



Brussels South Charleroi Airport

RUNWAY PERFORMANCE REPORT 2022

EXECUTIVE SUMMARY

The world-wide aviation sector is on a rapid recovery and throughout Europe traffic levels of 2019 are being reached. Brussels South Charleroi Airport follows this trend by recovering up to 102% of 2019 traffic.

Air Traffic Management (ATM) performance is driven by four Key Performance Areas (KPA's): safety, capacity, environment, and cost-efficiency. This report focuses on skeyes' operations at Brussels South Charleroi Airport. Its aim is to provide our main stakeholders with traffic figures for 2022 and relevant data on the performance of our operations at Brussels South Charleroi Airport, namely on three of the four KPA's: safety, capacity and punctuality and environment.

In 2022, the runway extension works at Brussels South Charleroi Airport were successfully completed. Despite the extensive nature of these works, no impact was detected. The runway extension works were carried out with the primary goal of enhancing safety and efficiency. This included lengthening the runway to accommodate larger aircraft, improving taxiway access, and upgrading navigational aids.

Traffic

Traffic in Brussels South Charleroi Airport has surpassed 2019 levels. skeyes controlled 83,489 movements at Brussels South Charleroi Airport, an increase of 27% compared to 2021. Instrumental Flight rules (IFR) traffic saw the biggest increases: 72% since 2021 and 5% since 2019. Visual Flight Rules (VFR) traffic is lagging behind in the recovery and showed 95% of 2019 values.

Regarding the IFR pattern through the day, the busy periods of 07:00 and 22:00 (local time) start to show again, after having almost disappeared in 2020. Another peak can be seen between 12:00 and 13:00, which is earlier in the day than in the pre-COVID years, where a peak was visible around 15:00. The least busy moment of the day can be located at 20:30.

Safety

Safety is a crucial pillar 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, there were 53 missed approaches, a decrease of 12% compared to 2019, year for which the arrival movements were similar to 2022. Unstable approach and weather (thunderstorm – Windshear) were the leading reasons, accounting for 72% of the missed approaches in 2022. skeyes promotes the increased use of Performance Based Navigation (PBN) procedures. Such approaches greatly improve predictability and therefore situational awareness can be improved. Currently skeyes is working on the PBN transition at Brussels South Charleroi Airport.

There were four runway incursions in Brussels South Charleroi Airport in 2022, two classified as having no ATM ground contribution and two as a severity E – No safety effect. One taxiway incursion, seven taxiway/apron events, one runway excursion and two runway events were reported in 2022. These occurrences are discussed in the Local Runway Safety Team (LRST) with the purpose to make all stakeholders aware and discuss possible actions. The Advanced-Surface Movements Guidance and Control System (A-SMGCS) at Brussels South Charleroi Airport became fully operational in 2022. It optimizes capacities while ensuring a high level of safety, which is expected to reduce runway incursions, enhancing the controllers' situational awareness by monitoring every target on the movement surface.

Capacity and Punctuality

Brussels South Charleroi Airport has a declared capacity for the used runway configurations. This capacity is based on a theoretical throughput capacity based on certain assumptions and rules. In this report the declared IFR capacity is given together with a view on the effectively used capacity. In 2022 the declared capacity was exceeded

on 6 days, during which times at least 76% of the traffic was VFR. For VFR traffic the IFR separation rules do not apply.

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. Brussels South Charleroi Airport is not considered as a contributor airport to this target. In 2022, Brussels South Charleroi Airport did not register any ATFM arrival delay, compared to the total of 836 minutes in 2021 because a zero rate regulation was placed with reason 'N - Industrial Action (non-ATC) – AD' – industrial action of the handling services – and 426 minutes in 2019 due to zero rate regulations with reason 'I -Industrial Action (ATC)' and a regulation with reason 'G -Aerodrome Capacity'

Environment

A preferential runway system (PRS) is in place at Brussels South Charleroi Airport and defines runway 24 as preferred to use. The PRS was followed for 79% of the time. A view is given on the wind direction and speed, the main factor that influences the runway selected.

Brussels South Charleroi Airport normally operates from 06:30 to 23:00 local time. Due to the late arrival of Ryanair flights, the airport managed to close at 23:00 local time only on 28 days. The night traffic in 2022 increased by 58% compared to 2019. The chapter closes with statistics on the continuous descent operations (CDO), also called green landings. CDO Fuel (flying a CDO from FL100) and CDO Noise (flying a CDO from FL60) are steady in the last years. As mentioned above, skeyes promotes the increased use of PBN procedures and is currently working on the PBN transition at Brussels South Charleroi Airport. 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.



SYNOPSIS

Le secteur de l'aviation connaît par le monde entier une reprise rapide et, dans toute l'Europe, les niveaux de trafic de 2019 sont atteints. Brussels South Charleroi Airport suit cette tendance et remonte jusqu'à atteindre 102% du trafic de 2019.

