skeyes nice to guide you

Brussels Airport

RUNWAY PERFORMANCE REPORT 2022

skeyes / Tervuursesteenweg 303 / B-1820 Steenokkerzeel
T +32 2 206 21 11 / F +32 2 206 22 88

member of FABEC

www.skeyes.be

EXECUTIVE SUMMARY

The aviation sector is recovering and throughout Europe levels of 2019 are reached. Traffic at Brussels Airport is also increasing at a rapid rate and is in 2022 at 76% of 2019 traffic. All forecasts show a continuous increase in traffic and a promising 2023. The network is almost rebuilt with several months in 2022 above 80% of 2019 levels.

This report gives an overview of Air Traffic Management (ATM) Performance in Brussels Airport. ATM Performance is driven by four Key Performance Areas (KPAs): safety, capacity, environment, and cost-efficiency. This report focuses on skeyes' operations at Brussels Airport (International Civil Aviation Organization (ICAO) code: EBBR). Its aim is to provide main stakeholders with traffic figures for 2022 and relevant data on the performance of the operations at Brussels Airport, namely on three out of four KPA's: safety, capacity, and environment.

Traffic

Traffic in Brussels Airport is still recovering from the COVID-19 crisis. skeyes controlled 178,930 movements at Brussels Airport, an increase of 51% in 2022 compared to 2021. Overall, the traffic level was at 76% of traffic seen in 2019. In the summer months traffic went even above 80% of 2019 traffic. Passengers are finding their way from and to Brussels Airport again, it is the section that grew the most in 2022. Cargo traffic decreased in 2022 compared to 2021, a record year for cargo activities.

Traffic pattern is showing similar trends in 2022 with the period before COVID-19. As such the morning peak and evening peak during the day are back in the airport. As in the previous years, the most used runways are 25R and 25L, which is almost solely used for arrivals. In April and August, the usage of these runways was lower due to wind conditions leading to the use of the north easterly runways.

Safety

Safety is an important pilar in air traffic control. As such safety occurrences and missed approaches are followed up by skeyes' safety unit who analyses the situations, trends and when relevant investigates.

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 2022, 222 missed approaches were logged which is an increase of 56% compared to 2021. The rate of missed approaches per 1,000 arrivals increased with 4%. Unstable approach, weather conditions and "too close behind preceding" were the three most common reasons for a missed approach in 2022. skeyes promotes the increased use of PBN (Performance Based Navigation) procedures. Such approach greatly improve predictability; therefore, situational awareness can be improved.

For safety occurrences, the report shows the events on runways and taxiways increased compared to 2021. In particular, there were eleven runway incursions, of which three with an ATM contribution. One of those was a significant incident (C), the other two had no immediate safety effect (E). Other noteworthy items from the safety occurrences were the continued increase in wildlife strikes and deviations from ATM procedures and ATC clearances. skeyes is working together with the stakeholders to identify and implement mitigations to counter this trend.

Capacity and Punctuality

Brussels Airport has a declared capacity for most of the used runway configurations. This declared capacity is based on the airport lay-out and the traffic in Brussels Airport and provides the capacity used for scheduling purposes. This capacity is based on a theoretical throughput capacity based on certain assumptions and rules. This report shows that in Brussels Airport the effectively used capacity does not exceed the declared capacity.

Since 2015 skeyes is subject to an annual target regarding ATFM arrival delay, delay of a flight caused by a regulation attributable to the terminal and air navigation services of the destination airport. In 2022, only Brussels is considered as a contributing airport and the target is set on 1.08 minutes per flight and 0.12 minutes per flight for delay due to reasons in the CRSTMP category. In 2022, Brussels tower caused 9,620 minutes of delay in total of which 1,714 minutes were due to reasons in the CRSTMP category. Translated to delay per flight, this is 0.11 minutes for all reasons and 0.02 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 area 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. These deviations from the PRS are slightly higher in 2022 compared to 2021. In 2022 there was an adherence to the PRS of 75% in time and 78% in movements.

Another objective related to environment is Continuous Descent Operations (CDO) or green landings. The percentage of arrivals performing a CDO decreased slightly (1%). However, the indicators for both CDO Fuel (flying a CDO from FL100) and CDO Noise (flying a CDO from FL60) are steady in the last years. Nonetheless, skeyes is continuously trying to increase the number of CDOs flown, by promoting the use of PBN (Performance Based Navigation) procedures.

Noise is also a topic in the environmental discussion. To limit the noise at night there is a limited number of night slots. This report shows that traffic at night is at 98% of the night traffic in 2019. While traffic increased with 51% in 2022 compared to 2021, traffic at night had a slower increase of 27%. The increase of traffic was mainly day traffic (increase of 52%).

SAMENVATTING

De luchtvaartsector herstelt zich en in heel Europa worden opnieuw de verkeersniveaus van 2019 bereikt. Ook het verkeer op Brussels Airport neemt snel toe en bedraagt in 2022 al 76% van het verkeer van 2019. Alle prognoses wijzen op een gestage toename van het verkeer en een veelbelovend 2023. Het netwerk is bijna heropgebouwd met meerdere maanden in 2022 boven 80% van het niveau van 2019.

Dit verslag geeft een overzicht van de prestaties inzake luchtverkeersbeheer (ATM, *Air Traffic Management*) op Brussels Airport. De prestaties inzake luchtverkeersbeheer worden bepaald door vier kernprestatiegebieden (KPA's, *Key Performance Areas*): veiligheid, capaciteit, milieu en kostenefficiëntie. Dit verslag behandelt de activiteiten van skeyes op Brussels Airport (ICAO-code: EBBR). Het beoogt aan de belangrijkste stakeholders verkeerscijfers voor 2022 en relevante gegevens over de prestaties van de activiteiten op Brussels Airport te verstrekken, namelijk over drie van de vier KPA's: veiligheid, capaciteit en milieu.

Verkeer

Het verkeer op Brussels Airport herstelt zich nog altijd van de COVID-19-crisis. skeyes controleerde 178.930 bewegingen op Brussels Airport, goed voor een stijging met 51% in 2022 ten opzichte van 2021. Het totale verkeersniveau bedroeg 76% van het verkeer in 2019. In de zomermaanden stegen de verkeerscijfers zelfs boven de 80% van 2019 uit. Passagiers vinden opnieuw hun weg van en naar Brussels Airport; het is het segment dat het meest groeide in 2022. Het vrachtverkeer daalde in 2022 ten opzichte van 2021, een recordjaar voor vrachtactiviteiten.

Het verkeerspatroon vertoont in 2022 gelijkaardige trends als in het precoronatijdperk. Zo zijn de ochtend- en avondpiek overdag weer helemaal terug op de luchthaven. Net als in de voorgaande jaren zijn de meest gebruikte banen 25R en 25L, waarbij die laatste bijna uitsluitend voor aankomsten wordt gebruikt. In april en augustus werden deze banen minder vaak gebruikt omwille van de wind, die het gebruik van de noordoostelijke banen meer in de hand werkte.

Veiligheid

Veiligheid is een belangrijke pijler in de luchtverkeersleiding. Veiligheidsvoorvallen en afgebroken naderingen worden dan ook opgevolgd door de *safety unit* van skeyes, die de situaties en trends analyseert en, in voorkomend geval, onderzoek verricht.

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 veiligheid van de luchtvaartnavigatiedienstverlening te verbeteren. In 2022 werden 222 afgebroken naderingen geregistreerd, goed voor een stijging met 56% ten opzichte van 2021. Het aantal afgebroken naderingen per 1.000 aankomsten nam toe met 4%. Een onstabiele nadering, de weersomstandigheden en het te kort op het voorgaande vliegtuig volgen waren de drie meest voorkomende oorzaken voor een afgebroken nadering in 2022. skeyes promoot het toegenomen gebruik van PBN-procedures (*Performance Based Navigation*). Een dergelijke aanpak verbetert de voorspelbaarheid aanzienlijk, waardoor het situationeel bewustzijn kan worden verbeterd.

Wat de veiligheidsvoorvallen betreft, toont het verslag aan dat de voorvallen op start- en landingsbanen en taxibanen zijn toegenomen ten opzichte van 2021. Er deden zich in het bijzonder elf *runway incursions*, voor waarvan drie met een ATM-bijdrage. Eén daarvan was een significant incident (C), de andere twee hadden geen onmiddellijk effect op de veiligheid (E). Andere opmerkelijke elementen die uit de veiligheidsvoorvallen naar voren kwamen, waren de aanvaringen met in het wild levende dieren en afwijkingen van ATM-procedures en ATC-klaringen die voortdurend toenamen. skeyes werkt samen met de stakeholders om de oorzaak te achterhalen en deze trend in te perken.

Capaciteit en Stiptheid

Brussels Airport heeft voor de meeste van de gebruikte baanconfiguraties een opgegeven capaciteit. Die opgegeven capaciteit is gebaseerd op de plattegrond van de luchthaven en het verkeer op Brussels Airport en vormt de capaciteit die voor planningsdoeleinden wordt gebruikt. Die capaciteit is gestoeld op een theoretische doorvoercapaciteit uitgaande van bepaalde hypotheses en regels. Uit dit verslag blijkt dat de effectief gebruikte capaciteit op Brussels Airport de opgegeven capaciteit niet overschrijdt.

Sinds 2015 geldt voor skeyes een jaardoelstelling inzake ATFM-vertraging 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 2022 wordt enkel Brussels Airport beschouwd als een bijdragende luchthaven en wordt 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 2022 veroorzaakte de toren van Brussels Airport in totaal 9.620 minuten vertraging, waarvan 1.714 minuten door redenen uit de CRSTMP-categorie. Omgerekend naar de vertraging per vlucht bedraagt ze 0,11 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 deze voorwaarden wordt voldaan, kan een andere baanconfiguratie worden gebruikt. De afwijkingen van het PRS liggen in 2022 licht hoger dan in 2021. In 2022 werd het PRS als volgt nageleefd: voor 75% op het vlak van tijd en voor 78% op het vlak van bewegingen.

Een andere milieugerelateerde doelstelling houdt verband met de *Continuous Descent Operations* (CDO) of groene landingen. Het percentage aankomsten waarbij een CDO wordt uitgevoerd, is licht gedaald (1%). De indicatoren voor zowel *CDO Fuel* (CDO vanaf FL100) als *CDO Noise* (CDO vanaf FL60) zijn de laatste jaren echter stabiel. Toch tracht skeyes voortdurend het aantal gevlogen CDO's op te krikken door het gebruik van PBN-procedures (*Performance Based Navigation*) te bevorderen.

Geluidshinder is ook een thema in de milieudiscussie. Om de nachtelijke geluidshinder te beperken is er een beperkt aantal nachtslots. Uit dit verslag blijkt dat het nachtverkeer 98% van dat van 2019 bedraagt. Terwijl het verkeer in 2022 met 51% is toegenomen ten opzichte van 2021, nam het nachtverkeer minder snel toe met 27%. De toename van het verkeer betrof vooral het dagverkeer (toename met 52%).

SYNOPSIS

Le secteur de l'aviation se redresse et, dans toute l'Europe, les niveaux de 2019 sont à nouveau atteints. Le trafic à Brussels Airport augmente également à un rythme rapide et représente en 2022 76% du trafic de 2019. Toutes les prévisions montrent une augmentation continue du trafic et une année 2023 prometteuse. Le réseau est presque reconstruit, avec en 2022 plusieurs mois au-dessus de 80% des niveaux de 2019.

Ce rapport donne un récapitulatif des performances de la gestion du trafic aérien (*Air Traffic Management* (ATM) *Performance)* à Brussels Airport. Les performances ATM reposent sur quatre domaines de performance clés (KPA, *Key Performance Areas*) : la sécurité, la capacité, l'environnement et l'efficacité économique. Ce rapport se focalise sur les opérations de skeyes à Brussels Airport (code de l'Organisation de l'Aviation Civile Internationale (OACI) : EBBR). Son objectif est de fournir aux principaux stakeholders les chiffres du trafic pour 2022 et des données pertinentes sur la performance des opérations à Brussels Airport, à savoir pour trois des quatre KPA : la sécurité, la capacité et l'environnement.

Trafic

Le trafic à Brussels Airport se relève encore de la crise du Covid-19. skeyes a contrôlé 178.930 mouvements à Brussels Airport, soit une augmentation de 51% en 2022 par rapport à 2021. Dans l'ensemble, le niveau de trafic représentait 76% du trafic observé en 2019. Pendant les mois d'été, le trafic a même dépassé les 80% de celui de 2019. Les passagers retrouvent le chemin de et vers Brussels Airport, c'est le segment qui a le plus progressé en 2022. Le trafic de fret a diminué en 2022 par rapport à 2021, année record pour les activités de fret.

Les tendances du trafic en 2022 sont similaires à celles de la période précédant le Covid-19. Ainsi, les pics du matin et du soir reviennent à l'aéroport. Comme les années précédentes, les pistes les plus utilisées sont les 25R et 25L, cette dernière servant presque exclusivement pour les arrivées. En avril et en août, l'utilisation de ces pistes a été plus faible, à cause du vent qui favorisait les pistes situées au nord-est.

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, qui analyse les situations, les tendances et, le cas échéant, mène des enquêtes.

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 2022, 222 approches interrompues ont été enregistrées, soit une augmentation de 56% par rapport à 2021. Le taux d'approches interrompues pour 1000 arrivées a augmenté de 4%. Une approche instable, les conditions météorologiques et une trop grande proximité avec le trafic précédent sont les trois raisons les plus fréquentes d'une approche interrompue en 2022. skeyes encourage l'utilisation accrue des procédures PBN (*Performance Based Navigation*). Ce type d'approche améliore grandement la prévisibilité, ce qui permet d'améliorer la conscience situationnelle.

En ce qui concerne les événements liés à la sécurité, le rapport montre que les événements survenus sur les pistes et les taxiways ont augmenté par rapport à 2021. En particulier, il y a eu onze incursions de piste, dont trois impliquant l'ATM. L'une d'entre elles était un incident significatif (C), les deux autres n'ont pas eu d'effet immédiat sur la sécurité (E). D'autres éléments notables parmi les événements liés à la sécurité ont été l'augmentation continue des collisions avec la faune et des écarts par rapport aux procédures ATM et aux clairances ATC. skeyes collabore avec les stakeholders pour trouver une solution.

Capacité et Ponctualité

Brussels Airport dispose d'une capacité déclarée pour la plupart des configurations de pistes utilisées. Cette capacité déclarée est basée sur la configuration de l'aéroport et sur le trafic à Brussels Airport et fournit la capacité utilisée à

des fins de planification. Cette capacité repose sur un débit théorique fondé sur certaines hypothèses et règles. Ce rapport montre qu'à Brussels Airport, la capacité effectivement utilisée ne dépasse pas la capacité déclarée.

Depuis 2015, skeyes est soumise à un objectif annuel concernant le retard ATFM à l'arrivée, c'est-à-dire le retard d'un vol causé par une régulation imputable aux services terminaux et de navigation aérienne de l'aéroport de destination. En 2022, 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 2022, la tour de Bruxelles a causé 9.620 minutes de retard au total, dont 1.714 minutes pour des raisons relevant de la catégorie CRSTMP. Converti en retard par vol, ce chiffre est de 0,11 minute pour toutes les raisons et de 0,02 minute pour les raisons relevant de la catégorie CRSTMP, ce qui est bien en deçà de l'objectif.

Environnement

Brussels Airport est situé dans une zone densément peuplée et doit interagir avec la zone 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. Ces dérogations par rapport au PRS sont légèrement plus nombreuses en 2022 qu'en 2021. En 2022, le respect du PRS a été de 75% en temps et de 78% en mouvements.

Un autre objectif lié à l'environnement est celui des opérations en descente continue (CDO, *Continuous Descent Operations*) ou atterrissages verts. Le pourcentage d'arrivées effectuant une CDO a légèrement diminué (1%). Toutefois, les indicateurs relatifs au *CDO Fuel* (vols CDO à partir du FL100) et au *CDO Noise* (vols CDO à partir du FL60) sont restés stables ces dernières années. Néanmoins, skeyes s'efforce continuellement d'augmenter le nombre de CDO effectuées en encourageant l'usage de procédures PBN (*Performance Based Navigation*).

Le bruit est également un sujet de la discussion environnementale. Pour limiter le bruit la nuit, il existe un nombre limité de créneaux horaires (slots) nocturnes. Ce rapport montre que le trafic de nuit représente 98% de celui de 2019. Alors que le trafic a augmenté de 51% en 2022 par rapport à 2021, le trafic de nuit a connu une augmentation plus lente, de 27%. L'augmentation du trafic a été essentiellement due au trafic de jour (augmentation de 52%).

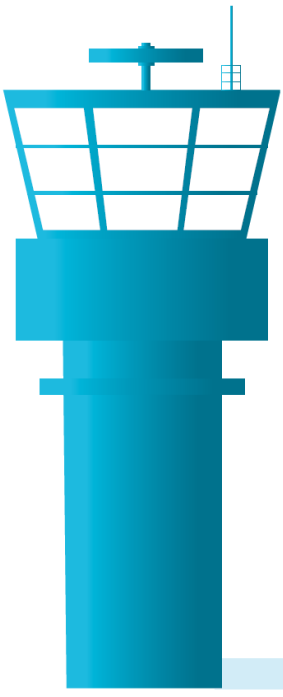


TABLE OF CONTENTS

LIST OF FIGURES

Figures

LIST OF TABLES

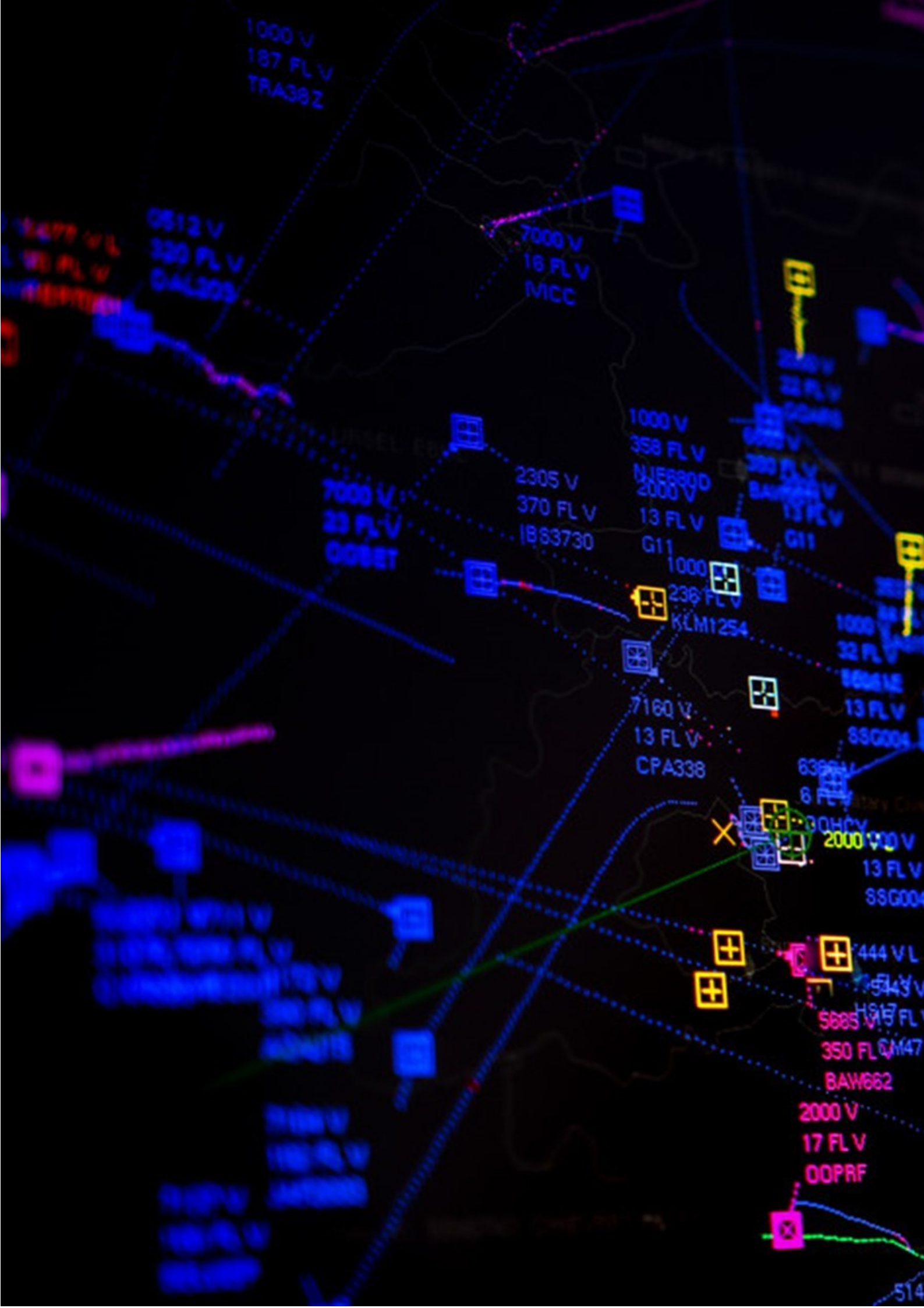
Tables

GLOSSARY

AAE	Above Aerodrome Elevation
AD	Aerodrome
AIP	Aeronautical Information Publication
AMC	Acceptable Means of Compliance
AMS	Airport Movement System
ANSP	Air Navigation Service Provider
ARR	Arrival
ATC	Air Traffic Control
ATCO	Air Traffic Control Officer
ATFM	Air Traffic Flow Management
ATIS	Automatic Terminal Information Service
ATM	Air Traffic Management
BATC	Brussels Airport Traffic Control
BCAA	Belgian Civil Aviation Authority
BSC	Belgium Slot Coordination
CAA	Civil Aviation Authority
CCO	Continuous Climb Operations
CDO	Continuous Descent Operation
CEM	Collaborative environmental management
COVID-19	Corona Virus Disease (2019)
CRSTMP	C-Capacity, R-Routing, S-Staffing, T- Equipment, M- Airspace Management, P-Special Event
CSMU	Corporate Safety Management Unit
CTOT	Calculated Take-Off Time
CTR	Control Zone of an Airport
DEP	Departure
DSA	Drone Service Application
EASA	European Aviation Safety Agency
EBAW	Antwerp Airport ICAO Code
EBBR	Brussels Airport ICAO Code
EBCI	Charleroi Airport ICAO Code
EBKT	Kortrijk-Wevelgem Airport Code
EBLG	Liege Airport ICAO Code
EBOS	Ostend Airport ICAO Code

