways show a higher average level-off time, especially for the highest altitude band. Arriving traffic from the East for runways such as RWY 01, 07L, 07R, and 19 have certain ATCO working methods put in place, which can lead to higher level offs (e.g. to avoid departing traffic in lower altitudes). Higher values in this new KPI are thus strongly influenced by the ATC organisation during such configurations. Which altitudes and level-off opportunities are given is furthermore always a balance between arriving and departing traffic.

Figure 4.10: Average level-off time per aircraft per altitude band per runway in 2023



Improvement measures and activities

Shortly after the COVID-19 pandemic started, numerous European ANSPs (including skeyes), airlines and EUROCONTROL took the initiative to collaboratively improve flight efficiency. Both air traffic controllers and pilots were/are encouraged to pro-actively facilitate and stimulate CDOs and Continuous Climb Operations (CCO), as well as more direct routings.

To promote and facilitate the number of CDOs flown to Brussels Airport, different measures are investigated or already implemented:

- On the one hand, skeyes is in contact with airlines presenting CDO statistics and communicating the phraseology.
- On the other, skeyes is increasing awareness amongst ATCOs through courses, and by informing them of the current statistics and performance. In addition, as a member of FABEC, skeyes actively participates in workshops and initiatives to improve - amongst others - CDO performance.

Furthermore, skeyes and Brussels Airport Company maintain a cooperation agreement with Brussels Airlines, TUI Fly and DHL, on undertaking joint initiatives that further reduce the environmental impact of airport operations. Additionally, the agreement on 'collaborative environmental management' (CEM) at Brussels Airport, also signed by EU-ROCONTROL and ACI Europe, continues to show benefits.



^{27.} EUROCONTROL, "European Continuous Climb and Descent Operations Action Plan," [Online]: https://www.eurocontrol.int/ publication/european-cco-cdo-action-plan (URI retrieved on 21/02/2024)

One of the initiatives within the CEM at Brussels Airport is the promotion of the Required Navigation Performance (RNP) approach procedures. Increasing the use of the RNP approaches has for main objectives, both for the flight crews and the controllers, to get more familiar with accommodating/ flying (full) RNP approach procedures and assess how the improved predictability (by letting aircraft fly the full published RNP approaches) enables flight crews to optimize their descent and improve the environmental performance. This is an important Area Navigation (RNAV) procedures and PBN transtep for the successful use of such procedures in a future, full PBN environment. As a matter of fact, in December 2020, skeyes released the first version of its national PBN implementation and transition plan 2024/2030 for the Belgian part of Brussels Flight Information Region (FIR). This plan aims at providing a strategy for the introduction of full PBN environments at the aerodromes of Antwerp, Brussels, Charleroi, Kortrijk, Liege and Ostend. Once introduced, the optimization of these PBN environments will be initiated. This comprises the redesign of airspace as well as the routes which can then be redesigned independently from the ground-based infrastructure and placed at the most strategically beneficial location. Such procedures are expected to greatly improve, amongst others, flight predictability, situational awareness and aircraft vertical performance, ultimately minimizing the impact on the environment (reduced fuel consumption, less noise,...). At Brussels Airport, skeyes is planning to proceed with the first phase of the plan in the coming months (in accordance with the agreements), namely to introduce a PBN-compliant environment. This move, in addition to be aligned with the strategy depicted in the national PBN transition plan, also fits in the on-going European PBN transition (EU regulation 2018/1048) and is part of the Brussels Airport Stargate project, one of the various environmental initiatives the European Commission and the Belgian government support in the in reducing emissions from air travel²⁹.

aviation sector²⁸ The initial assessment of the Stargate project from 2022 has its continuation with the second assessment period (2.0), taking place between November 2023 and February 2024. During the second evaluation of increased use of RNP at Brussels Airport, the environmental study is again being conducted to re-analyse the environmental performance based on the updated RNP procedure. These initiatives have been in line and its outcomes support the linked project of implementing generic sition at Brussels Airport.