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 South Charleroi Airport. 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 South Charleroi Airport, à savoir pour trois des quatre KPA : la sécurité, la capacité et l'environnement.

En 2022, les travaux d'allongement de la piste ont été achevés avec succès. Malgré l'ampleur des travaux, aucun n'impact n'a été recensé. Ces travaux ont été conduits principalement pour améliorer la sécurité des vols et l'efficacité de l'aéroport. Ils apportent un allongement de la piste de manière à pouvoir accueillir des avions de plus grandes envergures, une amélioration des accès au taxiway et une modernisation des aides à la navigation.

Trafic

Le trafic à Brussels South Charleroi Airport a dépassé les niveaux de 2019. skeyes a contrôlé 83.489 mouvements à Brussels South Charleroi Airport, soit une augmentation de 27% par rapport à 2021. Le trafic IFR (Instrumental Flight Rules) a connu les plus fortes augmentations : 72% depuis 2021 et 5% depuis 2019. Le trafic VFR (Visual Flight Rules) est à la traîne dans la reprise et affiche 95% des valeurs de 2019.

En ce qui concerne l'évolution du trafic IFR le jour, les périodes chargées de 07h00 et 22h00 (heure locale) commencent à réapparaître, après avoir quasiment disparu en 2020. Un autre pic peut être observé entre 12h00 et 13h00, ce qui est légèrement différent des années pré-Covid, où un pic était visible vers 15h00. Le moment le moins chargé le jour se situe à 20h30.

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, 53 approches interrompues ont été enregistrées, soit une diminution de 12% par rapport à 2019, année pour laquelle les mouvements d'arrivée ont été similaires à 2022. Une approche instable et des conditions météorologiques (orages, vent de cisaillements) ont été les raisons principales (72%) d'approches interrompues 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 de la situation. Actuellement, skeyes travaille à la transition PBN à Brussels South Charleroi Airport.

Quatre incursions de piste ont eu lieu à Brussels South Charleroi Airport en 2022, deux classées comme n'étant pas imputables à l'ATM au sol et les deux autres comme étant de classe E (sans effet sur la sécurité). Une incursion sur une voie de circulation (taxiway), sept événements sur une voie de circulation/aire de trafic, une sortie de piste et deux événements sur piste ont été signalés en 2022. Ces événements font l'objet d'une discussion au sein de la Local Runway Safety Team (LRST) dans le but de sensibiliser tous les stakeholders et de discuter des actions possibles. L'Advanced-Surface Movements Guidance and Control System (A-SMGCS) à l'aéroport de Charleroi est devenu pleinement opérationnel en 2022. Ce system optimise la capacité tout en assurant un haut niveau de sécurité aérienne qui permettra de réduire les incursions de piste et améliorera la visibilité des contrôleurs sur la situation des mouvements au sol.

Capacité et ponctualité

Brussels South Charleroi Airport dispose d'une capacité déclarée pour les configurations de pistes utilisées. Cette capacité repose sur un débit théorique fondé sur certaines hypothèses et règles. Le présent rapport comporte la capacité IFR déclarée ainsi qu'un aperçu de la capacité effectivement utilisée. En 2022, la capacité déclarée a été

dépassée pendant 6 jours, au cours desquels au moins 76% du trafic était VFR pendant les heures dépassant la capacité. Pour le trafic VFR, les règles de séparation IFR ne s'appliquent pas.

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. Brussels South Charleroi Airport n'est pas considéré comme un aéroport contributeur pour cet objectif. En 2022, Brussels South Charleroi Airport n'a enregistré aucun retard ATFM à l'arrivée, contre un total de 836 minutes en 2021 provoquées par une régulation « zero rate » catégorisée 'N - Industrial Action (non-ATC) – AD' et 426 minutes en 2019 provoquées par des régulations « zero rate » catégorisées 'I -Industrial Action (ATC)' et 'G -Aerodrome Capacity'.

Environnement

Un système de pistes préférentielles (PRS, Preferential Runway System) est en place à Brussels South Charleroi Airport et définit la piste 24 comme préférentielle. Le PRS a été suivi pendant 79% du temps. Un aperçu de la direction et la vitesse du vent est disponible au sein du rapport, facteur influençant la piste sélectionnée.

Brussels South Charleroi Airport fonctionne normalement de 06h00 à 23h00, heure locale. A cause des arrivées tardives des vols Ryanair, l'aéroport n'a réussi à fermer à 23h00 heure locale que 28 jours. Le trafic de nuit a augmenté de 58% en 2022 par rapport à 2019. Le chapitre se termine par des statistiques sur les Continuous Descent Operations (CDO), également appelées atterrissages verts. 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. skeyes encourage l'utilisation accrue des procédures PBN (Performance Based Navigation). Ces procédures d'approche s'inscrivent dans la transition en cours vers un Environnement PBN (réglementation de l'UE) et améliorent considérablement la prévisibilité pour les équipages, ce qui permet d'améliorer la performance des CDO. Actuellement, skeyes travaille à la transition PBN à Brussels South Charleroi Airport.