GLOSSARY

ETOT	Estimated Take-Off Time
EU	European Union
FABEC	Functional Airspace Block Europe Central
FL	Flight Level
FMP	Flow Management Position
ft	Feet
GeoZones	Unmanned Aircraft System geographical zones
ICAO	International Civil Aviation Organization
IFR	Instrument Flight Rules
KPA	Key Performance Area
KPI	Key Performance Indicator
LIDAR	Light Detection And Ranging
LT	Local Time
LVO	Low Visibility Operations
LRST	Local Runway Safety Team
MCT	Maximum Capacity Throughput
NM	Nautical Mile
PANS	Procedures for Air Navigation Services
PBN	Performance Based Navigation
PRS	Preferential Runway System
PRU	Performance Review Unit
RAT	Risk Analysis Tool
RI	Runway Incursion
RMZ	Radio Mandatory Zone
ROTA	Runway Occupancy Time for Arrival
RP3	Reference period 3
RPAS	Remotely Piloted Aircraft System
RWY	Runway
SRO	Simultaneous Runway Occupancy
TMZ	Transponder Mandatory Zone
TWY	Taxiway
UAS	Unmanned Aircraft System
UTC	Universal Time Coordinated
VFR	Visual Flight Rules
VLL	Very low level zones


1000 V
187 FL V
TRA38Z
7000 V
16 FL V
MCC
2305 V
370 FL V
IBS3730
1000 V
358 FL V
2000 V
13 FL V
G11
236 FL V
KLM1254
7160 V
13 FL V
CPA338
2000 V
17 FL V
OOPRF
BAW662

1.Traffic

In this chapter, traffic at Brussels Airport (International Civil Aviation Organization (ICAO) code: EBBR) is presented as recorded by the Airport Movement System (AMS). The AMS is an in-house developed tower air traffic control (ATC) system and records the movements at an aerodrome and within its Control Zone (CTR). The movements are defined as an aircraft either crossing the CTR, landing or taking off at the aerodrome.

The figures presented throughout the report consider a movement as a take-off or landing of all traffic (flights under Visual Flight Rules (VFR) and Instrumental Flight Rules (IFR), helicopters and airplanes, commercial, military or general aviation). As this report considers runway performance, movements such as crossings of CTRs are not considered. As per BCAA's (Belgian Civil Aviation Authority) aerodrome movement definition:

- *one take-off = one movement*
- *one landing = one movement*
- *one touch-and-go = two movements*

Traffic Overview

Traffic in Brussels Airport is still recovering from the COVID-19 crisis. In 2022, traffic continued to increase with 51% compared to 2021 towards 178,930 movements, 76% of traffic seen in 2019. The number of aircraft movements over the past four years are as follows:

- 2019: 234,462 (231,275 IFR; 3,187 VFR)
- 2020: 95,813 (93,118 IFR; 2,695 VFR)
- 2021: 118,736 (116,072 IFR; 2,664 VFR)
- 2022: 178,930 (176,179 IFR, 2,751 VFR)

Figure 1.1 shows the traffic evolution at Brussels Airport since 1997. Peaks and drops are indicated with the events that caused them (Sabena's bankruptcy, Financial crisis, etc). Even though various events influenced the fluctuation over the last 25 years, it is COVID-19 that had the biggest impact on traffic. A forecast by the network manager EUROCONTROL states that traffic will fully recover in 2026.

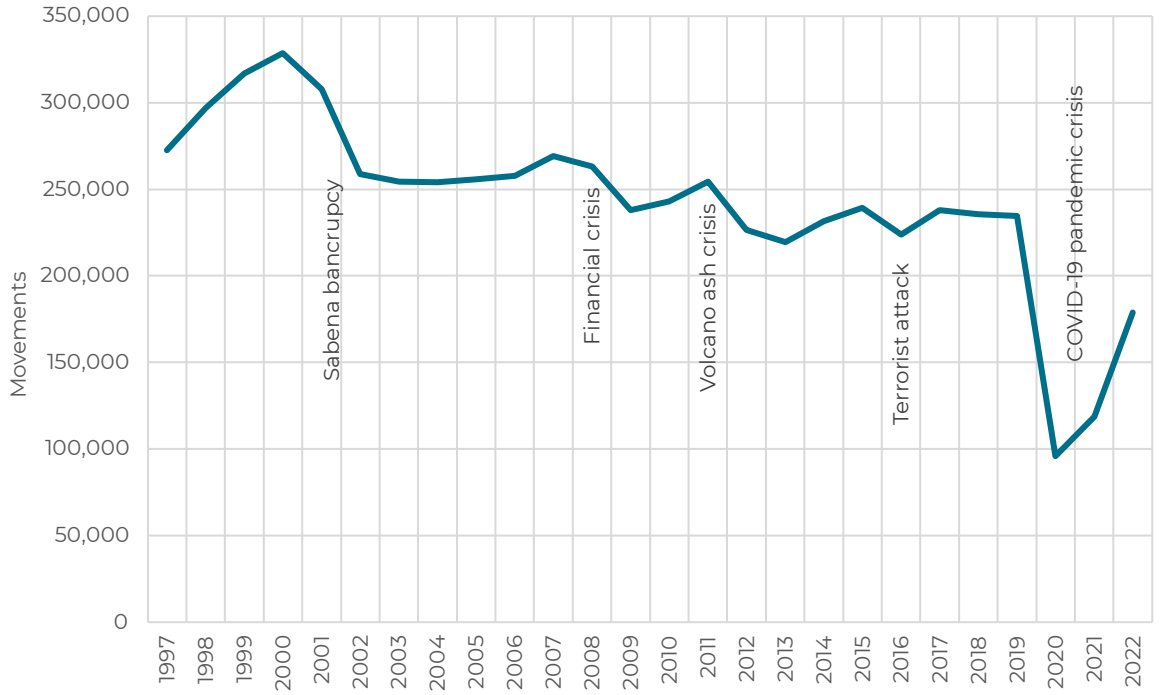


Figure 1.1: Historical traffic overview

Figure 1.2 provides information about the monthly evolution of the traffic at Brussels Airport for the previous four years. The years 2020 and 2021 were heavily impacted by the COVID-19 pandemic. In 2022, traffic is on the rise, mainly thanks to the increase in passenger flights that rose sharply in 2022. Cargo traffic decreased in 2022 compared to 2021, which was a record high year for cargo traffic. Although there was a decrease, 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.[1] The main cargo airline operating from Brussels Airport, European Air Transport (ICAO code: BCS), continued to increase their cargo operations in the last four years. Other airlines, like Aerologic (BOX), DHL UK (DHK), Qatar Airways (QTR) and Ethiopian Airlines (ETH) had more frequent cargo operations than in 2019 but had even more operations in 2020 or 2021. Cargo Airlines Virgin Atlantic (VIR) and Sichuan Airlines (CSC) started operating from Brussels Airport in the last four years and are in the top five cargo airlines in 2022. Kalitta Air (CKS), a top five cargo airline in 2019, had almost no movements in 2022.

[1]Aviation24, Brussels Airport invests 70 million euros to further modernise its cargo zone,2022,https://www.aviation24.be/airports/brussels-airport-bru/brussels-airport-invests-70-million-euros-to-further-modernise-its-cargo-zone (URL retrieved on 19/04/2023)

Traffic figures per month and per flight rule can be found in Table 1.1 with a comparison of 2022 with 2021 and with 2019. Arrival and departure figures are given in Table 1.2. The highest amount of traffic in 2022 was recorded in July with 18,204 movements.

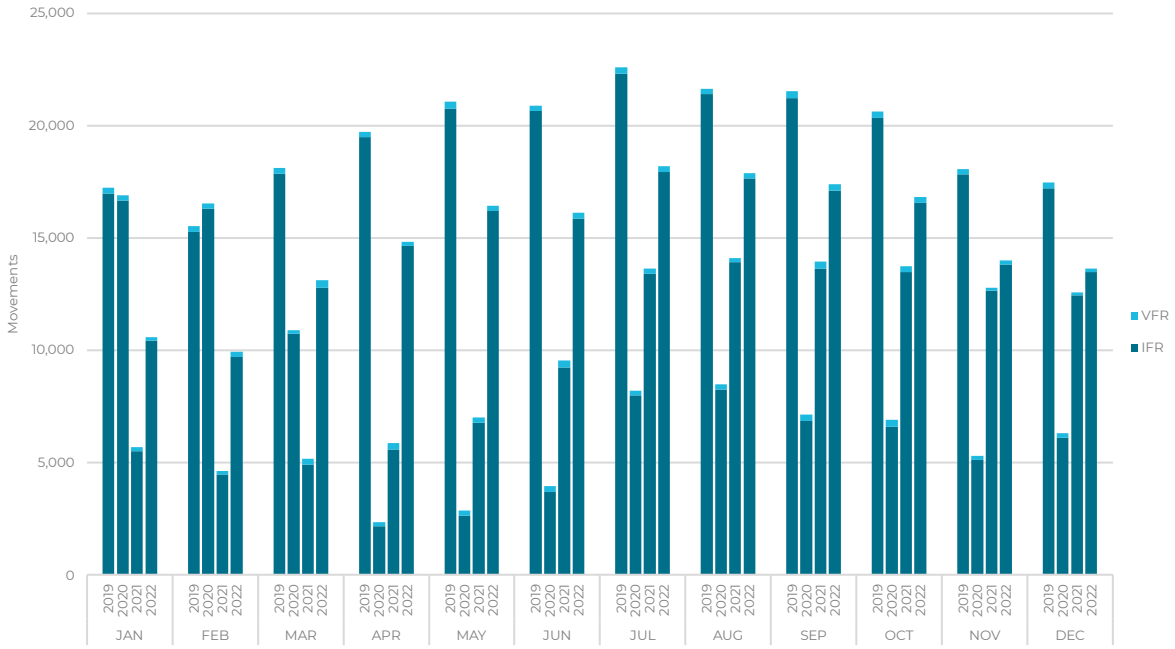


Figure 1.2: Total monthly movements per year

Table 1.1: Traffic figures per month and per flight rule

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
IFR	**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**
	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**
	2022 vs. 2019	-39%	-36%	-28%	-25%	-22%	-23%	-20%	-18%	-19%	-18%	-23%	-22%	**-24%**
	2022 vs. 2021	+90%	+118%	+160%	+161%	+139%	+72%	+34%	+27%	+25%	+23%	+9%	+8%	**+52%**
VFR	**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**
	2022	150	218	346	201	232	239	278	227	266	248	180	166	**2,751**
	2022 vs. 2019	-41%	-16%	+29%	-13%	-22%	+0%	-6%	+6%	-18%	-15%	-23%	-40%	**-14%**
	2022 vs. 2021	-17%	+29%	+38%	-28%	-1%	-21%	+24%	+32%	-13%	-7%	+24%	+29%	**+3%**
Total	**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**
	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**
	2022 vs. 2019	-39%	-36%	-28%	-25%	-22%	-23%	-19%	-17%	-19%	-18%	-23%	-22%	**-24%**
	2022 vs. 2021	+86%	+114%	+154%	+152%	+134%	+69%	+34%	+27%	+25%	+22%	+9%	+8%	**+51%**

Table 1.2: Arrival and departure traffic figures per month

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
ARR	**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**
	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**
	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**

DEP	**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**
	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**
	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**

On average there were 490 movements per day in 2022. Figure 1.3 shows the top ten days with the highest traffic and the ten days with the lowest traffic. Figure 1.4 shows a visualization of the movements per day in a calendar view. The top ten busiest days are all in the period from July to September, the busiest period of 2022. The winter period is the period with the lowest traffic. Two national strikes were held in 2022, on 20th of June 2022 and on 9th of November 2022, with a severe impact on traffic resulting in the day with the lowest number of movements and the fourth day with the lowest number of movements.

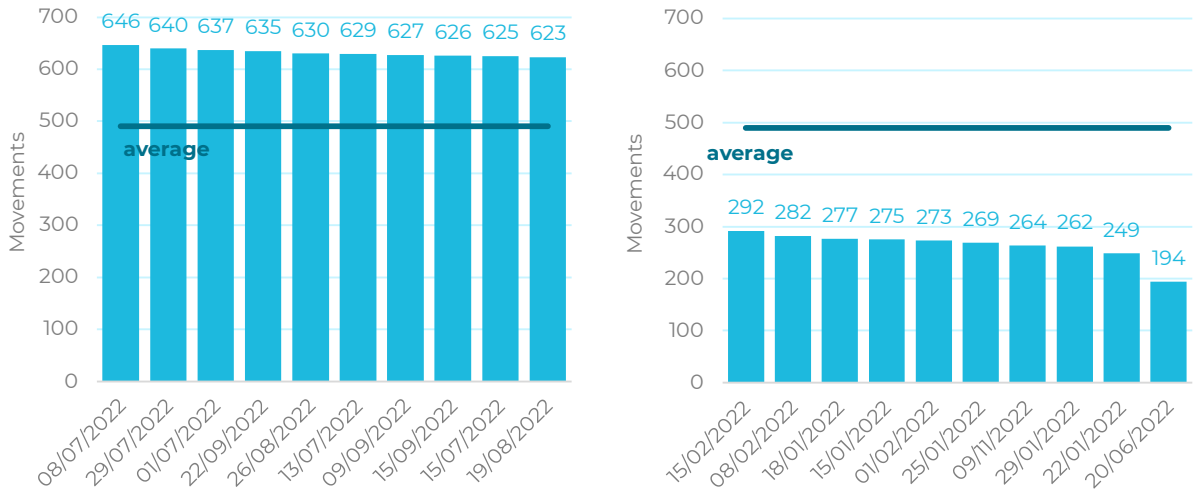


Figure 1.3: Top ten and bottom ten days in traffic in 2022

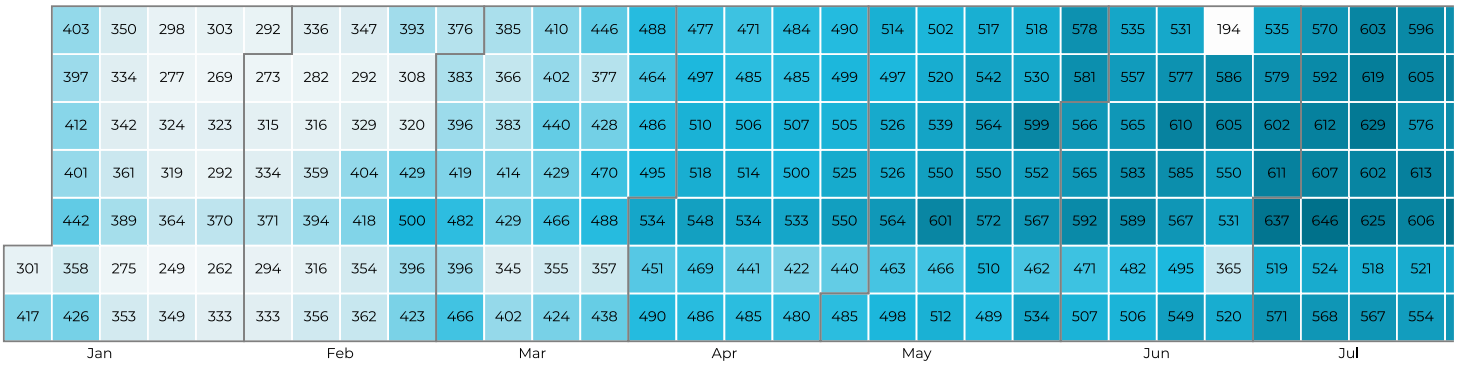


Figure 1.4: Calendar view of movements per day in 2022

Traffic Patterns

The graph in Figure 1.5 show the average traffic pattern throughout the hours of the day, in local time (LT), over the period from 2019 to 2022. While in 2020 and 2021 an overall decrease in traffic was seen with small peaks during the day, traffic in 2022 is showing a similar pattern to 2019 with a peak in the morning and a peak in the evening.

Traffic pattern tends to be different in the weekends. Figure 1.6 to Figure 1.8 show the traffic pattern on weekdays, Saturdays and Sundays. On weekdays a morning peak and an evening peak can be seen. On Saturdays there is only one peak, a morning peak, and no peak in the evening. On Sunday there is an evening peak but the peak in the morning is lower than the one on weekdays and Saturday.