Another initiative currently ongoing in Brussels Airport is the project HERON - which stands for Highly Efficient Green Operations -, an EU consortium project with the goal to faster deployment of a set of ambitious targets to mitigate CO2 emissions from air transport. Within HERON, skeyes leads the task related to the trials of Increased Second Glide Slope (ISGS) and its operational demonstration at Brussels Airport. RNP flight procedures with increased slope glide paths (3.2 and 3.5 degrees) will be published and flown by participating airlines, on the two main runways (RWY 25R and RWY 25L). Four airlines confirmed their participation in the ISGS trials, which are scheduled for 2024: Brussels Airlines, TUI, DHL, and Vueling

Furthermore, skeyes obtained the GreenATM level 3 accreditation in 2023. The Civil air Navigation Services Organisation (CANSO) GreenATM is an environmental accreditation program to provide ANSPs with an independent, industry-endorsed, accreditation of their environmental efforts.

Also on the airport side, initiatives are taken towards environmental aviation. Brussels Airport is ready to supply sustainable aviation fuel to aircraft. The use of sustainable aviation fuel is a key element



^{28.} skeyes, press skeyes, 2022, https://press.skeyes.be/skeyes-promotes-environmentally-friendly-approach-procedures-at-brussels-airport (URL retrieved on 19/04/2023)

^{29.} The Brussels Times, First 'sustainable aviation fuel' flight in Belgium departs from Brussels Airport, 2023, https://www.brusselstimes. com/345469/first-sustainable-aviation-fuel-flight-departed-from-belgium (URL retrieved on 19/04/2023)

Night Movements

Figure 4.11 shows the number of day and night decreased (-2% compared to 2022) whereas the day movements at Brussels Airport per year. Hereby, the night is defined to range from 23:00 to 06:00 local time. During the COVID-19 pandemic, night movements did not drop proportionally with the drop in total traffic. A possible reason for this is that the types of flights, which mainly operate during the day (passenger flights, low-cost flights) were highly impacted by the COVID-19 crisis, whereas the night traffic is mostly composed of cargo, an area that was not or very little impacted in terms of movements. In 2022, the night traffic had recovered back to 98% of the night traffic in 2019. Interestingly, in 2023, the number of night movements slightly

traffic continued to recover. On the one hand, the decrease in cargo mentioned in Chapter 1 is a potential explanation for this behaviour. On the other hand, it is to be pointed out that skeyes introduced a new and greener charging system in April 2023³⁰: The charges, which airlines need to pay for take-off, are now modulated according to aircraft noise and emissions, distance flown, and the time of the day/ night. To skeyes, these new charges will be revenue neutral and were put in place to foster skeyes ambitions to contribute to an environmentally friendly future of aviation.

Figure 4.11: Yearly day and night movements



The number of night slots is limited by a regula- BSC is a non-profit organization in accordance tion in the Ministerial Decree of the 21st of January 2009 in order to limit the noise impact during the is shared between the airport and airlines. Slot alnight. This decree states that a maximum of 16,000 night slots per calendar year can be allocated, the night being defined from 23:00 to 06:00 local time. The slot allocation at Brussels Airport is under the responsibility of Belgium Slot Coordination (BSC).

with Belgian Law. The ownership of the company location is an instrument developed to match the demand for slots from air carriers and general aviation to the supply of airport capacity. In 2023, 16,574 night movements³¹ were recorded at Brussels Airport by the AMS with BCAA criteria.

30. https://www.aviation24.be/air-traffic-control/skeyes/belgian-air-navigation-services-provider-skeyes-introduces-greener-charging-system/ (URL retrieved on 08/02/2023)

31. Note: The number of movements does not represent the number of slots used

Table 4.3 and Figure 4.12 show the distribution of the night movements throughout the night. Comparing 2023 to 2022, night traffic increased before 03:00 (+1%) and decreased in the hours between 03:00 and 06:00 (-8%).