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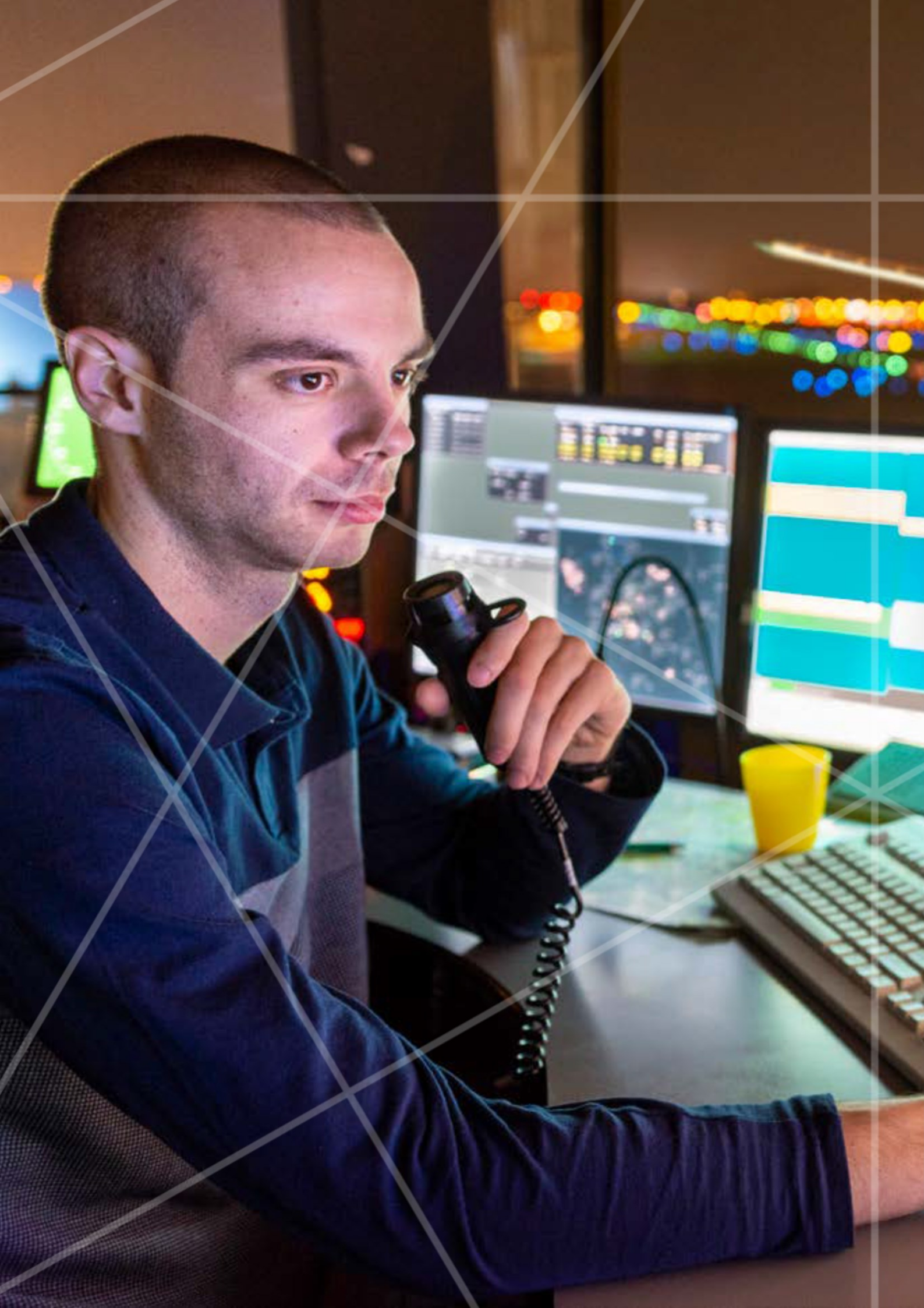
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GLOSSARY