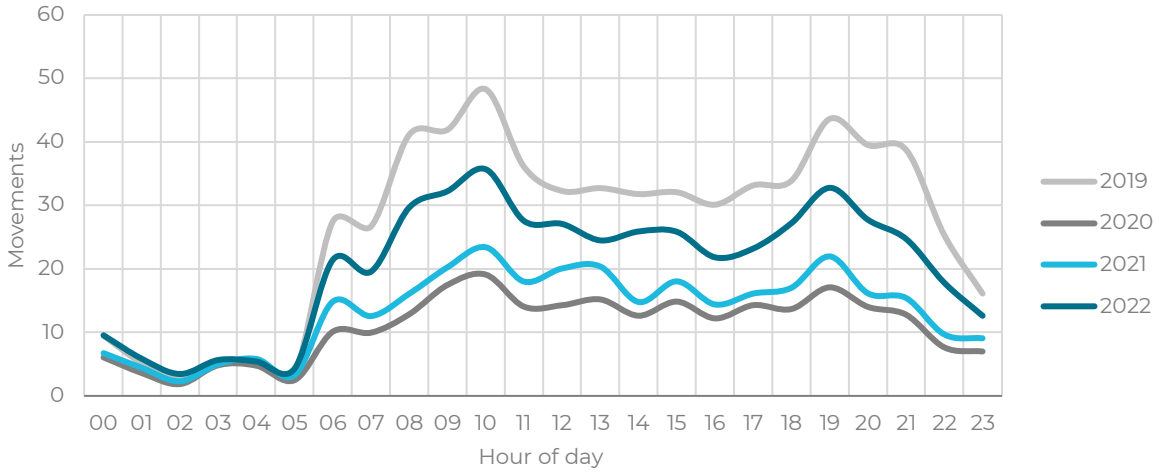
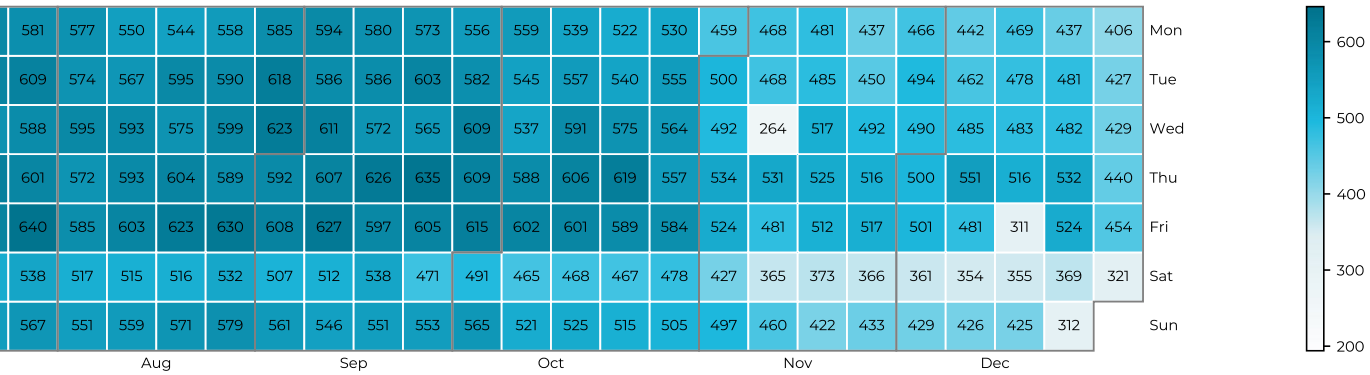


Figure 1.5: Average traffic pattern in local time



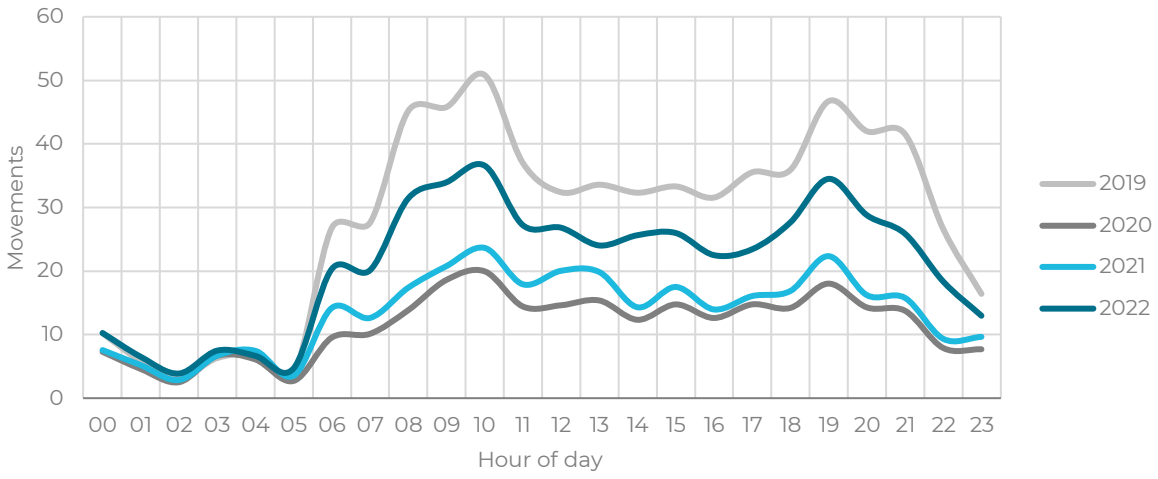


Figure 1.6: Average traffic pattern on weekdays (Monday-Friday) in local time

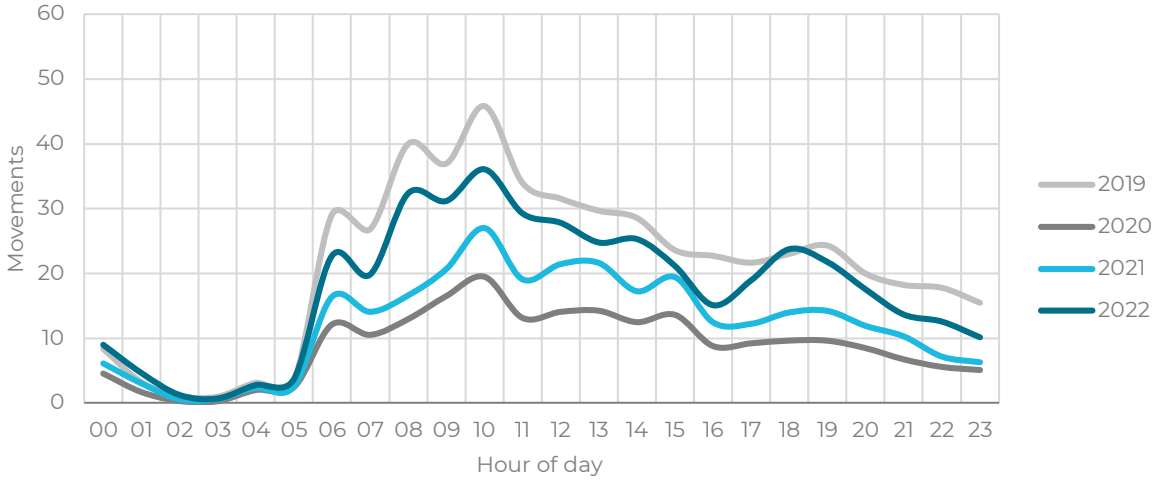


Figure 1.7: Average Traffic pattern on Saturday in local time

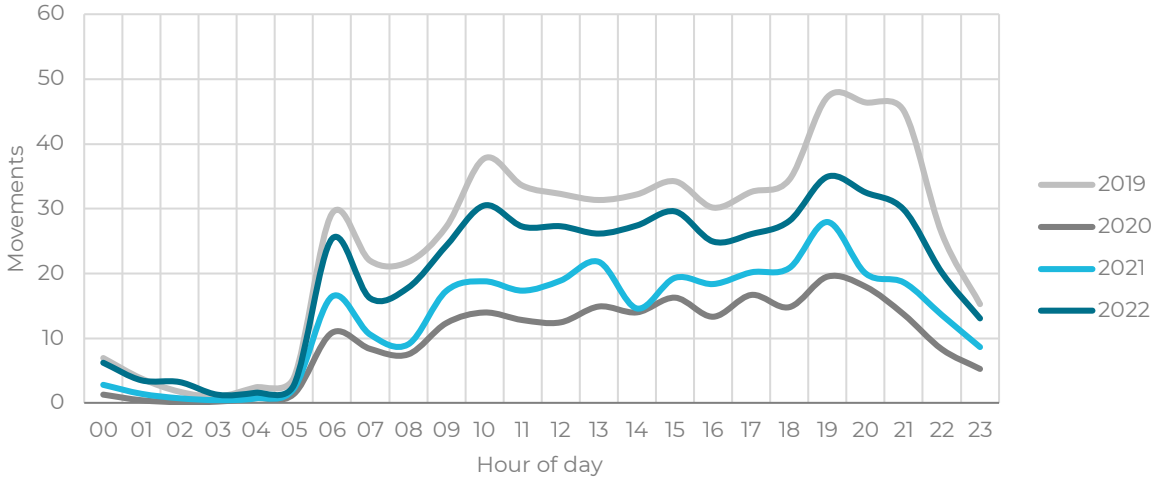


Figure 1.8: Average Traffic pattern on Sunday in local time

Runway Use

Brussels Airport has six runways in total: 25L/07R, 25R/07L and 19/01. See Figure 1.9 for the lay-out of the runways at Brussels Airport. The use of one runway configuration over another depends on several factors that must be considered, such as meteorological conditions, airport layout, agreement with the state, etc. Chapter 4 gives a more elaborate discussion on the influencing factors. Figure 1.10 shows the runway use at Brussels Airport and an indication of the departures and arrivals. Runway 25R is the most frequently used runway for all movements. Runway 25L is almost solely used for arrivals. 2020 was a special year for Brussels Airport, apart from the COVID-19 impact on the traffic, there were renovation works on RWY 25R/07L resulting in a more intensive use of runway 19.

In 2022, more use of the runways 07R and 07L was registered. These runways were used for 13% of the time, an increase compared to 9% in 2021 and 10% in 2019.

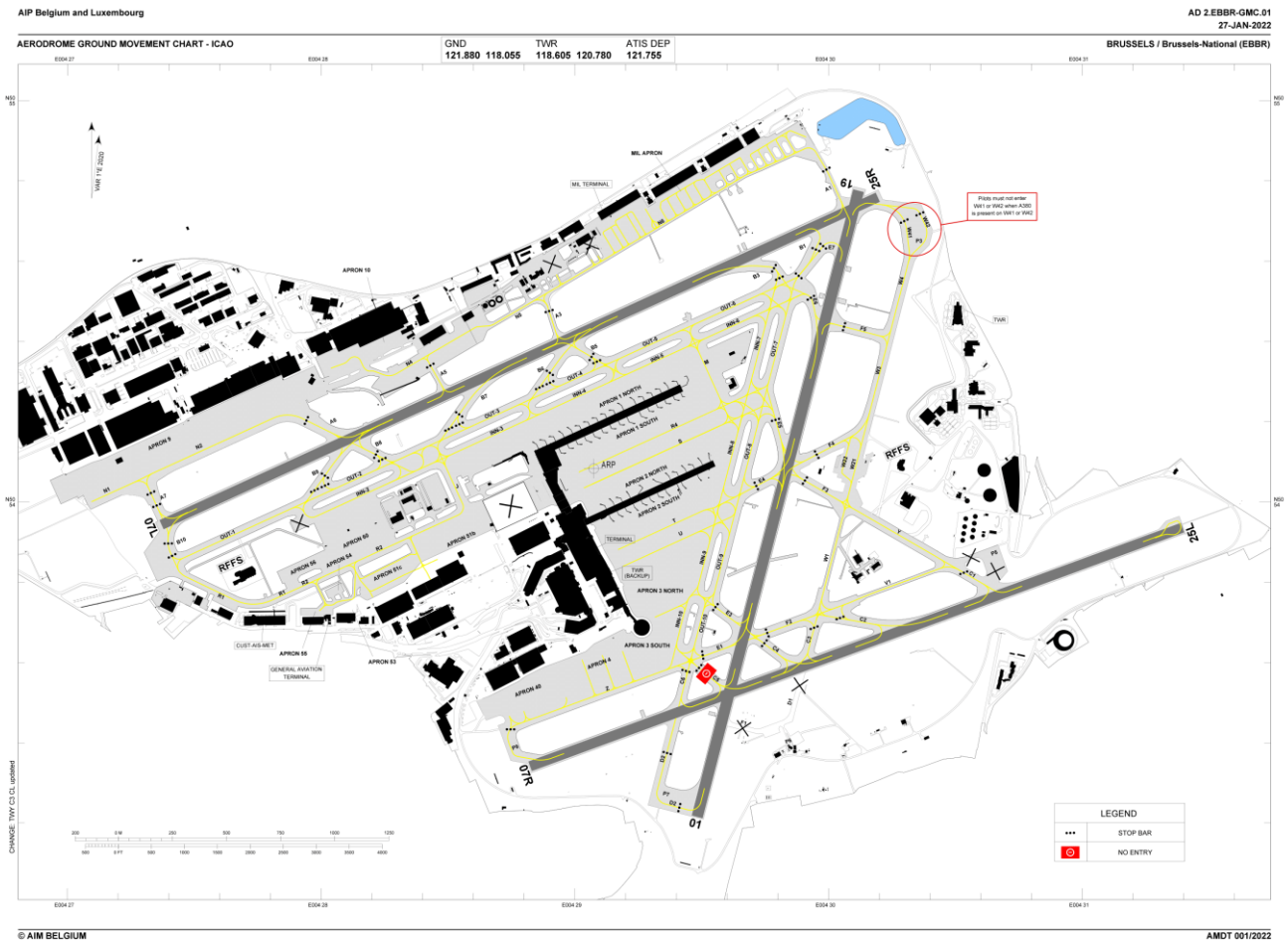


Figure 1.9: Aerodrome Ground Movement Chart - ICAO

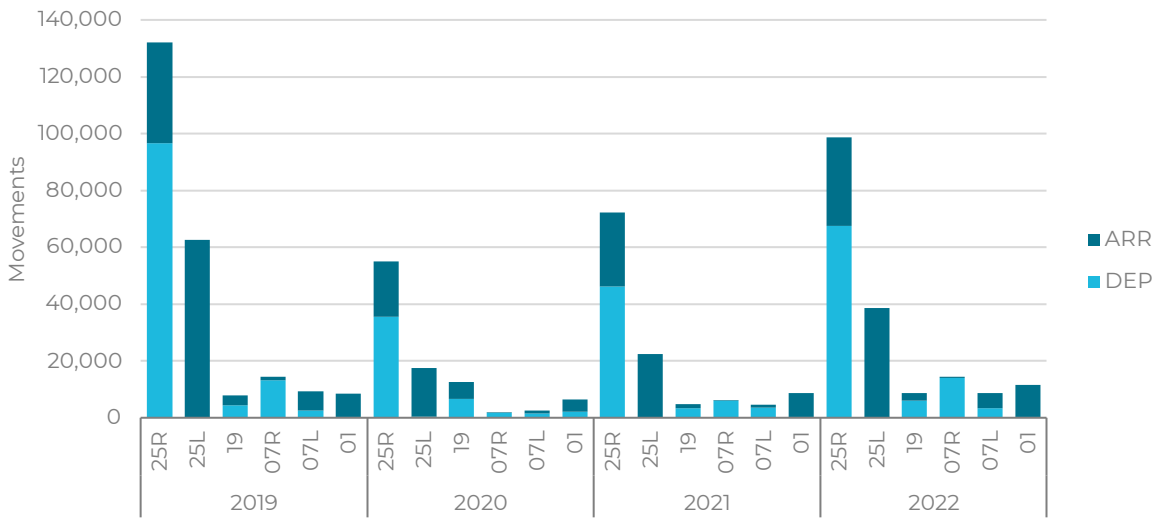


Figure 1.10: Departures and arrivals per runway per year

Figure 1.11 shows the runway use per month in percentages. Runway 25R and runway 25L are the most used runways in total. For April and August, these runways are less used compared to other months because there were more north-easterly winds during those periods. The wind roses are given in Chapter 4.

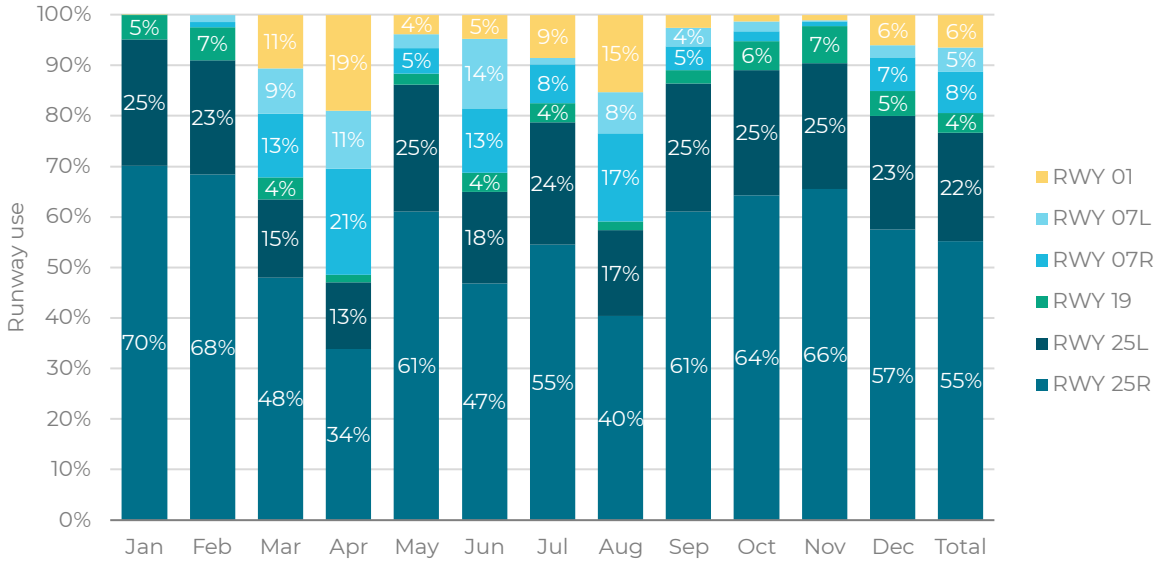


Figure 1.11: Share of runway use per month in 2022

Drone Activities

The challenges and opportunities associated with the expected widespread growth of unmanned aerial vehicles will be one of the factors driving the future of Air Navigation Service Providers (ANSP). Early 2020, the company skeydrone was created as subsidiary of skeyes. skeydrone envisages to play a central role in the implementation of U-space, a set of specific services and procedures designed to ensure safe and efficient access to airspace for a large number of drones, in Belgium. skeydrone offers a wide variety of services that enable safe and efficient drone operations in all types of airspace. Those services are provided to authorities – such as managers of Unmanned Aircraft System (UAS) geographical zones – and operators of critical infrastructure – such as ports, nuclear plants, prisons and industrial complexes. It provides soft- and hardware based solutions that allow to manage safety & security related risks associated with drone flights in and around their areas of responsibility. skeydrone also supports drone operators – both large and small enterprises, as well as government agencies – in order to offer solutions that allow to plan and execute flights in the safest and most efficient manners[2].

The UAS geographical zones, also called "GeoZones" are only accessible to drones complying with technical and operational criteria, as well as restrictions with regard to the use of these drones. Therefore, to facilitate planning, coordination and information flow between drone operators and Air Traffic Control, skeydrone has implemented a web application: the Drone Service Application (DSA). The two main objectives of DSA are to simplify the planning process for drone operators, and to visualize the planned drone operations for skeyes, which is the GeoZone manager for controlled airspace above and around the airports of Brussels, Antwerp (ICAO code: EBAW), Charleroi (ICAO code: EBCI), Kortrijk (ICAO code: EBKT), Liège (ICAO code: EBLG) and Ostend (ICAO code: EBOS)[3,4]. This source is used to show the drone activity in the following figures of this section.