Figure 4.12: Yearly night movements per hour (the hour indicates the start of the hour)



Table 4.3: Yearly night movements per hour (the hour indicates the start of the hour)

Year	23:00	00:00	01:00	02:00	03:00	04:00	05:00
2019	5,881	3,462	1,885	963	1,746	2,054	1,357
2020	2,547	2,207	1,307	672	1,766	1,731	902
2021	3,299	2,445	1,598	826	1,813	2,109	1,183
2022	4,582	3,457	2,110	1,231	2,038	1,950	1,548
2023	4,708	3,329	2,160	1,303	1,798	1,871	1,405

Figure 4.14: Monthly wind roses in 2023

Wind Pattern

One of the factors that play a main role in the selection of the runway is the wind direction and speed. This was also confirmed previously as meteorological conditions were the most frequent reason for not using the PRS.

Figure 4.13 shows the wind roses for the previous five years. Overall, the yearly patterns are rather similar.

Wind roses for each month of 2023, depicted in Figure 4.14, however, show some large variation. In January, February, March, July, November, and December north-west winds prevailed. The other months show a lot of variation in the wind direction, oftentimes including north-east winds. The impact of this can also be seen in the runway use per month in Figure 1.10.







MAY

Calm 2.08%

Calm 2.15%

Figure 4.13: Yearly wind roses



Calm 2.1%

2022



Calm 2.92%



2021

Calm 2.96%







OCT 5%



Calm 0.27%

Calm 0.0%



Calm 0.94%

Considerations and Improvements

Informing the residents

Since 2014, skeyes has been undertaking various actions to improve its communication and transparency about the runway use in order to better inform the stakeholders involved. In 2015, skeyes launched the website www.batc.be in collaboration with Brussels Airport to provide some dynamic information on the use of runways and the air traffic. A new version of the website was launched in 2018 with – amongst others – real-time meteorological information. Since then, continuous improvements have been made (e.g. addition of wind roses, more detailed information on runway works, etc).

Considerations for wind aloft

Strong tailwinds can lead to unstable approaches and go-arounds. To avoid unplanned runway changes, the tower supervisor chooses an alternative runway when the pilots communicate the presence of strong tailwinds and request other runways.

Since 2017 wind aloft data are available for display in the control tower (via the extraction of radar data and sent through Mode S). Since the end of 2020, ATC also receives wind aloft data derived using LIDAR (Light Detection And Ranging) meteo equipment; this ground-based system allows ATC to have wind aloft data available 24/7. The LIDAR data is used by EBBR Tower and Approach to inform pilots about wind aloft. This data can help to reduce missed approaches and to assist in the runways configuration choice. Since 2022, wind aloft values are available on ATIS (Automatic Terminal Information Service) when the RWY 25R, RWY25L/R is in use which is the main PRS RWY configuration by day.

Use and evaluation of forecasts

Wind measurements are often used by stakeholders to assess retrospectively whether tailwind limits were respected. However, the supervisor must choose the runway configuration based on forecasts and wind measurements. Note, a change of runway configuration cannot be carried out immediately but requires time.

As a result, weather forecasts play an important role in the choice of runways in use. Since 2018 the forecast is updated every hour (instead of three hours) to improve the accuracy.



ANNEX Fact sheet

Yearly Evolution

- 7 % increase in movements in 2023 compared to 2022
- 82% of 2019 traffic

Movements	2019	2020	2021	2022	2023	2023 vs 2022	2023 vs 2019
IFR	231,275	93,118	116,072	176,179	189,408	+8%	-18%
VFR	3,187	2,695	2,664	2,751	2,859	+4%	-10%
Total	234,462	95,813	118,736	178,930	192,267	+7%	-18%