AIP:	Aeronautical Information Publication
AMC:	Acceptable Means of Compliance
AMS:	Airport Movement System
ANSP:	Air Navigation Service Provider
A-SMGCS:	Advanced-Surface Movement Guidance and Control System
ATC:	Air Traffic Control
ATCO:	Air Traffic Control Officer
ATFM:	Air Traffic Flow Management
ATM:	Air Traffic Management
BCAA:	Belgian Civil Aviation Authority
CAA	Civil Aviation Authority
CCO:	Continuous Climb Operations
CDO:	Continuous Descent Operations
COVID-19:	Coronavirus Disease 2019
CRSTMP:	C-Capacity, R-Routeing, S-Staffing, T-Equipment, M-Airspace Management, P-Special Event
CTR:	Control Zone
DEP	Departure
DSA:	Drone Service Application
EBAW:	Antwerp International Airport ICAO Code
EBBR:	Brussels Airport ICAO Code
EBCI:	Brussels South Charleroi ICAO Code
EBKT:	Kortrijk-Wevelgem International Airport ICAO Code
EBLG:	Liège Airport ICAO Code
EBOS:	Ostend-Bruges International Airport ICAO Code
FABEC	Functional Airspace Block Europe Central
ICAO:	International Civil Aviation Organization
IFR:	Instrument Flight Rules
LRST:	Local Runway Safety Team
MCT:	Maximum Throughput Capacity
MVT:	Mixed Volume Traffic
NM:	Network Manager
NOTAM	Notice to Airmen
RAT	Risk Analysis Tool
RMZ:	Radio Mandatory Zone
RWY:	Runway
PRS:	Preferential Runway System
UAS:	Unmanned Aircraft System
VFR:	Visual Flight Rules
Wx:	Weather



1. Traffic

In this chapter, traffic at Brussels South Charleroi Airport (International Civil Aviation Organization (ICAO) code: EBCI) 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

The number of aircraft movements for the last four years are as follows:

- 2019: 82,108 movements (54,948 IFR, 27,160 VFR),
- 2020: 45,534 movements (25,070 IFR, 20,464 VFR)
- 2021: 65,842 movements (33,585 IFR; 32,257 VFR)
- 2022 83,489 movements (57,674 IFR; 25,815 VFR)

High traffic records were registered in Charleroi Airport in the year 2022, which was recovered from the COVID-19 crisis. The traffic picked up in 2022, increasing by 2% compared to 2019. The month with the most flights in 2022 was March, with 8,212 movements recorded in total exceeding the traffic of 2019 of the same period, by 33%.

After a record in Visual Flight Rules (VFR) traffic in 2021, VFR traffic in 2022 is back to similar levels seen in 2019, just 5% lower. There were no VFR flights restrictions in 2022, in opposition to 2020, where VFR flights were at times prohibited or restricted in Belgium.

The Instrumental Flight Rules (IFR) traffic remained on average +5% of 2019 levels and +72% of 2021 levels. This indicates a significant increase in air travel as compared to the previous year, despite the impact of the COVID-19 pandemic. Prior to February 2022, entry into Belgium was restricted for travellers from certain non-European countries. The subsequent reopening of the borders had a significant impact on Charleroi airport, which experienced a high volume of flights from countries such as Morocco. However, since the lifting of these restrictions in mid-February, the airport has observed a recovery in traffic, with levels nearly reaching those of 2019.

Traffic numbers and trends can be found in Figure 1.1 and Table 1-1 below.