Figure 1.12 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:

- **high risk:** runway and surroundings
- **moderate risk**: departure/approach track, visual circuits and rest of the control zone above 400 ft above aerodrome elevation (AAE), excluding the high risk zone
- **low risk**: on the edge of the control zone below 400 ft AAE, outside the moderate and high risk zone

For Kortrijk-Wevelgem, where there is a Radio Mandatory Zone (RMZ), the categories are defined as:

- **high/moderate risk:** runway, departure/approach track, visual circuits from ground to the top of the RMZ
- **low risk:** the entire RMZ outside the high/moderate risk zone, but where drone operation cannot be higher than 400 ft above ground level

[2] skeydrone, "Enabling safe drone operations", 2022. https://skeydrone.aero/ (URL retrieved on 21/04/2022)

[3] UAS geographical zone statuses can be seen at https://map.droneguide.be (URL retrieved on 21/04/2022)

[4] 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)

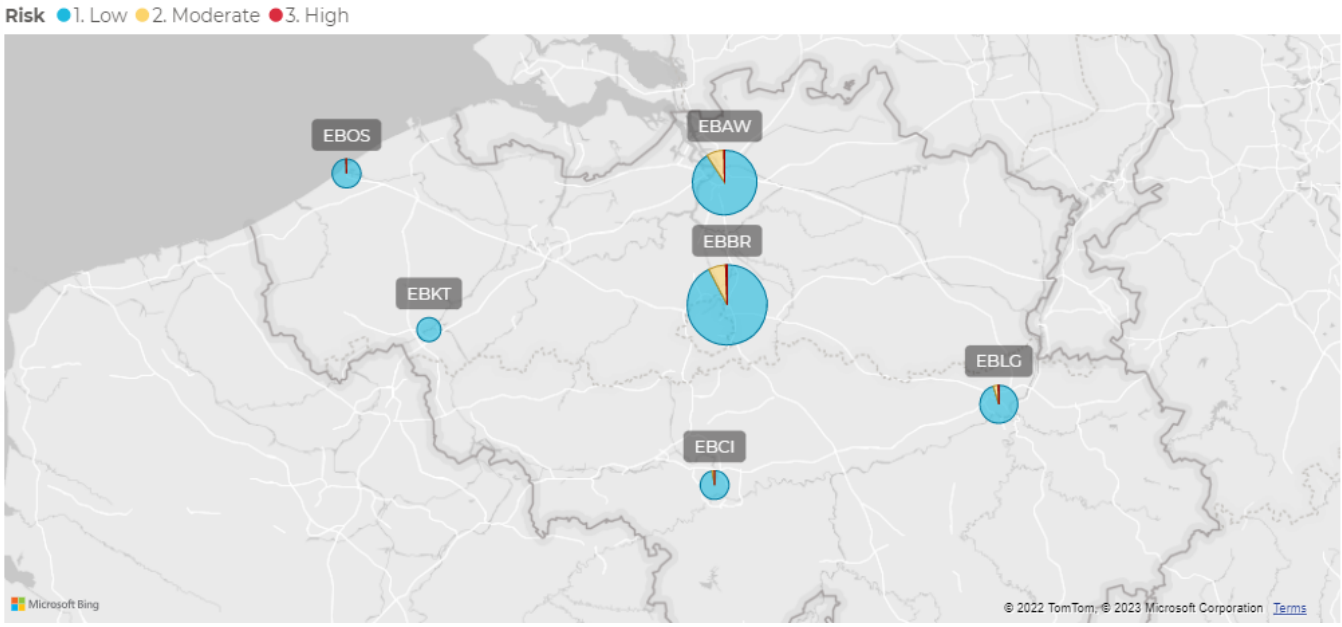


Figure 1.12: Drone activities in 2022 in the CTR or RMZ/TMZ where skeyes provides air traffic services

As per European Union Aviation Safety Agency (EASA) definition[5], 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 1.3 provides an overview of the complexity of operations at Brussels Airport and the other five airports, where skeyes provides services. In addition, Figure 1.13 provides a detailed view of the authorized activities around Brussels Airport in 2022, displaying the initial coordinates of all UAS.

Table 1.3: Authorized drone activities per EASA risk category in 2022

	OPEN	SPECIFIC	FORMER CLASS 1[6]	Total
EBBR	**3,481**	**1,709**		**5,190**
EBAW	2,557	1,181		3,738
EBCI	58	345		926
EBKT	333	163	8	504
EBLG	1,161	536		1,697
EBOS	562	182	11	845
Outside regions controlled by skeyes	1,354	281	26	1,661
Total	10,119	4,397	45	14,561

[5] EASA, "Drones - regulatory framework background". https://www.easa.europa.eu/domains/civil-drones/drones-regulatory-framework-background (URL retrieved on 21/04/2022)

[6] Since 31/12/2020, the EU Drone Regulation has been in force in Belgium and old licenses for FORMER CLASS 1 operations expired a year after, i.e. at the end of 2021. Thus, no operations in the FORMER CLASS 1 category should have taken place in 2022 – yet some records can be found in the logs of the DSA. For further information, contact skeydrone.

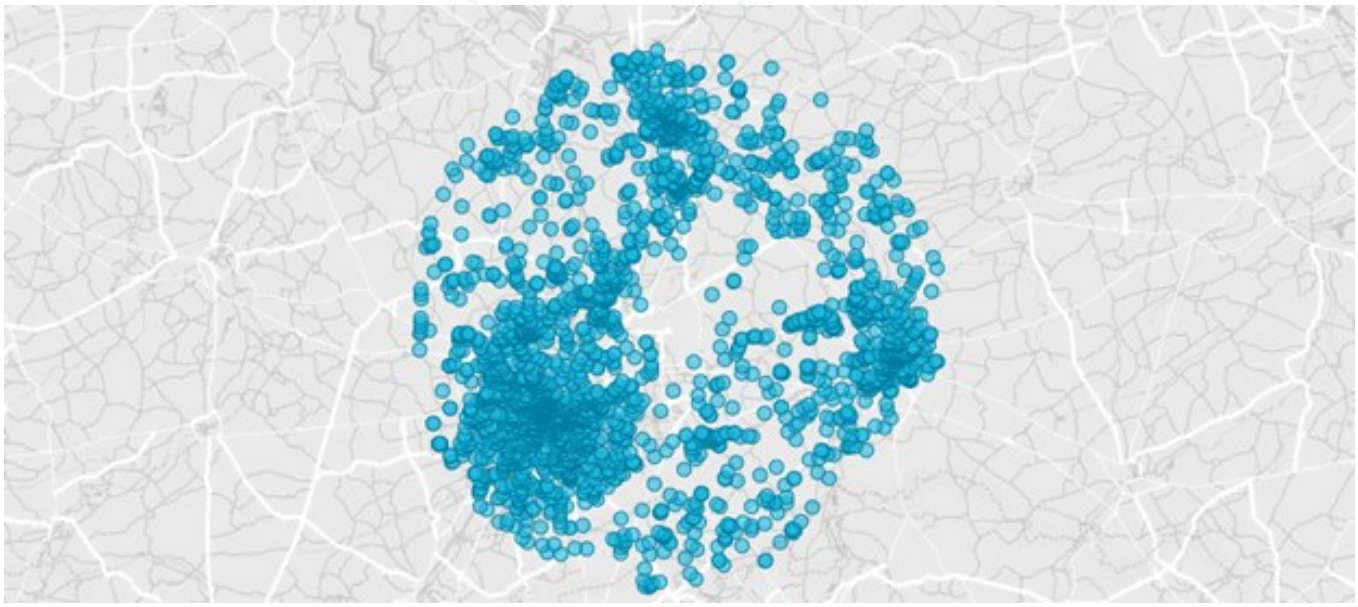


Figure 1.13: Initial coordinates of drone activities near Brussels Airport in 2022


brussels airlines
brus
airp

2. Safety

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

The missed approaches covered in the following 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 skeyes had in the chain of events (in accordance with EU Reg 376/2014 and EU Reg 2019/317). The following chapters indicate the severity classification that was 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 air traffic control (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 monitored on a weekly basis. Missed approaches are closely followed by skeyes' safety unit, trends are analysed and when relevant, investigations are conducted to identify root causes and implement improvement measures.

In 2022, 222 missed approaches were logged, an increase of 56% compared to 2021. This increase is higher than the increase in number of arrivals in 2022 compared to 2021 (51%). The graph in Figure 2.1 presents the rate of missed approaches per 1,000 arrivals for the previous four years. The number of arrivals is provided by the AMS under the BCAA's aerodrome movement definition. Overall the rate of missed approaches increased by 4% in 2022 compared to 2021. In 2020, an exceptional high number of missed approaches due to meteorological conditions were registered, mainly because of storms that occurred in February 2020. Also, due to the small amount of arrivals on RWY 07R, variations on the number of missed approaches create fluctuations on the missed approach rate (e.g. 2020 with a rate of 14.7, being two missed approaches. and in 2022 a rate of 6.1, being three missed approaches).

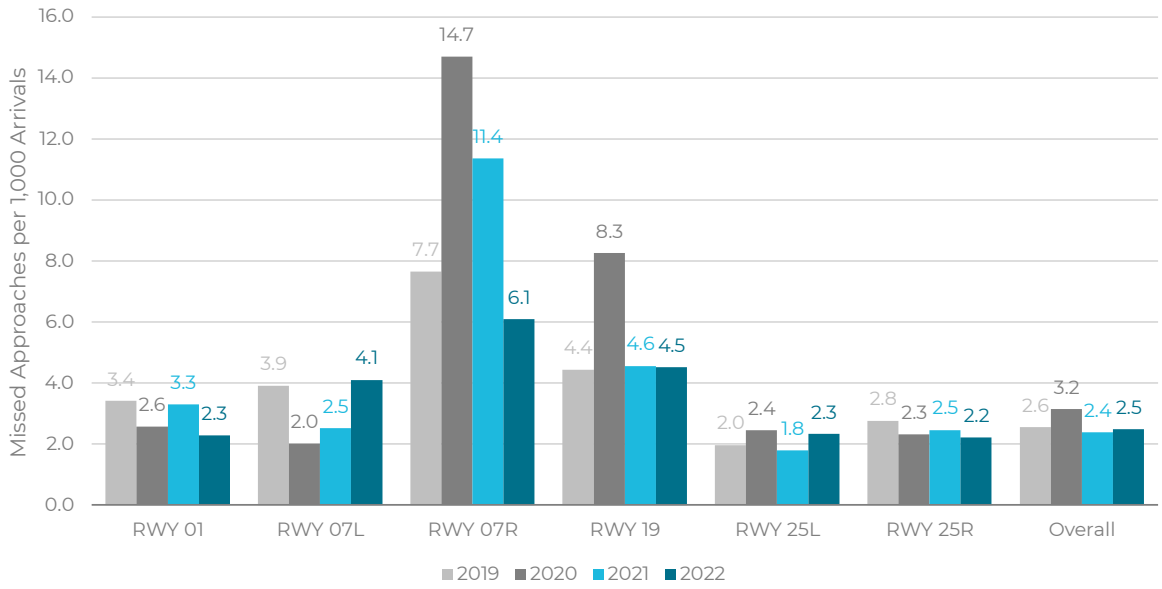


Figure 2.1: Missed approaches per 1,000 arrivals per runway since 2019 at Brussels Airport

All missed approaches are recorded by cause of event, and the reporting is done by the ATCOs. Figure 2.2 shows the missed approaches per cause in 2022. Unstable approach, weather conditions and too close behind preceding were the three most common reasons for a missed approach in 2022.

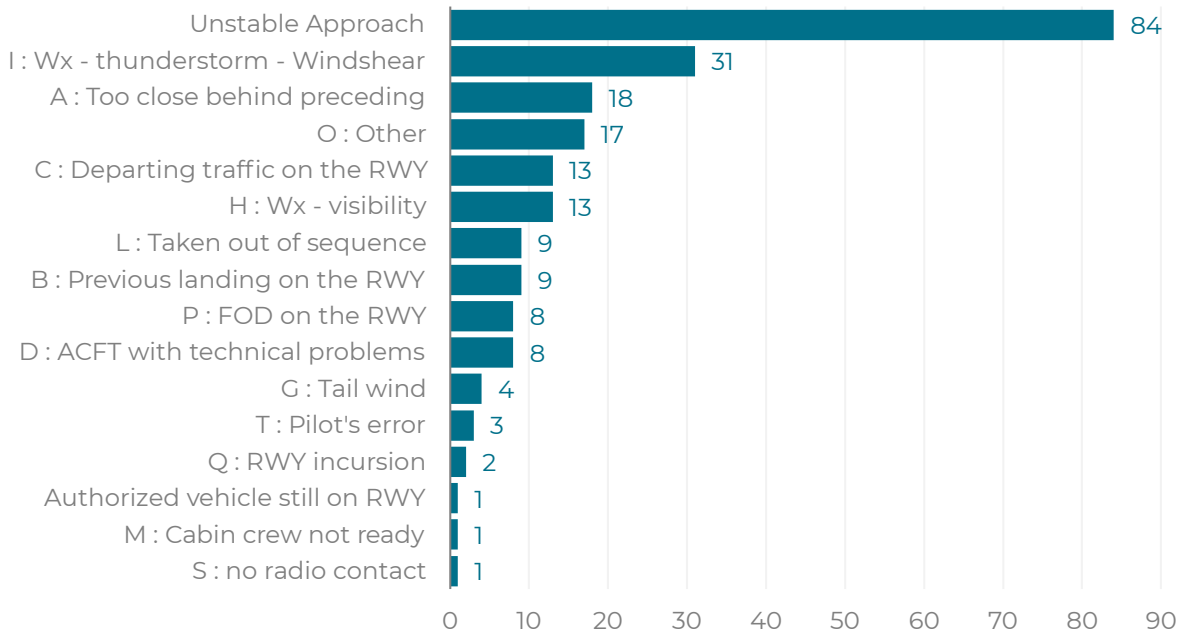


Figure 2.2: Missed approaches in 2022 per cause

Table 2.2 shows the main causes for each runway. Each table shows the number of missed approaches per year and the number of missed approaches due to the top five reasons for each runway in 2022 with an indication of the frequency. Most missed approaches were registered on the main runways, runway 25L (90 missed approaches) and 25R (69 missed approaches). The main reasons for a missed approach on these runways were an unstable approach, weather conditions and departing traffic on the runway. 22 missed approaches were reported on 07L, a steep increase compared to last year but in line with 2019. On runway 07R three arrivals did a missed approach. Runway 01 had 26 missed approaches, similar to 2019 and 2021. 12 missed approaches were reported on runway 19, the number is in line with 2019 and 2021. In 2020, runway 19 was used more often and this resulted in more missed approaches on that runway.

Table 2.2: Top five causes for missed approaches in 2022 per runway and the frequency in previous years

Top 5 causes in 2022 RWY 25L	2019	2020	2021	2022
Total Missed Approaches	123	42	40	90
Unstable Approach	49	13	18	41
I : Wx - thunderstorm - Windshear	18	13	3	19
H : Wx - visibility	11	8	4	9
A : Too close behind preceding	15		5	5
O : Other		1		5
Part top 5 causes of 2022	76%	83%	75%	88%

Top 5 causes in 2022 RWY 25R	2019	2020	2021	2022
Total Missed Approaches	98	45	64	69
Unstable Approach	27	13	20	20
C : Departing traffic on the RWY	25	4	13	12
I : Wx - thunderstorm - Windshear	4	9	1	9
O : Other	2	1	1	5
H : Wx - visibility	14	3	7	4
Part top 5 causes of 2022	73%	67%	66%	72%

Top 5 causes in 2022 RWY 07L	2019	2020	2021	2022
Total Missed Approaches	26	2	3	22
Unstable Approach	12	1		11
O : Other				4
B : Previous landing on the RWY	4		2	3
A : Too close behind preceding	4			2
L : Taken out of sequence	1			1
Part top 5 causes of 2022	81%	50%	67%	95%

Top 5 causes in 2022 RWY 07R	2019	2020	2021	2022
Total Missed Approaches	9	2	1	3
B : Previous landing on the RWY	4		1	2
Unstable Approach	1			1
I : Wx - thunderstorm - Windshear	1			
S : no radio contact	1			
A : Too close behind preceding	2			
Part top 5 causes of 2022	100%	0%	100%	100%

Top 5 causes in 2022 RWY 01	2019	2020	2021	2022
Total Missed Approaches	28	11	28	26
Unstable Approach	18	5	9	8
A : Too close behind preceding	7	2	11	5
L : Taken out of sequence			1	3
D : ACFT with technical problems	1			2
P : FOD on the RWY			2	2
Part top 5 causes of 2022	93%	64%	82%	77%

Top 5 causes in 2022 RWY 19	2019	2020	2021	2022
Total Missed Approaches	15	49	6	12
Unstable Approach	3	10	2	3
A : Too close behind preceding	3	1		3
B : Previous landing on the RWY		3		2
I : Wx - thunderstorm - Windshear	6	26	1	1
C : Departing traffic on the RWY		1	2	1
Part top 5 causes of 2022	80%	84%	83%	83%

Runway Incursions (RI)

According to 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 AMC 3 of EU Reg 2019/317, the 'incorrect presence' is 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 2022 can be seen in Figure 2.3. In total there were eleven runway incursions. Three were with air traffic management (ATM) contribution. One was a significant incident (C) in May, where a vehicle entered the sensitive area of the runway during low visibility procedures without ATC clearance. The other two were incidents without an immediate safety effect, both concerning the crossing of a red stop bar. Eight of the eleven runway incursions had no ATM ground contribution. Figure 2.4 gives a yearly overview of the runway incursions for the period from 2019 until 2022. The total number of runway incursions in 2022 is higher than in 2021 where there were ten runway incursions. The runway incursions with no ATM contribution increased by one.