Quarterly comparison

• Year-to-year comparison in Q1 and Q2 at -17% of 2019

Movements	2019	2020	2021	2022	2023	2023 vs 2022	2023 vs 2019	
Q1	50,875	44,317	15,490	33,644	40,577	+21%	-20%	
Q2	61,660	9,175	22,444	47,374	51,059	+8%	-17%	
Q3	65,761	23,816	41,683	53,463	54,119	+1%	-18%	
Q3	56,166	18,505	39,119	44,449	46,512	+5%	-17%	

Missed Approaches

279 missed approaches in 2023 Top three causes:

- unstable approach (120)
- too close behind preceding (28)
- other (28)

Safety Occurrences

- 12 Runway incursions, 3 under investigation & 9 without ATM contribution
- Increase in taxiway incursion (20 in 2023) and TWY/Apron event reports (20 in 2023)
- Less call sign confusions reported.
- Decrease in deviations from ATM procedures & deviations from ATC clearance after updated pushback procedures-
- Successful emergency exercise.

Capacity

- The maximum declared IFR capacity of 75 movements/hour was never exceeded.
- The declared IFR capacity was, however, exceeded for the following runway configurations:
- Declared capacity for 01 01 was exceeded by maximally 4 movements.
- Declared capacity for 19 19 was exceeded by maximally 3 movements.
- Declared capacity for 19,25R 25R was exceeded by maximally 8 movements.
- Declared capacity for 25R 25R was exceeded by maximally 8 movements

Punctuality

Arrival delay: Arrival Delay: 0.43 min/flight; CRSTMP delay: 0.04 min/flight

ATFM impact:

- Departures: 368,891 minutes ATFM delay, 5% (17,324 min) due to skeyes' regulations
- Arrivals: 277,817 minutes ATFM delay, 19% (52,955 min) due to skeyes' regulations

PRS

The preferential runway system was active 69% of the time in 2023.

CDO

Percentage of CDO flights over all CDO-capable arrivals increased to 80% for CDO Noise and stayed at 64% for CDO Fuel. A new KPI for the average time spent level-off was defined for different altitude bands.

Night movements

16,574 night movements (-2% vs 2022, -4% vs 2019)

SAFETY





Reasons Missed Approaches

Figure A.1: Missed approaches on RWY 25L/07R per reason in 2023

	Reasons	2019	2020	2021	2022	2023
	FOD (foreign object debris) on the runway	-	-	-	-	-
	aircraft with technical problems	-	-	-	-	-
	authorized vehicle still on runway	-	-	-	-	-
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	-	-	-	-	-
	no radio contact	1	-	-	-	-
	other	-	-	-	-	-
	pilot's error	-	-	-	-	-
7R	previous landing on the runway	4	-	1	2	-
,0 ∕	runway condition	-	-	-	-	-
R S	runway incursion	-	-	-	-	-
	tail wind	-	-	-	-	-
	taken out of sequence	-	-	-	-	-
	technical problems of ground equipment	-	-	-	-	-
	too close behind preceding	2	-	-	-	-
	training flight	-	-	-	-	-
	unstable approach	1	-	-	1	2
	weather - thunderstorm - windshear	1	-	-	-	-
	weather - visibility	-	2	-	-	-
	EOD (foreign object debric) on the runway	2	1	2	7	
	pireraft with technical problems	5	1	2	2	-
	authorized vehicle still on runway	2	-	-	2	5
	cabin crew not ready	2	1			1
	doparting traffic on the rupway	2	1			1
	no radio contact	2	-			-
	other	2	1		5	10
	pilot's error	3	1	-	-	-
_	previous landing on the runway	1	1	1	1	2
Y 25I	runway condition	-	-	-	-	2
N N	runway incursion	-	-	1	-	1
	tail wind	8	1	3	1	3
	taken out of sequence	1	-	2	4	4
	technical problems of ground equipment	1	-	-	-	-
	too close behind preceding	15	-	5	5	10
	training flight	2	-	-	-	-
	unstable approach	49	13	18	41	46
	weather - thunderstorm - windshear	18	13	3	19	10
	weather - visibility	11	8	4	9	3