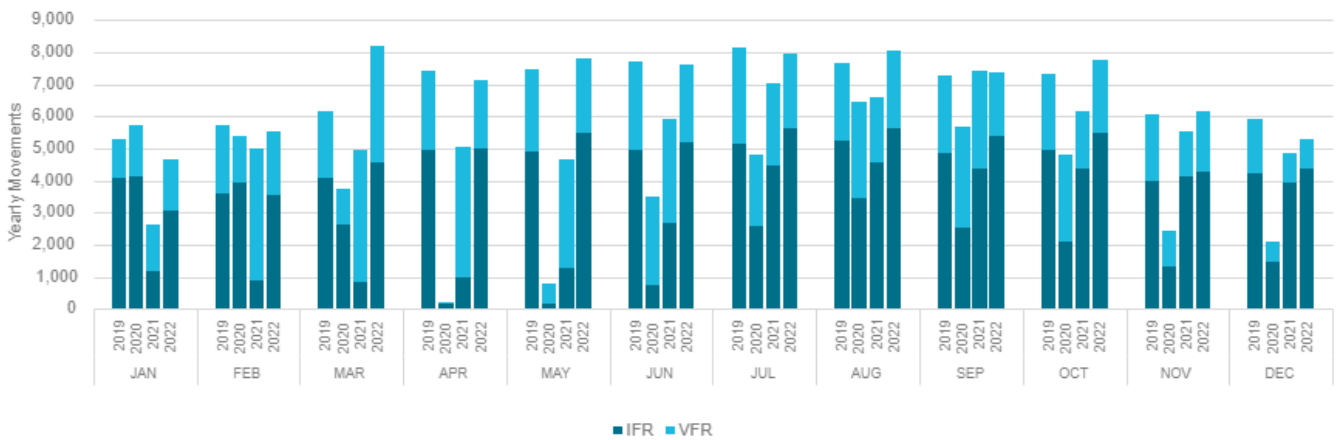


Figure 1.1: Monthly movements per year

Table 1-1: Monthly movements per year

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
IFR	2019	4,102	3,618	4,084	4,936	4,918	4,962	5,134	5,219	4,864	4,938	3,973	4,200	54,948
	2020	4,109	3,921	2,607	144	148	719	2,566	3,471	2,520	2,087	1,296	1,482	25,070
	2021	1,188	890	826	972	1,260	2,651	4,484	4,551	4,360	4,380	4,105	3,918	33,585
	2022	3,060	3,566	4,560	4,978	5,471	5,212	5,647	5,633	5,405	5,479	4,287	4,376	57,674
	2022 vs 2019	-25%	-1%	+12%	+1%	+11%	+5%	+10%	+8%	+11%	+11%	+8%	+4%	+5%
	2022 vs 2021	+158%	+301%	+452%	+412%	+334%	+97%	+26%	+24%	+24%	+25%	+4%	+12%	+72%
VFR	2019	1,174	2,094	2,075	2,476	2,554	2,760	3,015	2,437	2,406	2,366	2,090	1,713	27,160
	2020	1,633	1,485	1,110	35	632	2,776	2,216	2,993	3,147	2,723	1,115	599	20,464
	2021	1,439	4,118	4,112	4,053	3,397	3,265	2,562	2,063	3,081	1,797	1,430	940	32,257
	2022	1,601	1,946	3,652	2,158	2,331	2,410	2,306	2,423	1,952	2,260	1,879	897	25,815
	2022 vs 2019	+36%	-7%	+76%	-13%	-9%	-13%	-24%	-1%	-19%	-4%	-10%	-48%	-5%
	2022 vs 2021	+11%	-53%	-11%	-47%	-31%	-26%	-10%	+17%	-37%	+26%	+31%	-5%	-20%
Total	2019	5,276	5,712	6,159	7,412	7,472	7,722	8,149	7,656	7,270	7,304	6,063	5,913	82,108
	2020	5,742	5,406	3,717	179	780	3,495	4,782	6,464	5,667	4,810	2,411	2,081	45,534
	2021	2,627	5,008	4,938	5,025	4,657	5,916	7,046	6,614	7,441	6,177	5,535	4,858	65,842
	2022	4,661	5,512	8,212	7,136	7,802	7,622	7,953	8,056	7,357	7,739	6,166	5,273	83,489
	2022 vs 2019	-12%	-4%	+33%	-4%	+4%	-1%	-2%	+5%	+1%	+6%	+2%	-11%	+2%
	2022 vs 2021	+77%	+10%	+66%	+42%	+68%	+29%	+13%	+22%	-1%	+25%	+11%	+9%	+27%

Table 1-2: Monthly arrival and departure figures per year

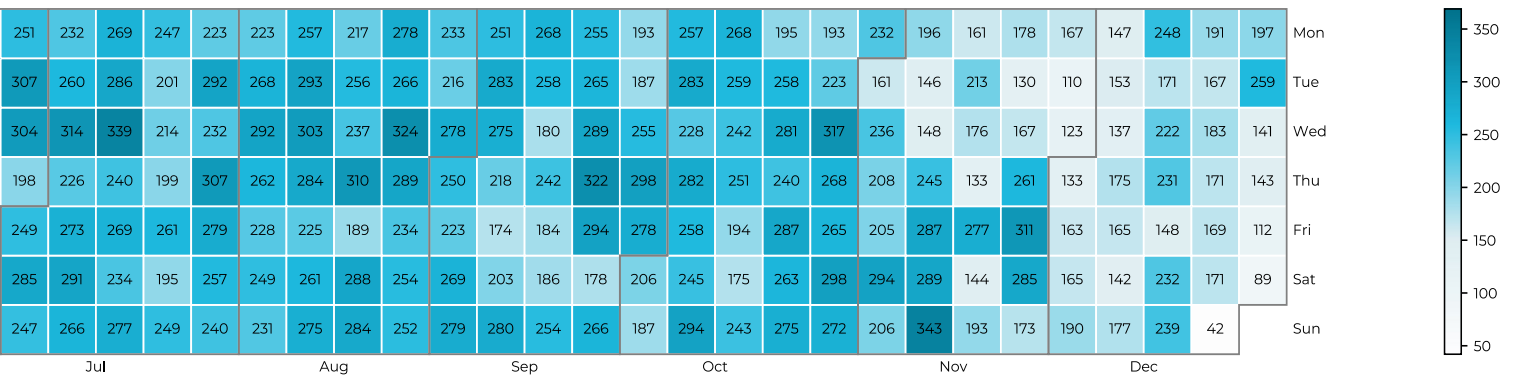
		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Arrivals	2019	2,638	2,850	3,081	3,707	3,734	3,859	4,075	3,829	3,634	3,653	3,031	2,958	41,049
	2020	2,873	2,702	1,860	89	385	1,751	2,389	3,232	2,835	2,408	1,203	1,039	22,766
	2021	1,316	2,503	2,468	2,514	2,329	2,962	3,518	3,310	3,719	3,089	2,769	2,430	32,927
	2022	2,329	2,757	4,106	3,566	3,901	3,813	3,973	4,030	3,677	3,871	3,085	2,638	41,746
Departures	2019	2,638	2,862	3,078	3,705	3,738	3,863	4,074	3,827	3,636	3,651	3,032	2,955	41,059
	2020	2,869	2,704	1,857	90	395	1,744	2,393	3,232	2,832	2,402	1,208	1,042	22,768
	2021	1,311	2,505	2,470	2,511	2,328	2,954	3,528	3,304	3,722	3,088	2,766	2,428	32,915
	2022	2,332	2,755	4,106	3,570	3,901	3,809	3,980	4,026	3,680	3,868	3,081	2,635	41,743