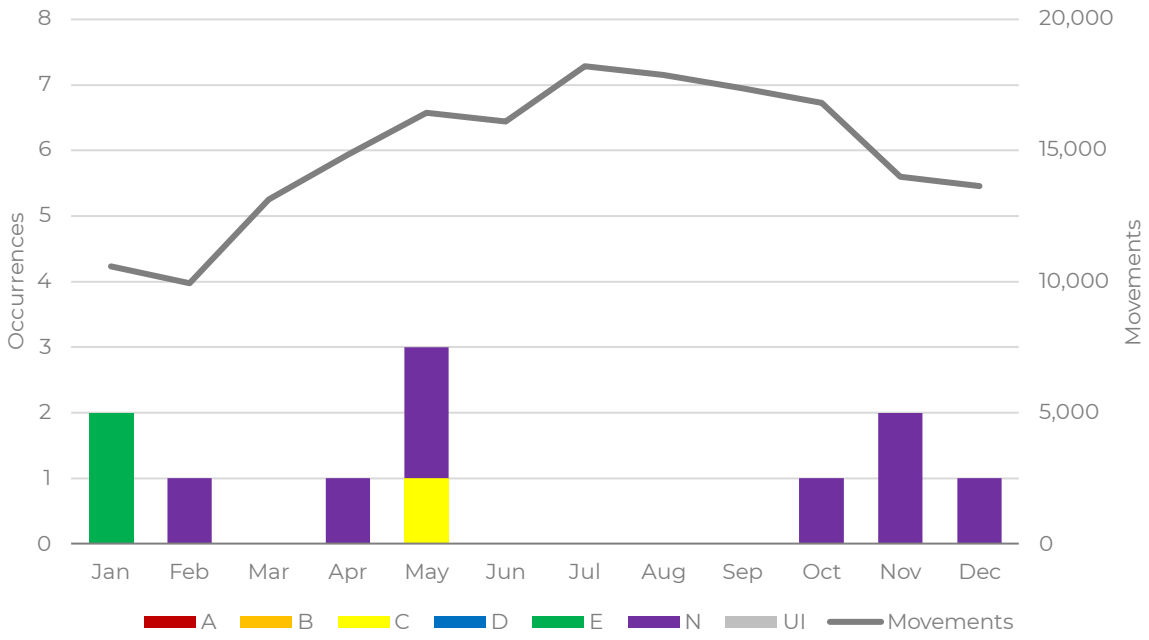


Figure 2.3: Runway incursions at Brussels Airport by month in 2022

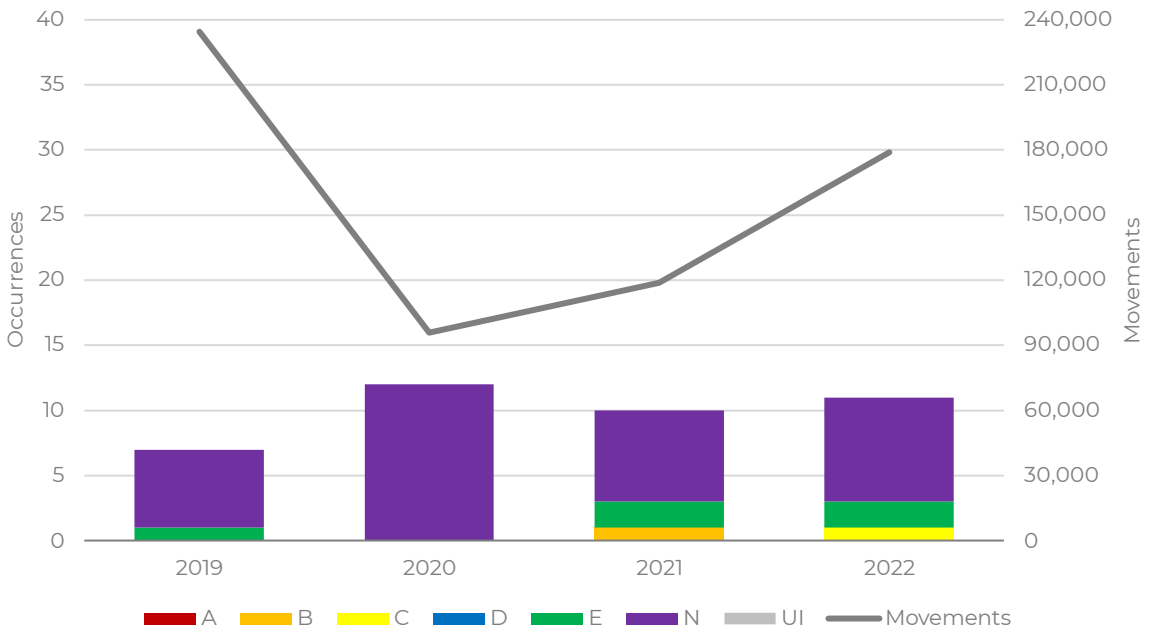


Figure 2.4: Runway incursions per severity category at Brussels Airport in 2019-2022, per year

Figure 2.5 allows to put the numbers above in perspective, by comparing the ratio of runway incursions per 100,000 flights, per year. The rate of runway incursions was significantly bigger in the last three years compared to 2019. The rate of runway incursions decreased in 2022 compared to 2021.

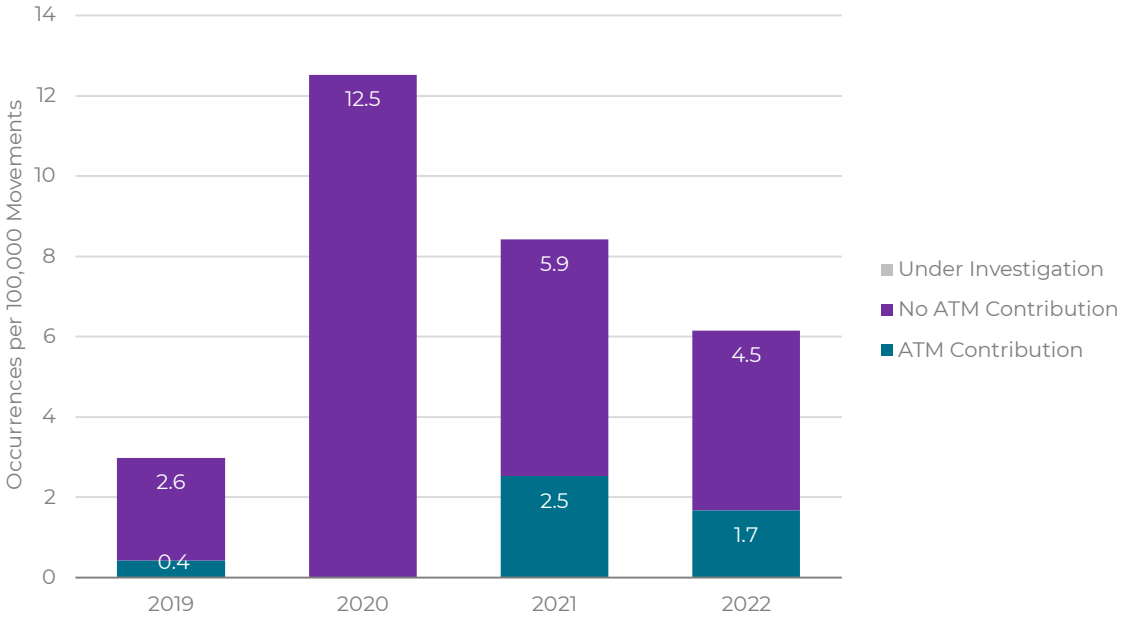


Figure 2.5: Rates of runway incursions by ATM contribution per 100,000 movements, per year

Besides incursions of the runway, other events can occur on the runway and in extent the taxiway. Figure 2.6 shows these events per category for the period 2019 to 2022. The number of these events did increase since 2020.

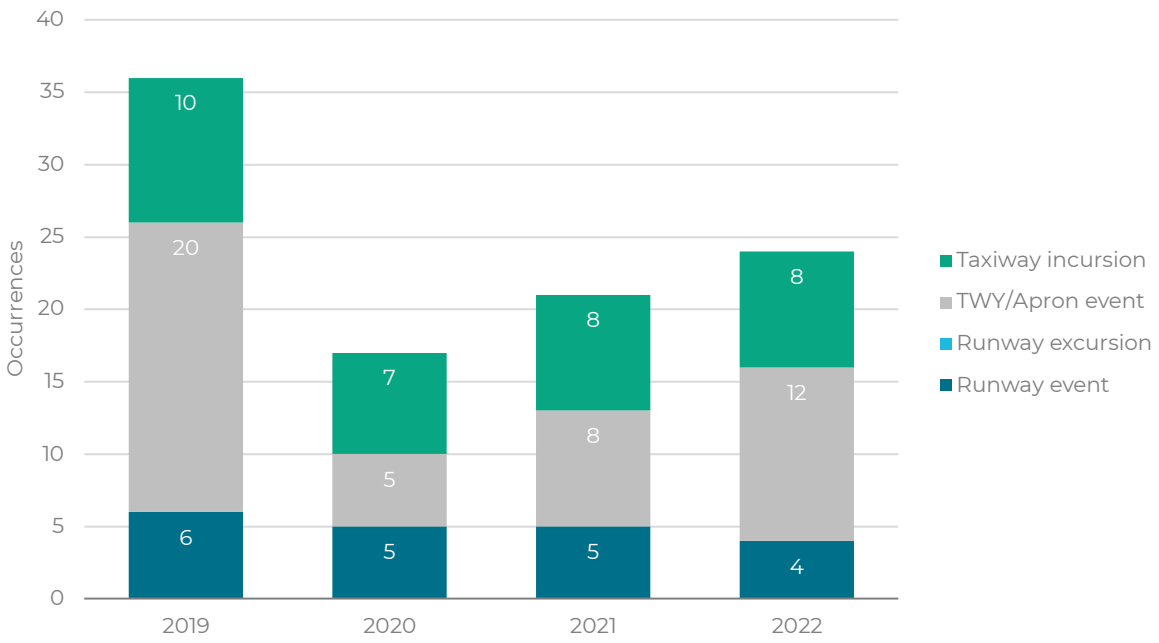


Figure 2.6: Runway and taxiway safety related occurrences by year

Other Noteworthy Incidents

Safety occurrences of other types are discussed in this section. In 2022, there were 262 reports of wildlife strikes, an increase of 30% compared to 2021 and 62 reports more than in 2019 (200 reports). Comparing the wildlife reports per 100,000 movements, there were 72 % more wildlife strikes per 100,000 movements compared to 2019. There has been a decrease compared to 2021 when there was a very high number of wildlife strikes reported.

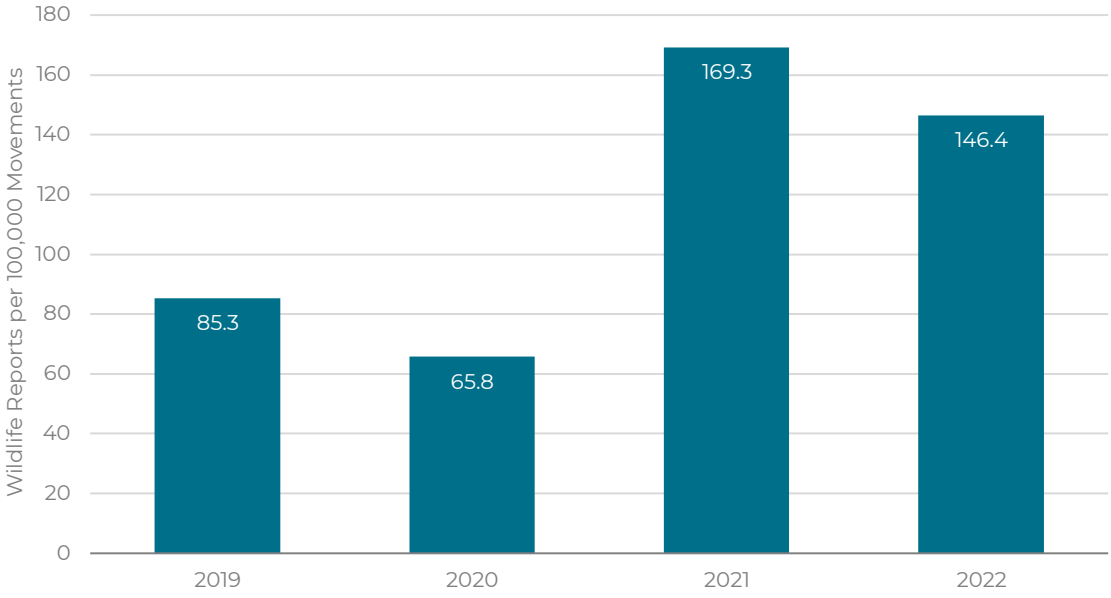


Figure 2.7: Rate of wildlife reports at Brussels Airport

In 2021, a significant increase was seen in the deviations from Air Traffic Management (ATM) procedures and the deviations from Air Traffic Control (ATC) clearance, see Figure 2.8 and Figure 2.9. This increase continued in 2022. The deviations happened most frequently during pushback operations. As a result of the reports, skeyes updated the pushback procedures and is working together with the stakeholders to identify and implement mitigations to counter this trend.

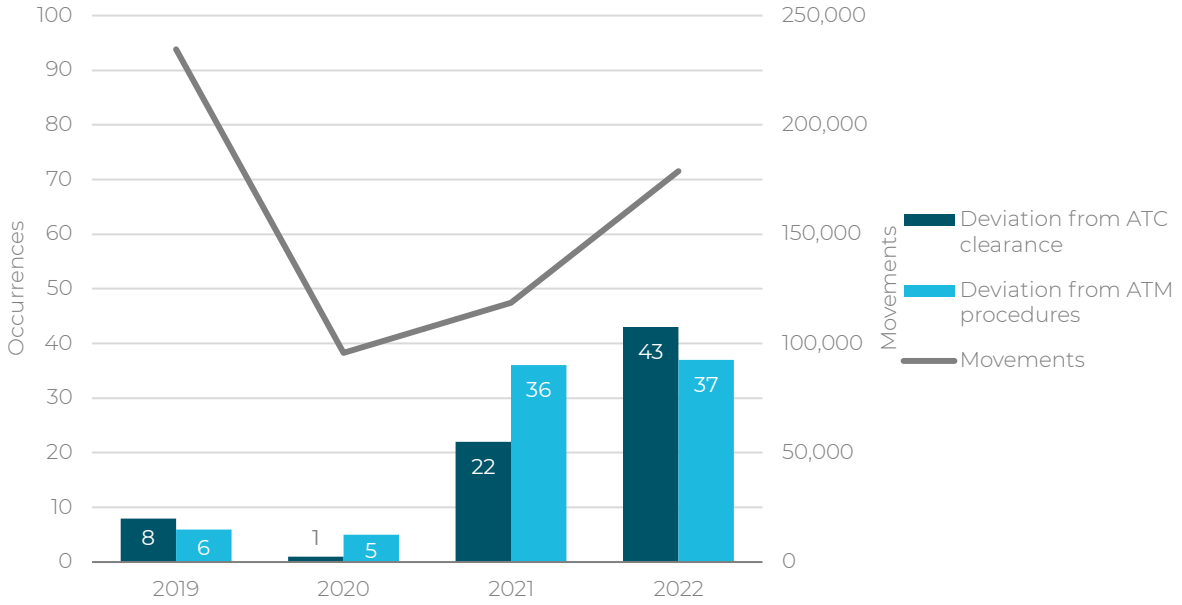


Figure 2.8: Deviations from ATM procedures and ATC clearance at Brussels Airport by year

With the traffic increase, the rate of the reports concerning deviations from ATM procedures decreased compared to 2021. However, it is still high compared to 2019. The Deviations from ATC clearance increased in 2022 compared to 2021.

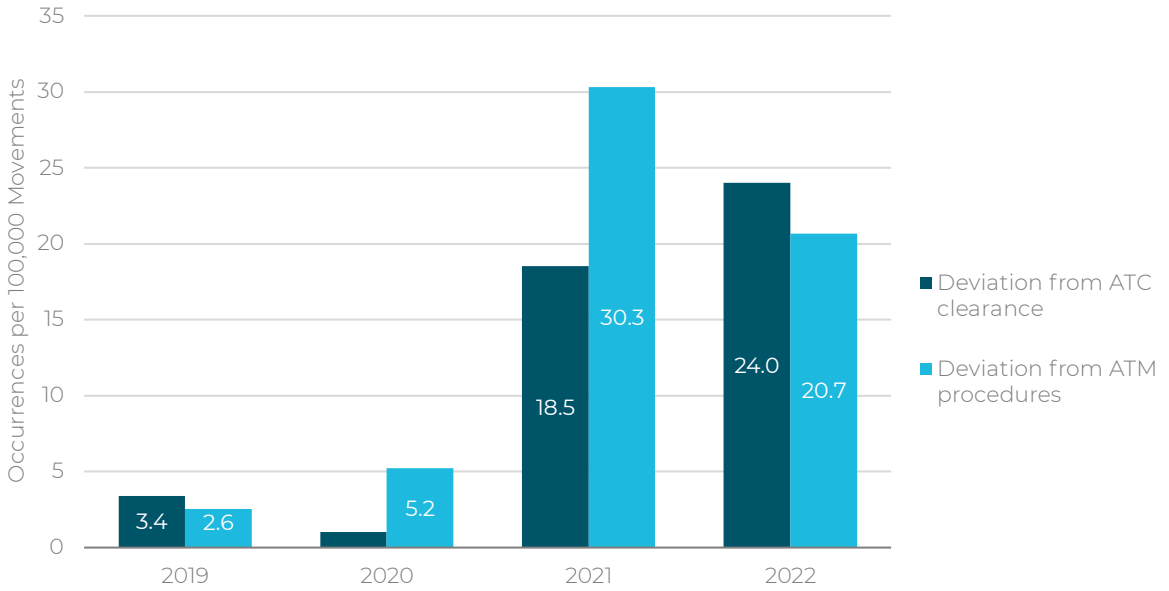


Figure 2.9: Rate of deviations from ATM procedures and ATC clearance er 100,000 movements per year

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, skeyes promotes the increased use of PBN (Performance Based Navigation) 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.


N2

3. Capacity & Punctuality

This chapter addresses the airport capacity and punctuality. In a first section, 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. The arrival delay, delay due to regulations placed by Brussels Airport on the arrivals, is analysed and the ATFM delay from the airport's point of view is given, i.e. 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 Air Navigation Service Providers (ANSPs).

Airport Capacity

The capacity of an aerodrome, i.e. how many operations 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.

For optimal conditions, a theoretical measure of the 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 approach speed.
- The inter departure time is a function of the time to reach an altitude after being cleared for take-off.

The Theoretical Throughput Capacity per runway configuration is the theoretical number of operations that an aerodrome can handle within an hour under optimal conditions. In practice, such optimal conditions are seldom reached. Therefore, the declared capacity is thus set at 90% of the optimum. Here, it is worth noting that the declared capacity only represents the capacity of IFR flights, because safe Wake Vortex Separation Distances between two flights have been assumed during the calculation. Therefore, it is also referred to as “declared IFR capacity”. Table 3.1 shows the declared capacity per runway configuration at Brussels Airport.

The difference in declared capacity per runway configuration adds complexity for the flight planning and impacts the performance of other area as there are deviations from the PRS due to traffic exceeding capacity in 2022 and ATFM regulations due to the runway configuration in use at the time.

Table 3.1: Declared IFR capacity [7]

Runway Configuration	Runways		Declared Capacity (movements/hour)		
	Departures	Arrivals	only departures	only arrivals	Mixed fleet
RW01	01	01	38	33	40
RW19	19	19	38	33	39
RW07L	---	07L	---	32	32
RW07R	07R	---	34	---	34
RW25L	---	25L	---	34	34
RW25R	25R	25R	41	34	41
RW01-07R-07L	07R-07L	01	34	27	54
RW25L-25R	25R	25L+25R	41	68	75
RW25R-19	25R+19	25R	35	34	45

Besides the calculated theoretically possible capacity, the Effectively Used Capacity is an important performance indicator for the airport and for the air navigation service provider handling the arrivals and departures. With this effectively used capacity, we regard how many operations have actually been performed within each hour of the year and check if the declared capacity has ever been exceeded. Figure 3.1 shows the distribution of hourly movements per runway configuration for rolling hours with a step of one minute during the times the runway configuration was at least one hour in use in 2022. For this plot, helicopter movements are not considered, but both VFR and IFR flights[8] are considered. The declared capacity is indicated as a horizontal line. The peak of the distribution shows the most likely number of movements during the next hour when picking a random minute of the year during which the runway configuration is in use and will stay in use for this next hour.

Figure 3.1 shows that the declared IFR capacity has not been exceeded in 2022. The runway configuration 25R - 25L,25R is the configuration that is used most of the time. For this configuration, the declared capacity is 75 movements per hour. In 2022, when this runway configuration was in use, the maximum number of movements is 54 movements per hour. Usually there are around 27 movements per hour during the use of this runway configuration.

[7] 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.

[8] Only showing IFR flights would give a distorted view on the number of hourly movements – especially for airports with high VFR shares. For interpretation, however, it is to be considered that the declared capacity is only declared for IFR movements.