Figure A.2: Missed approaches on RWY 25R/07L per reason in 2023

	Reasons	2019	2020	2021	2022	2023
	FOD (foreign object debris) on the runway	2	-	-	-	-
	aircraft with technical problems	-	-	1	1	-
	authorized vehicle still on runway	1	-	-	-	1
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	1	-	-	-	5
	no radio contact	-	-	-	-	-
	other	-	-	-	4	3
	pilot's error	-	-	-	-	-
ŗ	previous landing on the runway	4	-	2	3	3
	runway condition	-	-	-	-	1
	runway incursion	-	-	-	-	-
	tail wind	-	-	-	-	-
	taken out of sequence	1	-	-	1	-
	technical problems of ground equipment	-	-	-	-	1
	too close behind preceding	4	-	-	2	2
	training flight	-	1	-	-	1
	unstable approach	12	1	-	11	10
	weather - thunderstorm - windshear	-	-	-	-	-
	weather - visibility	1	-	-	-	2
		C C	2	2	~	-
	FOD (foreign object debris) on the runway	6	2	2	3	2
	aircraft with technical problems	2	4	6	2	6
	authorized vehicle still on runway	I	-	-	-	-
	cabin crew not ready	-	-	-		
	departing traffic on the runway	25	4	13	12	11
	no radio contact	1	-	-	1	-
	other	2	1	1	5	12
	pilot's error	1	1	1	3	1
5	previous landing on the runway	4	-	5	1	5
	runway condition	I	I	-	-	-
-		-	-	-	1	-
	tail wind	5	5	-	2	-
	taken out of sequence	-	-		1	-
	technical problems of ground equipment	-	-	-	-	1
	too close behind preceding	5	2	4	3	8
	training flight	-	-	-	-	-
	unstable approach	27	13	20	20	43
	weather - thunderstorm - windshear	4	9	1	9	2
	weather - visibility	14	3	7	4	2

	Reasons	2019	2020	2021	2022	2023
	FOD (foreign object debris) on the runway	-	-	2	2	1
	aircraft with technical problems	1	-	-	2	2
	authorized vehicle still on runway	-	-	-	-	-
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	1	2	-	-	1
	no radio contact	-	-	-	-	-
	other	-	-	2	2	1
	pilot's error	-	2	-	-	1
5	previous landing on the runway	-	-	1	-	1
×	runway condition	-	-	-	-	-
Å	runway incursion	-	-	1	1	-
	tail wind	1	-	-	1	-
	taken out of sequence	-	-	1	3	1
	technical problems of ground equipment	-	-	-	-	-
	too close behind preceding	7	2	11	5	8
	training flight	-	-	-	-	-
	unstable approach	18	5	9	8	15
	weather - thunderstorm - windshear	-	-	1	2	1
	weather - visibility	-	-	-	-	-
	FOD (foreign object debris) on the runway	-	-	-	-	-
	aircraft with technical problems	-	2	1	1	1
	authorized vehicle still on runway	-	-	-	-	-
	cabin crew not ready	-	1	-	-	-
	departing traffic on the runway	-	1	2	1	1
	no radio contact	-	-	-	-	-
	other	-	1	-	1	2
	pilot's error	-	-	-	-	-
6 L \	previous landing on the runway	-	3	-	2	3
Š	runway condition	2	-	-	-	-
-	runway incursion	-	-	-	-	-
	tail wind	-	1	-	-	-
	taken out of sequence	-	-	-	-	-
	technical problems of ground equipment	1	-	-	-	-
	too close behind preceding	3	1	-	3	-
	training flight	-	-	-	-	-
	unstable approach	3	10	2	3	4
	weather - thunderstorm - windshear	6	26	1	1	13
	weather - visibility	-	3	-	-	-

Figure A.3: Missed approaches on RWY 25L/07R per reason in 2023



Runway Performance Report **2023**



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