March was a busy month in 2022, with the 5th of March being the day with the highest movement record – 369 movements – of the year. Figure 1.2 gives an overview of the amount of traffic per day in 2022. As previously stated, it can be seen that the first two months were rather calm, and traffic picked up in March. As previously mentioned, there has been a recovery in traffic since mid-February due to the lifting of COVID restrictions, which has allowed passengers from non-European countries to travel again. Among these countries is Morocco, which ranks in the top 5 for arrivals and destinations at Brussels South Charleroi Airport .

Mostly the top ten busiest days are all in the period from end of February to September, the busiest period of 2022. The months of December and January are the months 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.

156	91	111	265	93	277	232	129	231	261	250	335	299	172	321	295	249	253	268	275	191	271	272	304	237	
116	231	102	45	93	112	200	129	290	256	198	255	245	160	302	253	251	292	240	239	227	274	198	279	263	
226	66	71	69	118	289	129	302	269	274	244	260	297	165	227	217	237	259	254	271	257	296	175	300	296	
246	158	143	51	169	104	204	138	271	241	217	276	180	171	304	257	337	233	257	197	288	286	261	286	281	
164	259	165	106	138	275	140	239	236	250	265	259	171	184	284	207	255	276	261	200	220	268	287	248	150	
168	133	300	91	79	269	263	233	324	369	274	260	296	209	217	268	188	292	240	256	246	239	255	343	236	129
177	258	103	184	234	130	197	148	300	293	270	283	239	297	238	238	170	322	230	252	253	261	176	308	232	196
	Jan				Feb			Mar					Apr				May						Jun		

Figure 1.2: Calendar View of movements per day in 2022



Traffic Patterns

Prior to the pandemic, the average traffic pattern over the day has remained steady, allowing for the use of a meaningful average to be used to see daily peaks. Figures 1.3 and 1.4 provide a yearly comparison between 2019 and 2022 of the traffic patterns for IFR and VFR traffic, respectively. These figures illustrate a noticeable difference in the distribution of traffic over the day, reflecting the changes in air travel resulting from the COVID-19 pandemic. It can be seen that the change in pattern started to happen since the beginning of the pandemic, with a less pronounced peak and a more uniform distribution of traffic in 2020. In 2021, the peak traffic time moved from 15:00 to 12:00-13:00, indicating a shift in travel behaviour that may be attributed to changes in travel restrictions and passenger preferences.

As already mentioned before, IFR traffic in 2022 was above 2019 traffic, and this is also clearly visible here. A peak can be seen between 12:00 and 13:00, which is slightly different than in the pre-COVID years, where a peak was visible around 15:00. The evening peak in 2022 occurs slightly later than in pre-covid years, at 22:00. The least busy moment during the opening hours of the airport can be located at 20:30.