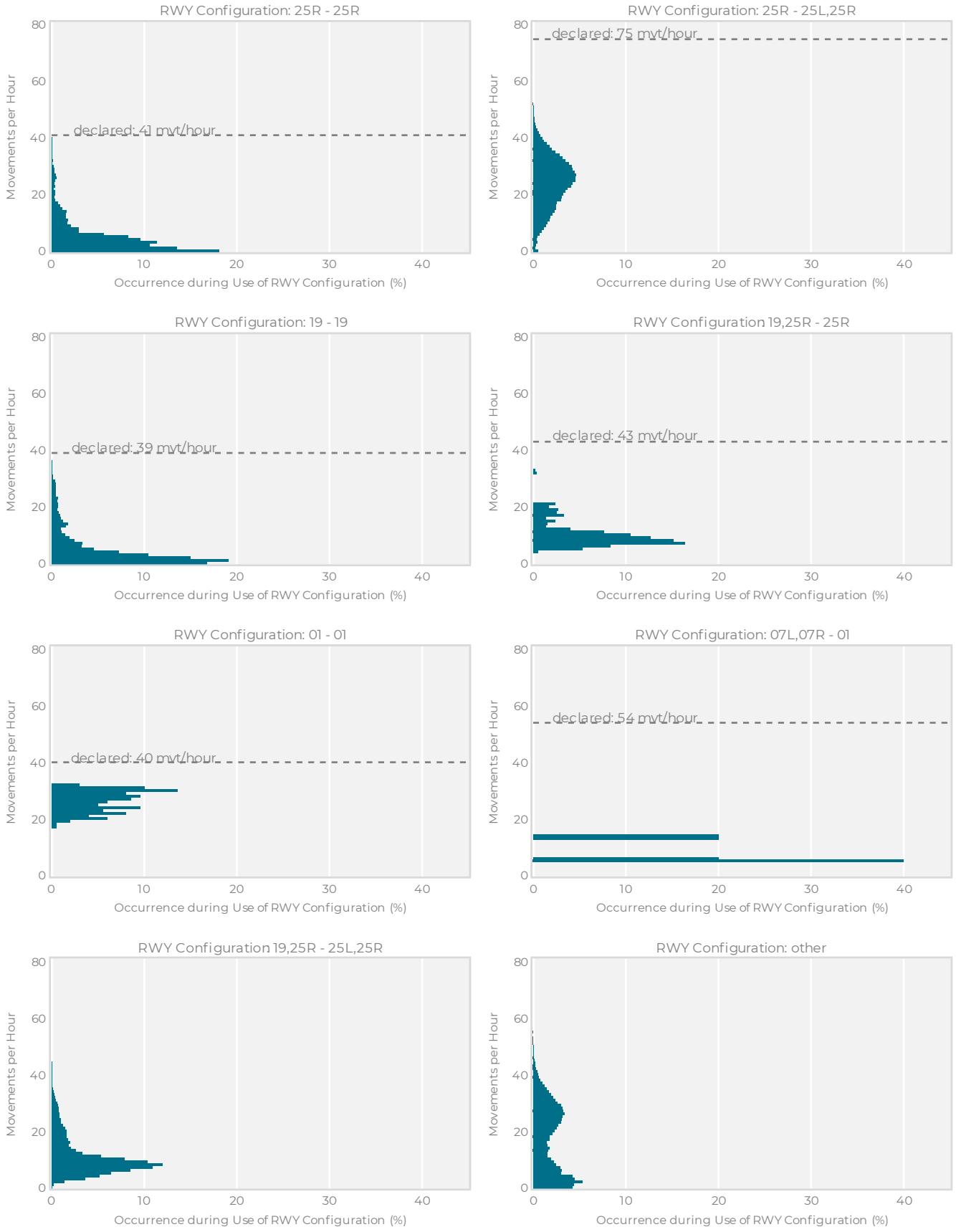


Figure 3.1: Distribution of hourly movements throughout 2022 per runway configuration at Brussels Airport

Punctuality

Punctuality is a service quality indicator from a passenger perspective. This section observes one of the factors that influences the punctuality: ATFM (Air Traffic Flow Management) 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 take-off 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:

- A – Accident
- C - ATC Capacity
- D - De-icing
- E - Equipment (non-ATC)
- G - Capacity Aerodrome
- I – Industrial Action (ATC)
- M - Airspace Management
- N – Industrial Action (non-ATC)
- O - Other
- P - Special Events
- R - ATC Routing
- S - ATC Staffing
- T - Equipment (ATC)
- V - Environment
- W - Weather
- NA - 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..[9]

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/flight 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 four 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).[10]. In 2022 a total of 9,620 minutes of arrival delay at Brussels tower were registered. Weather, as in previous years, is the main reason for regulations that caused delay for arriving aircraft. 1,714 minutes of delay is attributable to the CRSTMP category which presents the causes with skeyes contribution.

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 0.11 minutes per arrival in 2022 and a CRSTMP arrival delay of 0.02 minutes per arrival. This can be also be seen in Figure 3.2 which shows the arrival delay rates for the past four years. In 2022 there was again a higher need for regulations for reasons related to weather and ATC Capacity and Staffing.

Table 3.2: Arrival delay (minutes) and number of IFR arrivals with an activated flight plan submitted to the Network Manager at Brussels Airport per year

	Minutes of ATFM Arrival Delay				IFR Arrivals
	CRSTMP	Weather	Other categories	Total	(with flight plan)
2019	7,276	76,310	19,721	**103,307**	114,639
2020	1,575	15,557	0	**17,132**	45,674
2021	725	1,538	45	**2,308**	57,070
2022	1,714	7,423	483	**9,620**	87,119

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

[10] 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.

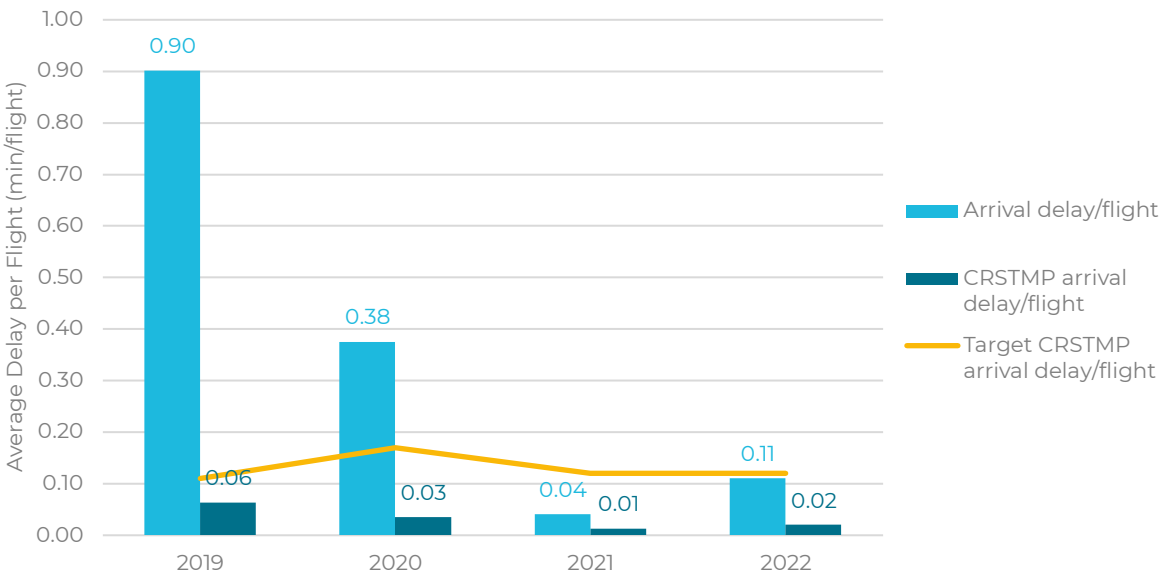


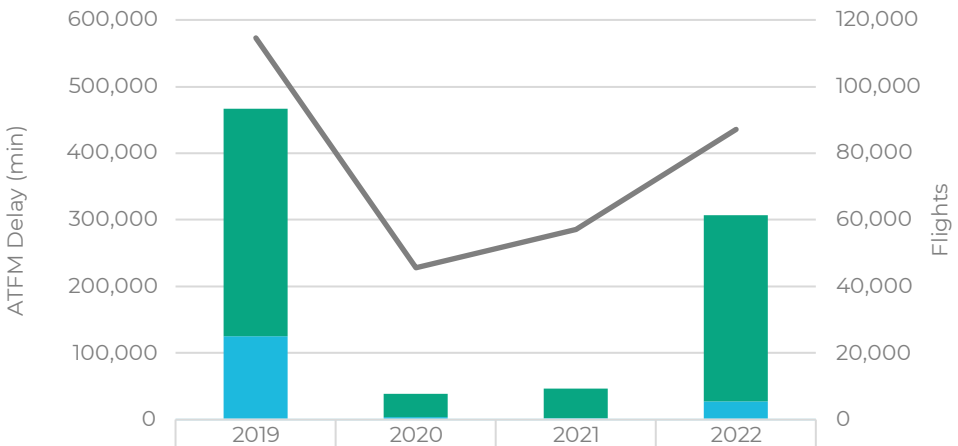
Figure 3.2: Arrival Delay KPI at Brussels Airport for 2019-2022, per year

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. en-route or at the other departure or arrival airport.

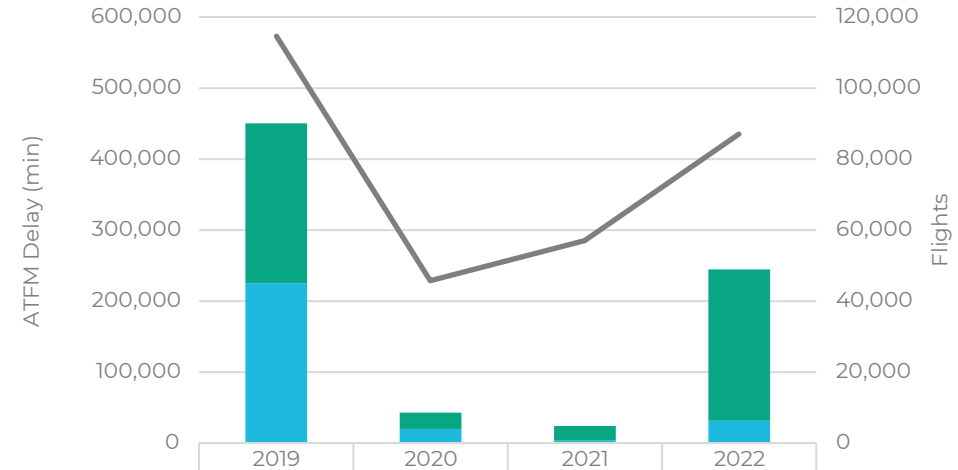
Figure 3.3 and Figure 3.4 show the delay on departing and arriving traffic over the last four years. Also, the ratio between the delays imposed by skeyes and other ANSPs is provided. In 2022, 27,925 departing flights from Brussels Airport were delayed resulting in a total 307,301 minutes of delay. Thereof, 9% (27,167 minutes) of that delay is attributable to skeyes while 91% (280,134 minutes) is attributable to other ANSPs. 15,373 flights arriving at Brussels Airport were delayed with a total of 244,305 minutes of ATFM delay. Of which 13% (31,373 minutes) of that delay is attributable to skeyes while 87% (212,932 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 and lack of Capacity and Staffing. Another event that impacted the punctuality in Brussels Airport was the implementation of 4-Flight in France. The 4-Flight is the new integrated control system of the French ANSP. Regulations were put in place to protect that airspace and also the neighbouring from an overload in France and Germany.



	2019	2020	2021	2022
Other ANSP	341,558	34,803	45,000	280,134
skeyes	125,493	3,990	1,780	27,167
IFR departures (with flight plan)	114,642	45,668	57,074	87,105

Figure 3.3: ATFM delay on departures in Brussels Airport attributable to skeyes and other ANSPs



	2019	2020	2021	2022
Other ANSP	225,304	23,030	20,337	212,932
skeyes	225,162	19,765	3,152	31,373
IFR arrivals (with flight plan)	114,639	45,674	57,070	87,119

Figure 3.4: ATFM delay on arrivals in Brussels Airport attributable to skeyes and other ANSPs

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 3.5 and Figure 3.6 show that 74% of the delayed departures, and 60% of the delayed arrivals were delayed for a maximum of 15 minutes. 1% of the departure flights in 2022 and 2% of the arrivals had a delay above one hour.

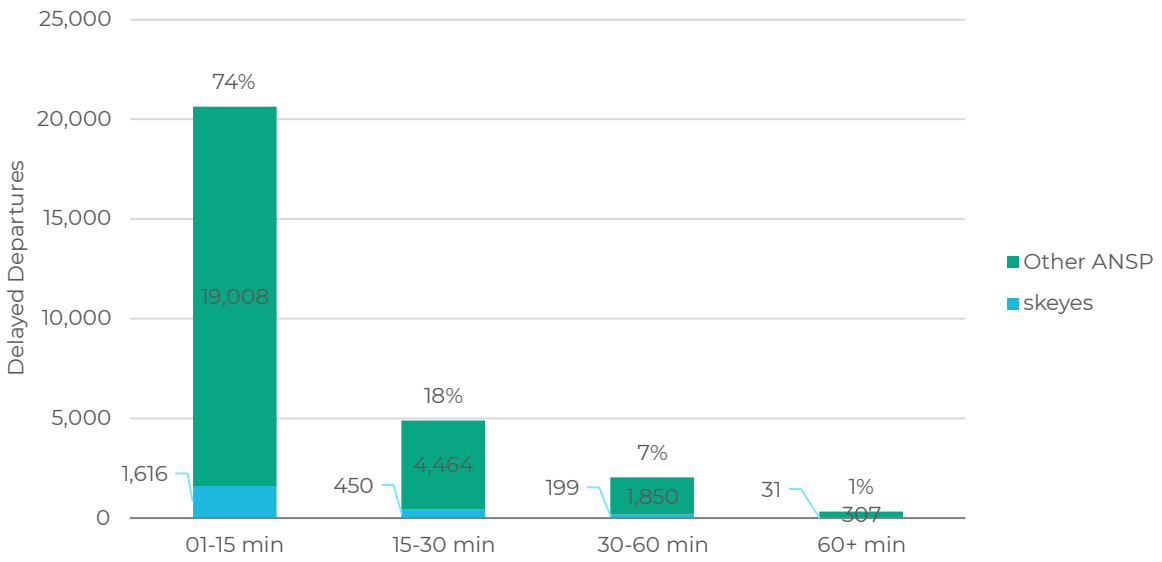


Figure 3.5: Distribution of delayed departures per delay interval

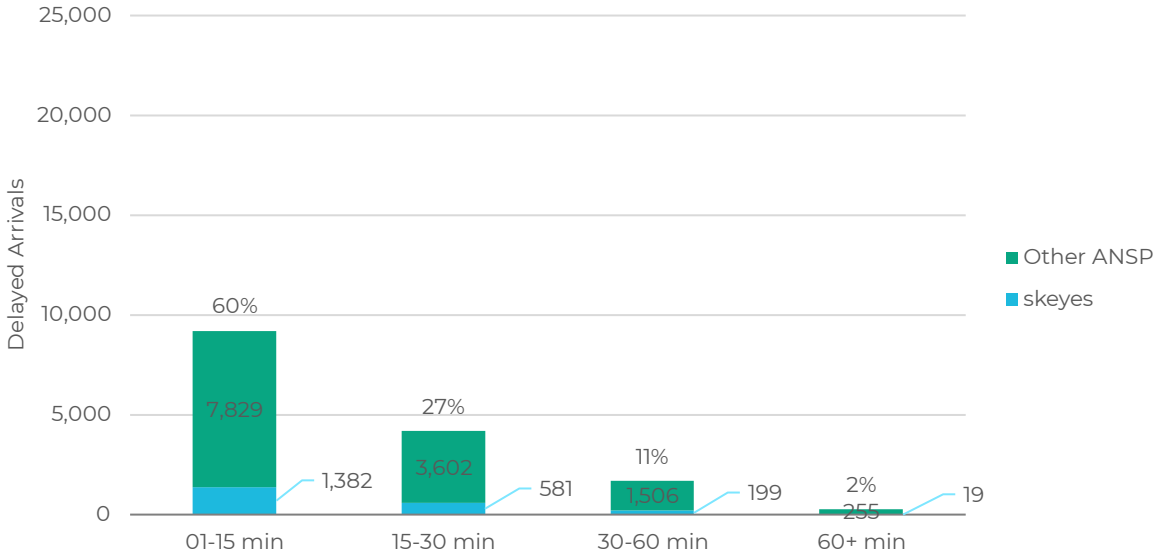


Figure 3.6: Distribution of delayed arrivals per delay interval

4. Environment

The first part of this chapter is dedicated to the runway configuration scheme in use 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 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 put in place indicators to monitor the use of CDOs, in collaboration with the other members of FABEC. 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 with a view to reducing noise pollution. This means that the number of night slots is limited. Night movements are also part of this chapter.

Preferential Runway System (PRS)

The basic flight principle is that an airplane needs to take off and land into the wind. However, to choose the runway in use, skeyes must consider, in addition to the speed and surface wind direction, other factors such as environmental regulations, runway length, available navigation aids for approach and landing, the weather conditions and the available instrument approach procedures, or availability of runways and taxiways. For environmental reasons, a Preferential Runway System (PRS) is in place at Brussels Airport. This system defines the runways to be used depending on the time of the day, day of the week, wind conditions and more. When these conditions are not met, skeyes may choose a more suitable alternative runway configuration to maintain the safety of operations. The figure below shows the runway configuration scheme as listed in the Aeronautical Information Publication (AIP).

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

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

Figure 4.2 shows, per month in 2022, the percentage of time when the PRS was followed and the percentage for the whole year (Total). The lower use of the PRS in April and August is due to the wind direction in the course that month. This phenomenon is observed every year in April.

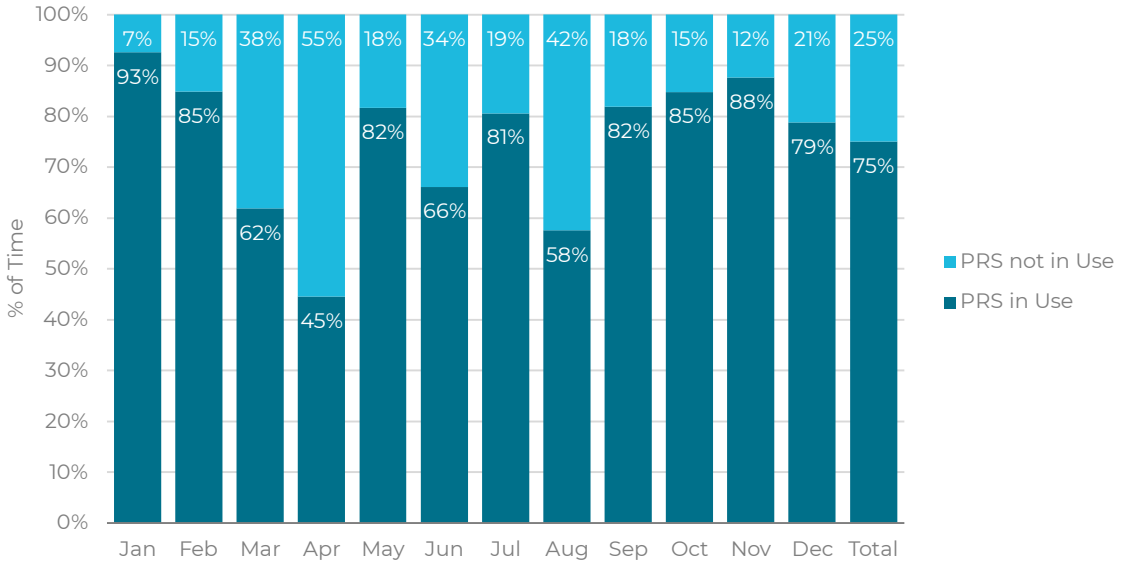


Figure 4.2: Monthly Overview of PRS Use 2022 (in time)

Table 4.1 provides the total time when PRS was not in use, the time per reason why the PRS was not in use ,and the total time when the PRS was in use. The main reason for not using the PRS was meteorological conditions at the airport (74%) and near the airport (18%) together with non-availability RWY/TWY (4%).