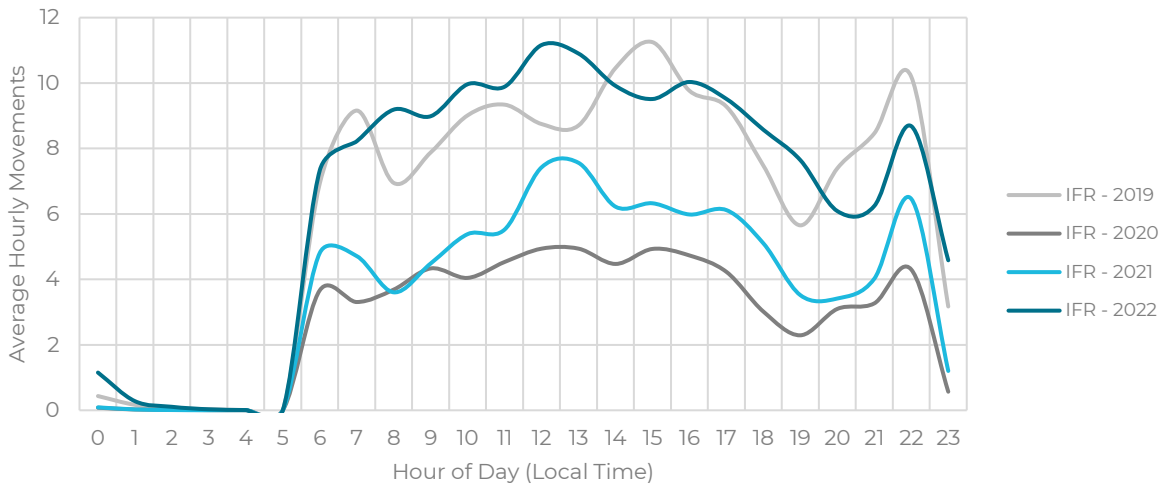


Figure 1.3: IFR hourly average traffic comparison

In opposition to IFR traffic, the number of VFR flights in 2022 is below 2019 and 2021 traffic. During the busiest times of the day, between 10:00 and 17:00, there was on average less movements per hour in 2022 than in the previous year.

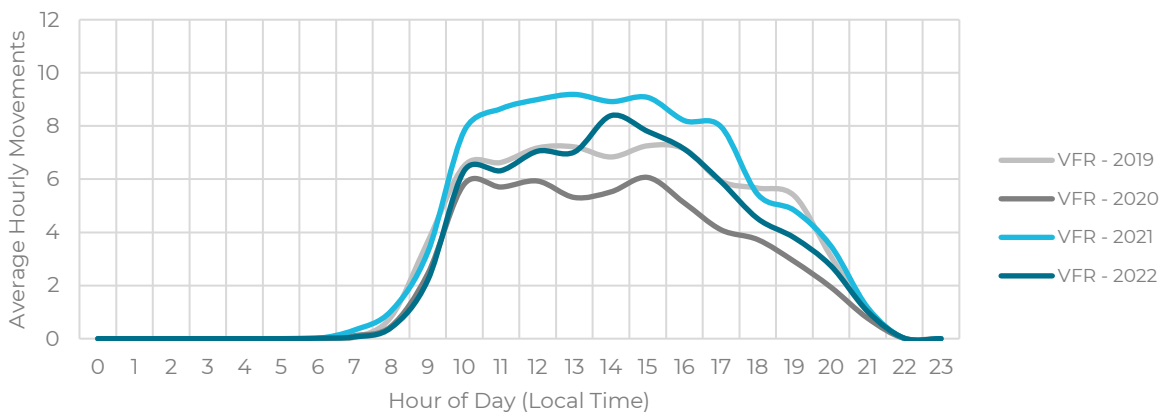


Figure 1.4: VFR hourly average traffic comparison

Runway Use

The use of one runway configuration over another depends on several factors that have to be taken into account, such as meteorological conditions or runway equipment for example. In Brussels South Charleroi Airport, there is a preferential runway system to be used, as mentioned in the Aeronautical Information Publication (AIP). Runway 24 is the preferred runway for take-off and landing.