Table 4.1: Overview of use of PRS and reasons for PRS not in use per month in 2022 (hh:mm)

PRS in use / Reason PRS not in use	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
PRS not in use	**55:17**	**101:52**	**283:40**	**399:24**	**136:41**	**244:13**	**144:13**	**315:47**	**130:12**	**113:41**	**88:51**	**158:03**	**2171:54**
Meteorological conditions at the airport	54:22	82:46	221:33	314:27	109:15	176:35	111:35	228:56	89:00	50:48	55:39	118:35	1613:31
Meteorological conditions near the airport in the departure and/or approach path	-	09:22	44:52	72:58	21:45	52:26	25:11	79:02	10:34	26:22	16:56	33:53	393:21
Non-availability RWY/TWY	00:55	08:55	13:09	04:21	-	14:10	01:26	01:39	16:59	16:57	08:13	02:50	89:34
Traffic demand exceeds capacity of PRS	-	-	03:12	03:46	05:32	01:02	05:44	02:00	12:59	12:57	05:29	-	52:41
Special activities	-	-	-	-	-	-	-	02:56	-	04:55	01:56	02:45	12:32
Planned maintenance of airport and/or ATC equipment	-	00:49	-	03:52	-	-	-	00:29	-	00:42	00:38	-	06:30
Other	-	-	00:41	-	00:09	-	-	-	-	01:00	-	-	01:50
Unplanned non-availability (U/S) of airport and/or ATC equipment	-	-	-	-	-	-	-	00:45	00:40	-	-	-	01:25
Obstacles in the departure and/or approach path	-	-	00:13	-	-	-	00:17	-	-	-	-	-	00:30
PRS in use	**688:43**	**570:08**	**460:20**	**320:36**	**607:19**	**475:47**	**599:47**	**428:13**	**589:48**	**630:19**	**631:09**	**585:57**	**6588:06**

skeyes usually measures the use of the PRS in number of hours. However, it sometimes occurs that a certain runway configuration is in use while there is (almost) no traffic arriving or departing at the airport. For that reason, the analysis of the PRS in use will be expressed in percentage of movements, i.e. how many flights in comparison with the total were following the PRS. The figures below show the monthly evolution of the PRS use (Figure 4.3) and the comparison with the previous years (Figure 4.4).

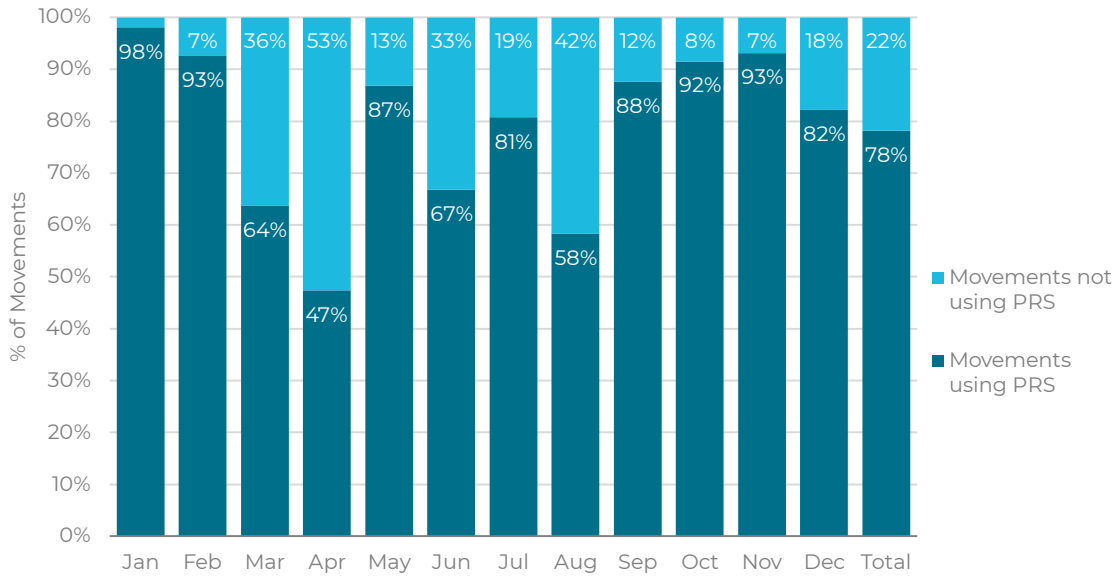


Figure 4.3: Use of PRS in number of movements per month and total in 2022

In 2022, 78 % of the movements followed the PRS. This is in line with the previous years., although a decrease in use of the PRS can be seen when compared to 2019. A higher use of PRS can be observed in number of movements compared to the use of PRS in time which can be because the PRS was adhered at times when there was more traffic.

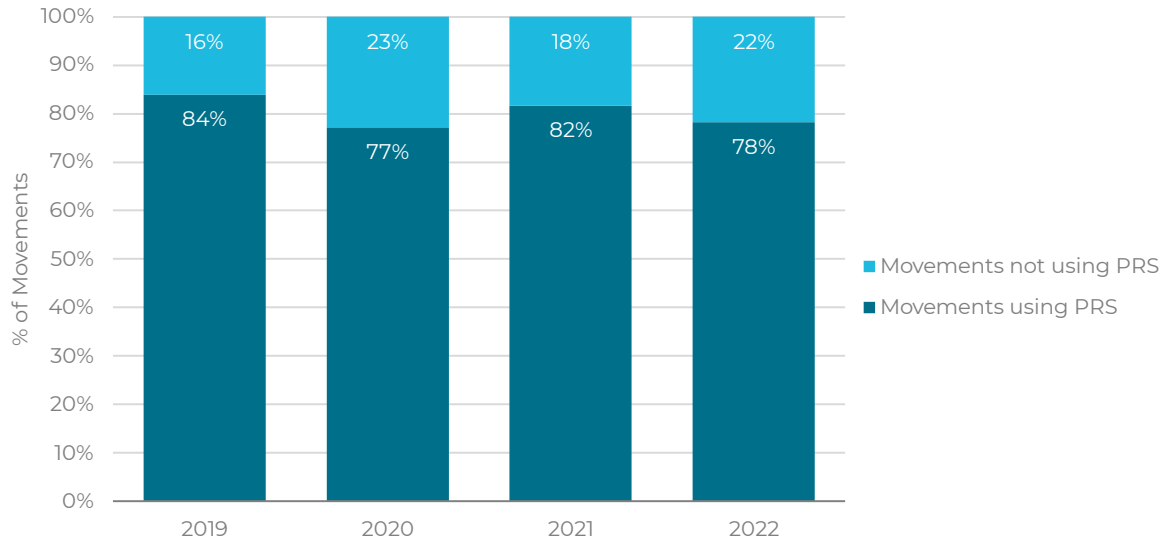


Figure 4.4: Use of PRS in number of movements per year

Continuous Descent Operations

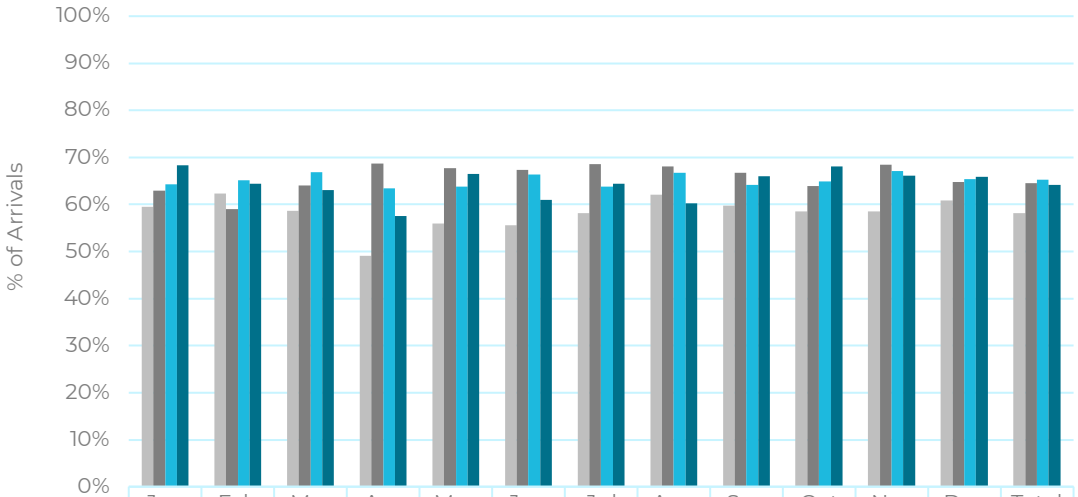
A CDO is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions.[11] By doing so, the aircraft will use less fuel and produce less noise. 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 3,000ft.
- CDO Noise: binary indicator (yes/no) indicating if a CDO was flown from FL60 to 3,000ft.

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 feet/minute.

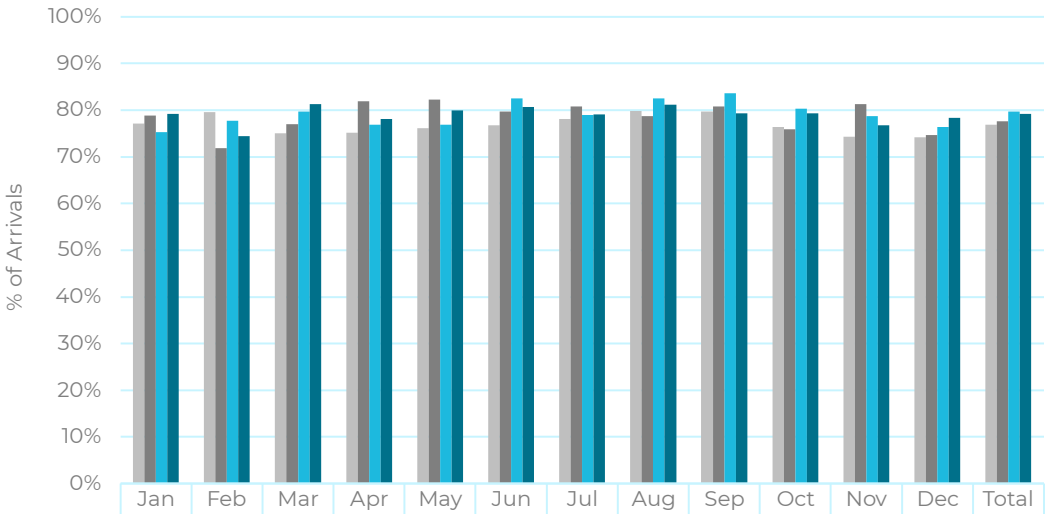
Figure 4.5 and Figure 4.6 show the monthly evolution of the indicators for CDO fuel and CDO noise at Brussels Airport. Flights such as touch-and-go's, military flights and helicopters are not taken into account. Note this calculation of arrivals differs from the BCAA movements definition used in the previous chapters. As such, differences to the number of arrivals presented in chapter 1 may occur. In 2022, the CDO Noise reached 79% and the CDO Fuel 64%. Compared to 2021 the percentage of flights that did a CDO was slightly lower. The total of CDOs per year can be observed in Figure 4.7 together with the arrivals considered in the calculation of the CDOs. The CDO performance indicator per runway is shown in Figure 4.8 and Figure 4.9.

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



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CDO Fuel 2019	59%	62%	59%	49%	56%	56%	58%	62%	60%	59%	58%	61%	58%
CDO Fuel 2020	63%	59%	64%	69%	68%	67%	69%	68%	67%	64%	68%	65%	65%
CDO Fuel 2021	64%	65%	67%	63%	64%	66%	64%	67%	64%	65%	67%	65%	65%
CDO Fuel 2022	68%	64%	63%	58%	66%	61%	64%	60%	66%	68%	66%	66%	64%

Figure 4.5: Percentage of arrivals flying CDO Fuel



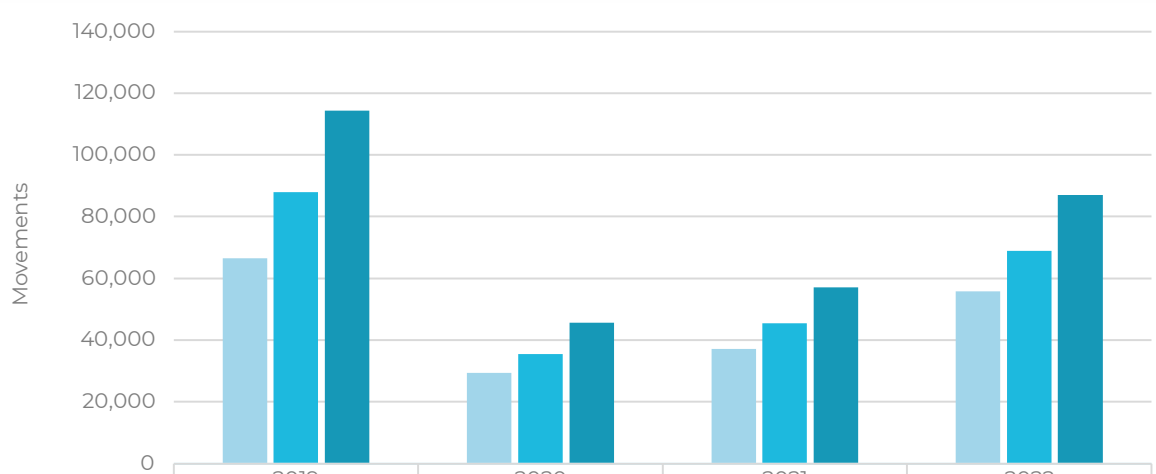
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
CDO Noise 2019	77%	80%	75%	75%	76%	77%	78%	80%	80%	76%	74%	74%	77%
CDO Noise 2020	79%	72%	77%	82%	82%	80%	81%	79%	81%	76%	81%	75%	78%
CDO Noise 2021	75%	78%	80%	77%	77%	82%	79%	83%	84%	80%	79%	76%	80%
CDO Noise 2022	79%	74%	81%	78%	80%	81%	79%	81%	79%	79%	77%	78%	79%

Figure 4.6: Percentage of arrivals flying CDO Noise

CDO statistics are inherently variable, because they are influenced by a multitude of external factors, such as:

- Pilots' CDO flying experience
- Pilots' experience with specific airport
- ATC experience
- Runway usage (equipment)
- Aircraft type/equipment
- Military airspace open/closed
- Traffic flows
- Impact of other traffic streams on arriving traffic.

As a result, it is difficult to explain an increase or decrease over years, especially when small variations are observed.



	2019	2020	2021	2022
CDO Fuel	66,536	29,456	37,220	55,868
CDO Noise	88,018	35,422	45,443	68,953
Arrivals	114,425	45,657	57,027	87,075

Figure 4.7: Total number of CDO Fuel and CDO Noise flown per year

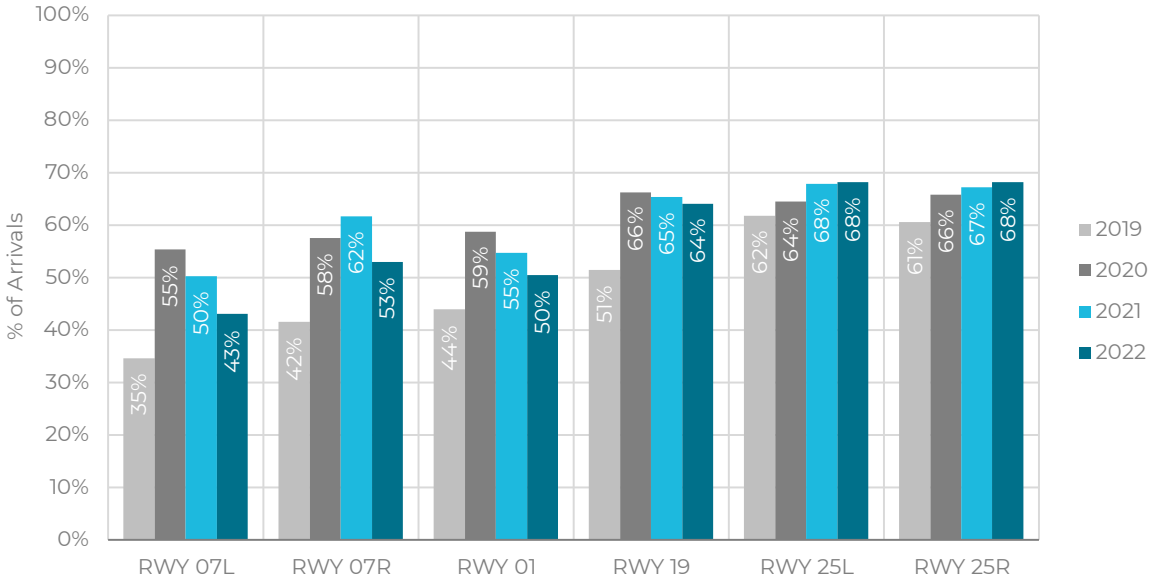


Figure 4.8: CDO Fuel flown per runway per year as percentage of arrivals

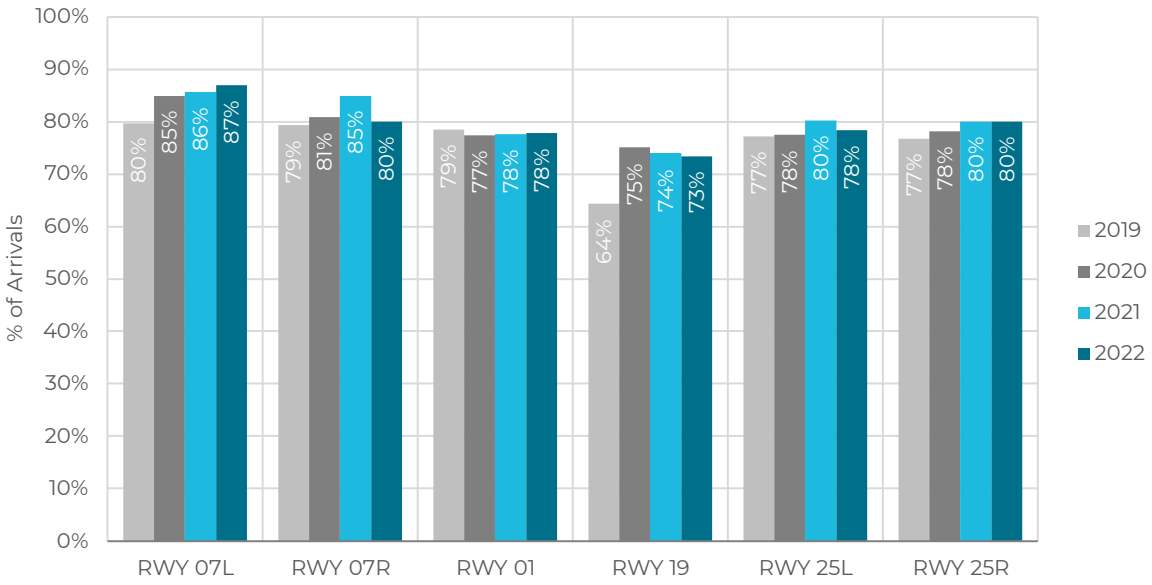


Figure 4.9: CDO Noise flown per runway per year as percentage of arrivals

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 encourage Continuous Descent Operations (CDO) 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:

- skeyes is in contact with airlines presenting CDO statistics and communicating the phraseology;
- skeyes is increasing awareness amongst ATCOs through courses, and by informing them of the current statistics and performance;

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. Furthermore, the agreement on 'collaborative environmental management' (CEM) at Brussels Airport, signed also by EUROCONTROL and ACI Europe, continues to show benefits.

One of the initiatives within the CEM at Brussels Airport is the increased use of the Required Navigation Performance approach, which was assessed in 2022. Such approach procedures fit in the on-going transition towards a PBN Environment (EU regulation), and greatly improve predictability for the flight crews such that CDO performance can be improved. This initiative is part of the Brussels Airport Stargate project, one of the various environmental initiatives the European Commission and the Belgian government supports in the aviation sector[12].

Another initiative currently ongoing in Brussels Airport is the project HERON (Highly Efficient Green Operations), an EU consortium project with the goal to faster deployment of a set of ambitious targets to mitigate CO_2 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.

Also on the airport side, initiatives are taken towards environmental aviation. Brussels Airport is ready to supply sustainable airline fuel to aircraft. The use of sustainable airline fuel is key element in reducing emissions from air travel[13].

[12] skeyes, press skeyes,2022,https://press.skeyes.be/skeyes-promotes-environmentally-friendly-approach-procedures-at-brussels-airport (URL retrieved on 19/04/2023)

[13] 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

During the COVID-19 pandemic, night (23:00-06:00 LT) traffic did not drop proportionally with the drop of total traffic. A possible reason for this is the type of flights, passenger flights and low cost flights were highly impacted by the COVID-19 crisis and operate mainly in the day. Night traffic is mainly cargo, an area that was not or very little impacted in terms of movements. Continuing on this, night traffic is back to 98% of the night traffic in 2019 while the traffic during the day is only at 75% of the day traffic in 2019.

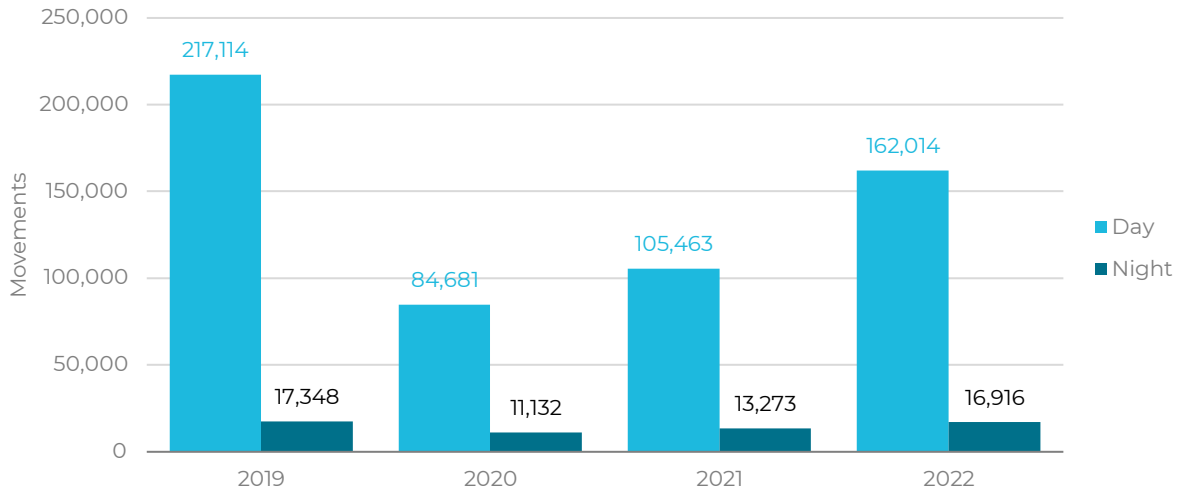
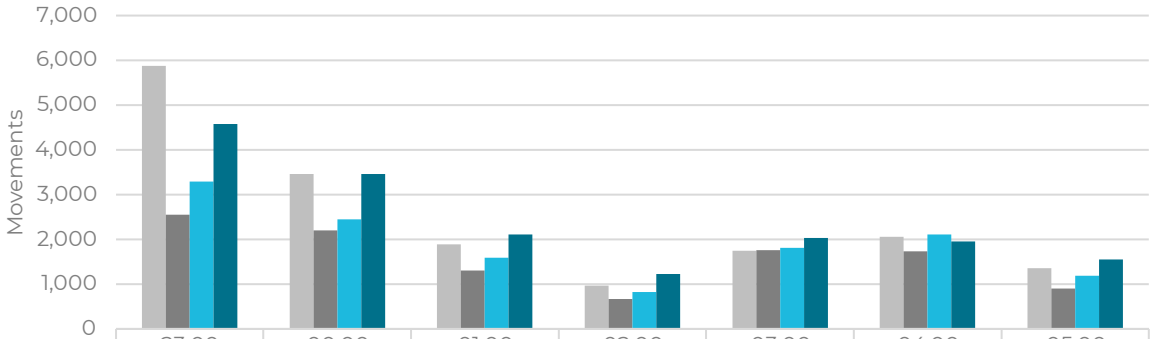


Figure 4.10: Day and night movements in EBBR 2019-2022

Night flights are limited by a regulation in the matter is the Ministerial Decree of the 21st of January 2009 in order to limit the noise impact during the night. This decree states that a maximum of 16,000 night slots per calendar year can be allocated with the night is defined from 23:00 to 06:00 local time. The slot allocation at Brussels Airport is under the responsibility of Belgium Slot Coordination (BSC). BSC is a non-profit organization in accordance with Belgian Law. The ownership of the company is shared between the airport and airlines. Slot allocation is an instrument developed to match demand for slots from the air carriers and general aviation to the supply of airport capacity. In 2022, 16,916 night movements[14] were recorded at Brussels Airport by the AMS. The following graph shows the distribution of the night movements throughout the night (Figure 4.10). It can be seen that traffic between midnight and 06:00 is at or above the levels of 2019 except for the slot from 04:00 to 05:00.



	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

Figure 4.11: Number of movements between 23:00 and 06:00 LT (hour indicates start time of period)

[14] Note: number of movements does not present number of slots used.

Wind Pattern

One of the factors that play a main role in the selection of the runway is the wind direction and speed. This is also confirmed previously as meteorological conditions were the most frequent reason for not using the PRS. Figure 4.11 shows the wind roses for the previous four years (2019-2022). These show that there was a similar wind pattern in 2022 as in 2021 with a slight increased south easterly component. The wind roses for each month (Figure 4.12) show that during April and August the wind direction was mainly north-easterly. The impact of this can also be seen in the runway use per month in Figure 1.12.

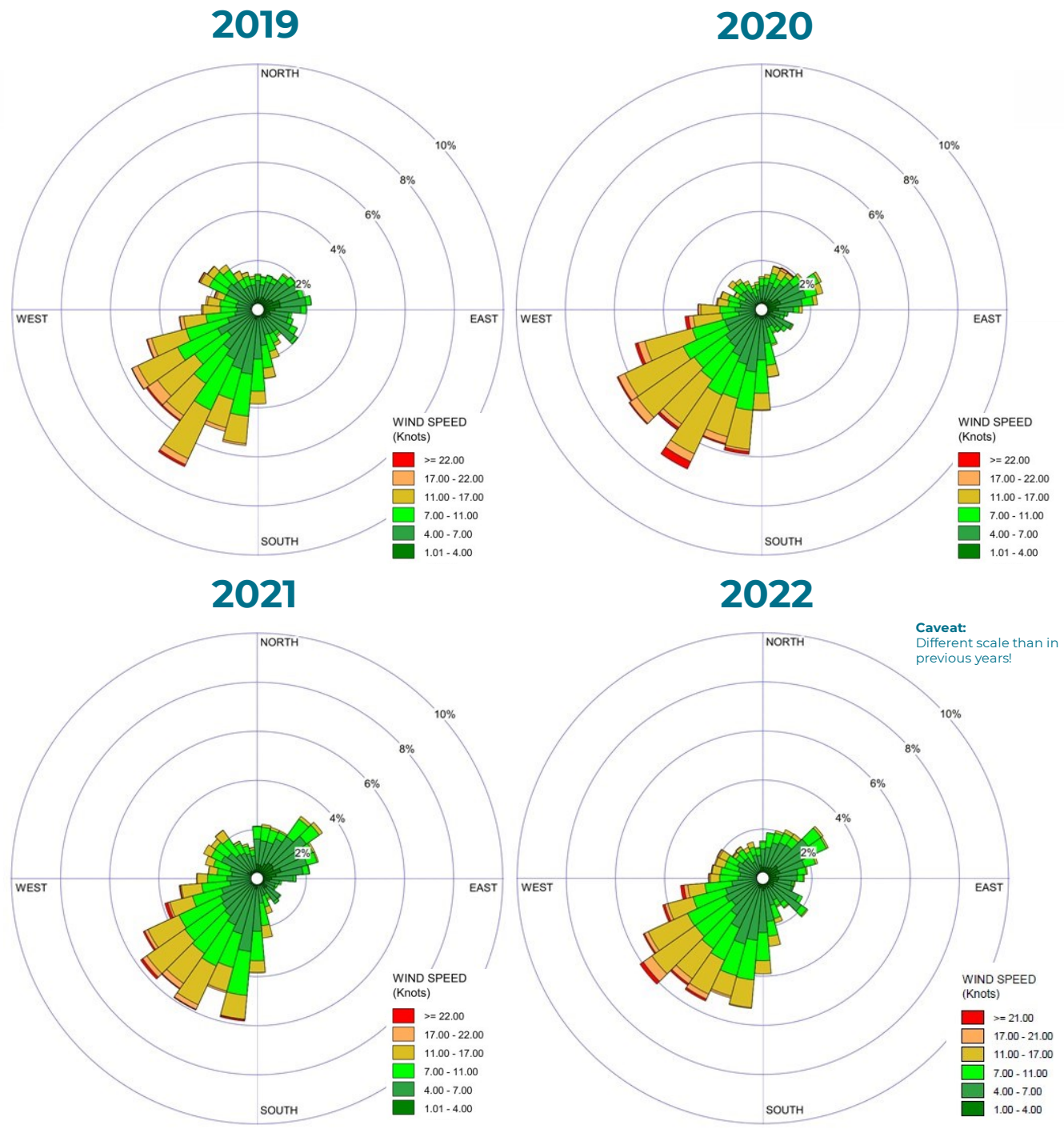


Figure 4.12: Wind roses for Brussels Airport 2019-2022

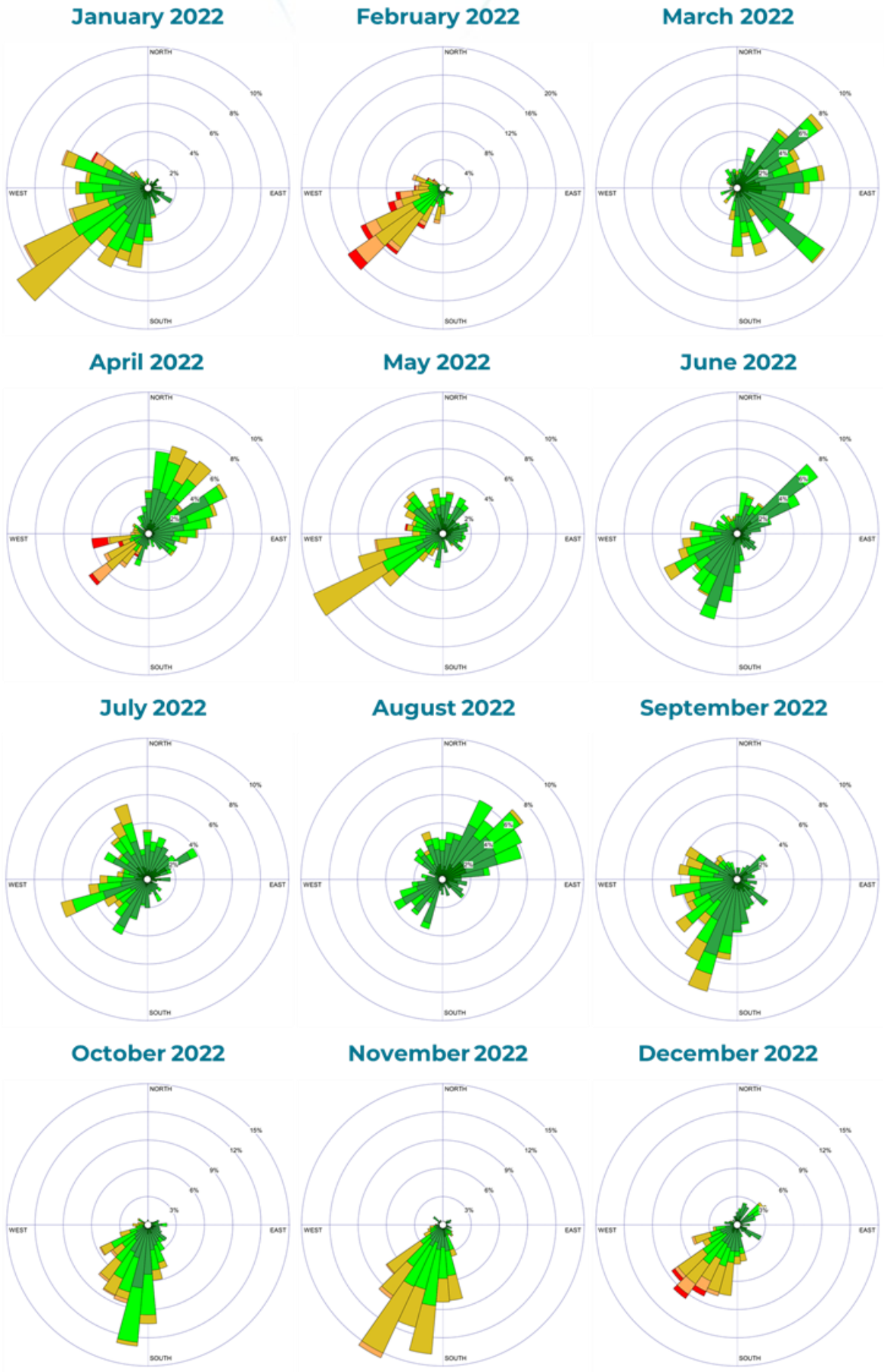


Figure 4.13: Wind roses for Brussels Airport per month of 2022

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

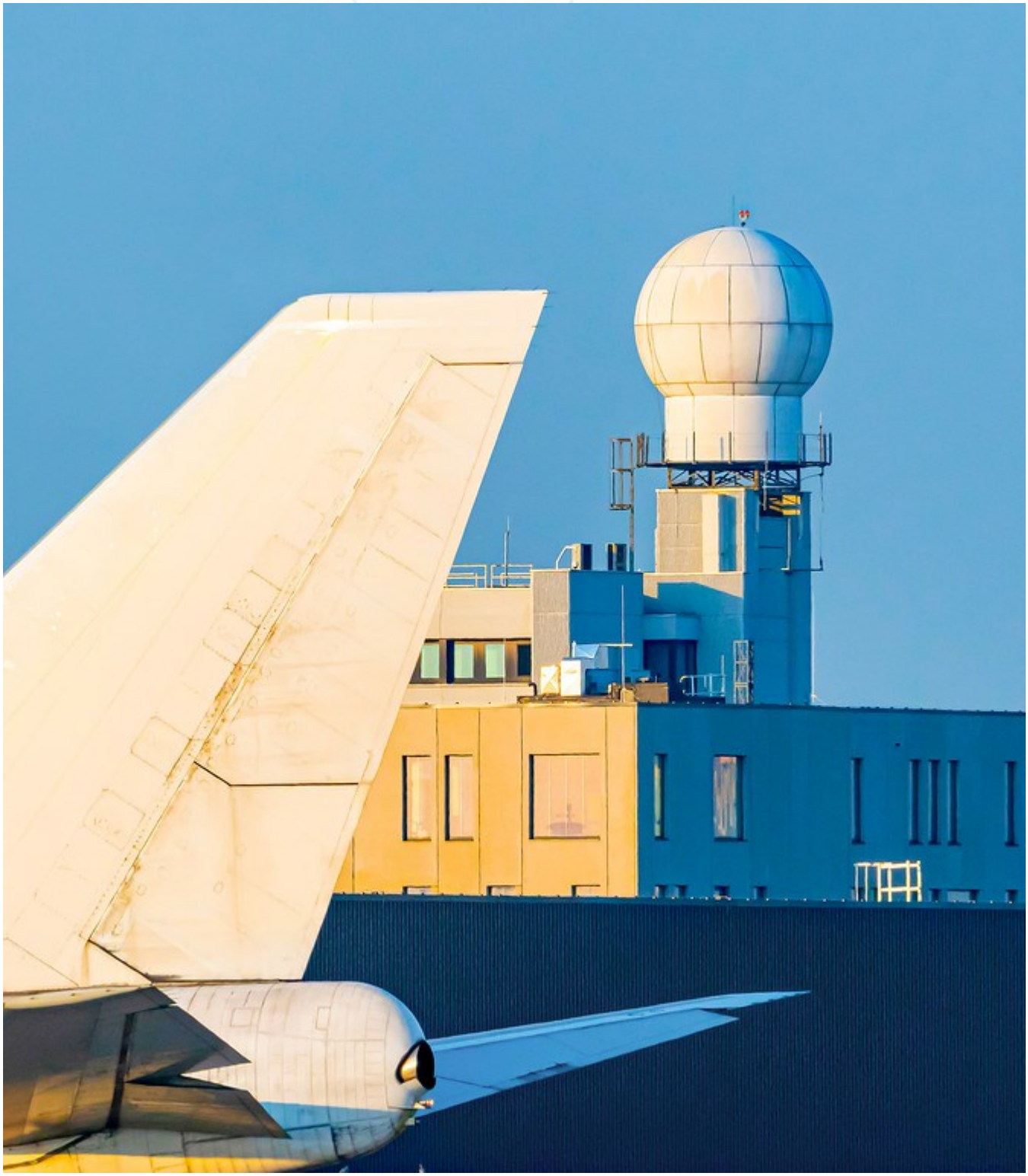
Strong tailwinds can lead to unstable approaches and go-arounds. To avoid unplanned runway changes, the tower supervisor chooses an alternative runway when the pilots communicate the presence of strong tailwinds and request other runways.

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 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 and tail wind information is available on ATIS (Automatic Terminal Information Service) to inform the pilots.

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

ANNEX: Fact sheet 2022

Traffic

Yearly Evolution

- 51 % increase in movements compared to 2021
- 76% of 2019 traffic

Movements	2019	2020	2021	2022	2022 vs. 2021	2022 vs 2019
Total	234,462	95,813	118,736	178,930	+51%	-24%
IFR	231,275	93,118	116,072	176,179	+52%	-24%
VFR	3,187	2,695	2,664	2,751	+3%	-14%

Quarterly Comparison

- Low year-to-year comparison in Q1, summer traffic (Q3) at -19%

Movements	2019	2020	2021	2022	2022 vs. 2021	2022 vs 2019
Q1	50,875	44,317	15,490	33,644	+117%	-34%
Q2	61,660	9,175	22,444	47,374	+111%	-23%
Q3	65,761	23,816	41,683	53,463	+28%	-19%
Q4	56,166	18,505	39,119	44,449	+14%	-21%

Safety

Missed Approaches

- 222 missed approaches in 2022, -26 % vs. 2019
- Top three causes in 2022:
  1. Unstable approach (84)
  2. Wx – Thunderstorm – Windshear (31)
  3. Too close behind preceding (18)

Safety Occurrences

- 11 Runway incursions, 3 with ATM contribution
- Increase continued in:
  - deviations from ATM procedures
  - deviations from ATC clearance
  - Wildlife strikes

Capacity & Punctuality

Capacity

Runway configuration	Declared IFR Capacity
25R, 25L+R	75 movements/hour
19	39 movements/hour
25R, 19	45 movements/hour

- The declared capacity was never exceeded

Punctuality

Arrival delay:

- Arrival Delay: 0.11 min/flight
- CRSTMP delay: 0.02 min/flight

ATFM impact:

- Departures: 307,301 minutes ATFM delay, 9% (27,167 min) due to skeyes' regulations
- Arrivals: 244,305 minutes ATFM delay, 13% (31,373 min) due to skeyes' regulations

Environment

PRS

- 78 % of movements used the PRS

CDO

- Ratio of CDO Fuel and CDO noise slightly decreased (1%)

Night movements

- 16,916 night movements (+27% vs. 2021, -2% vs. 2019)

skeyes nice to guide you

skeyes / Tervuursesteenweg 303 / B-1820 Steenokkerzeel
T +32 2 206 21 11 / F +32 2 206 22 88

member of FABEC

www.skeyes.be