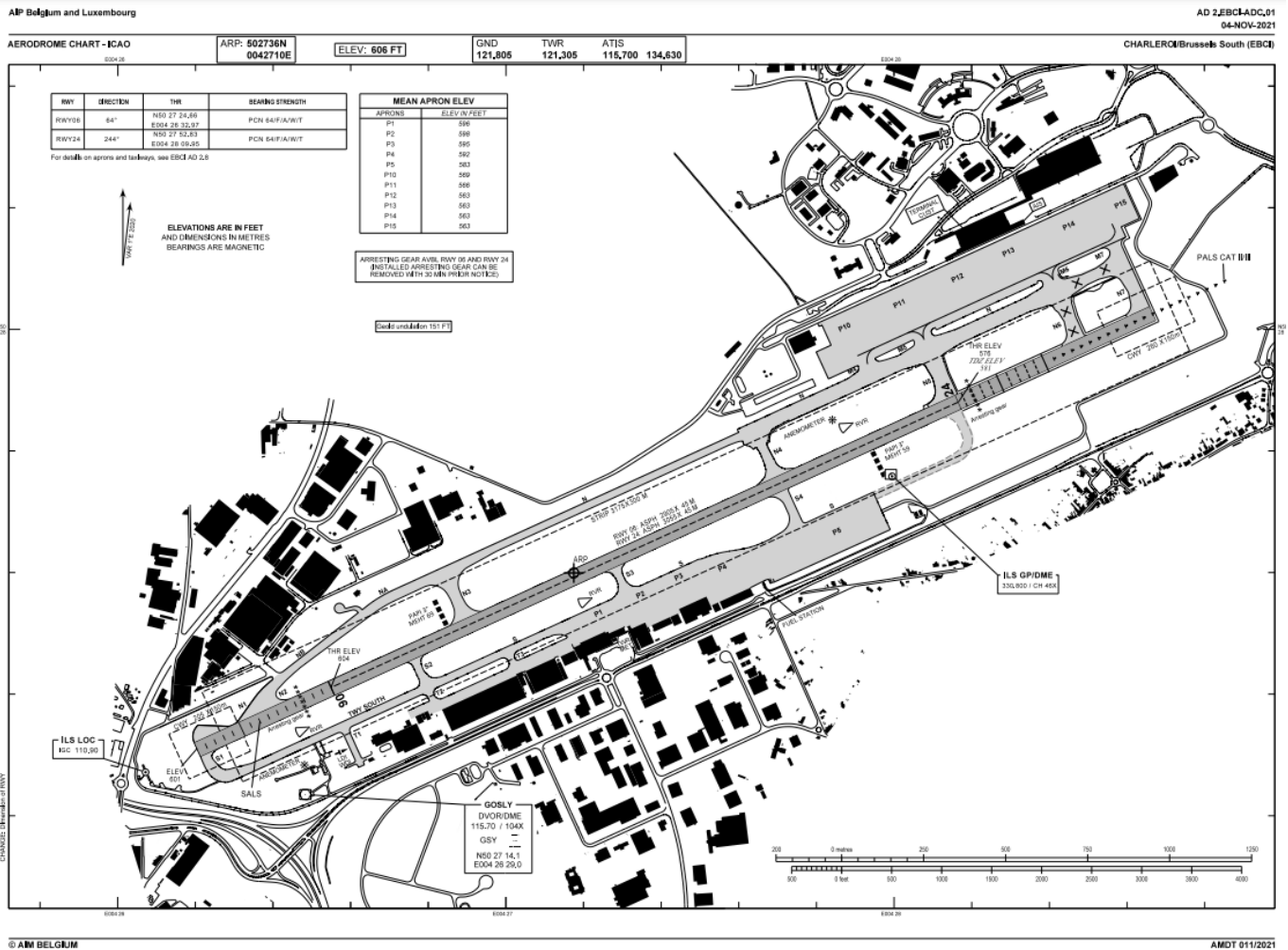


Figure 1.5: Aerodrome Ground Movement Chart - ICAO

Figure 1.6 shows the runway used in Brussels South Charleroi Airport since 2019. In 2022, runway 24 was used for 79% of take-offs and landings. It is close to 2021 trend, but the ratio is below than in 2019 and 2020. Most of the time, the wind blows from a south-westerly direction in Charleroi Airport, which explains the preferred use of runway 24

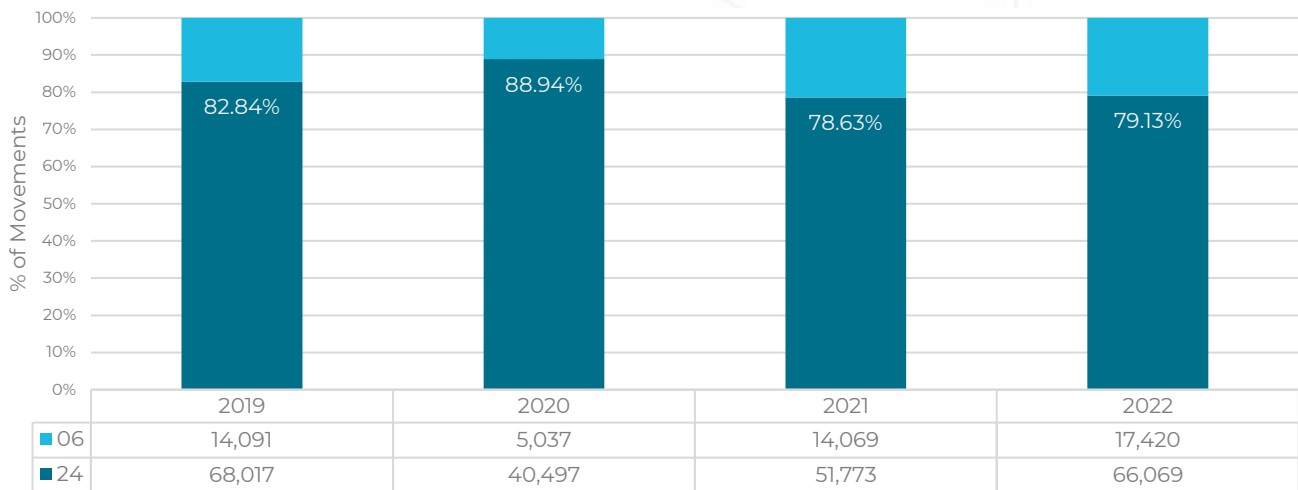


Figure 1.6: Runway use per year

Figure 1.7 below shows the runway use per month of 2022. Runway 24 is overall the most used runway, however, in March and April, more north-easterly winds were recorded at Brussels South Charleroi Airport – as in all other Belgian airports – which explains the increased usage of runway 06 in those months. More details about winds can be found in Figure 4.3 and Figure 4.4 in the fourth chapter of this report.

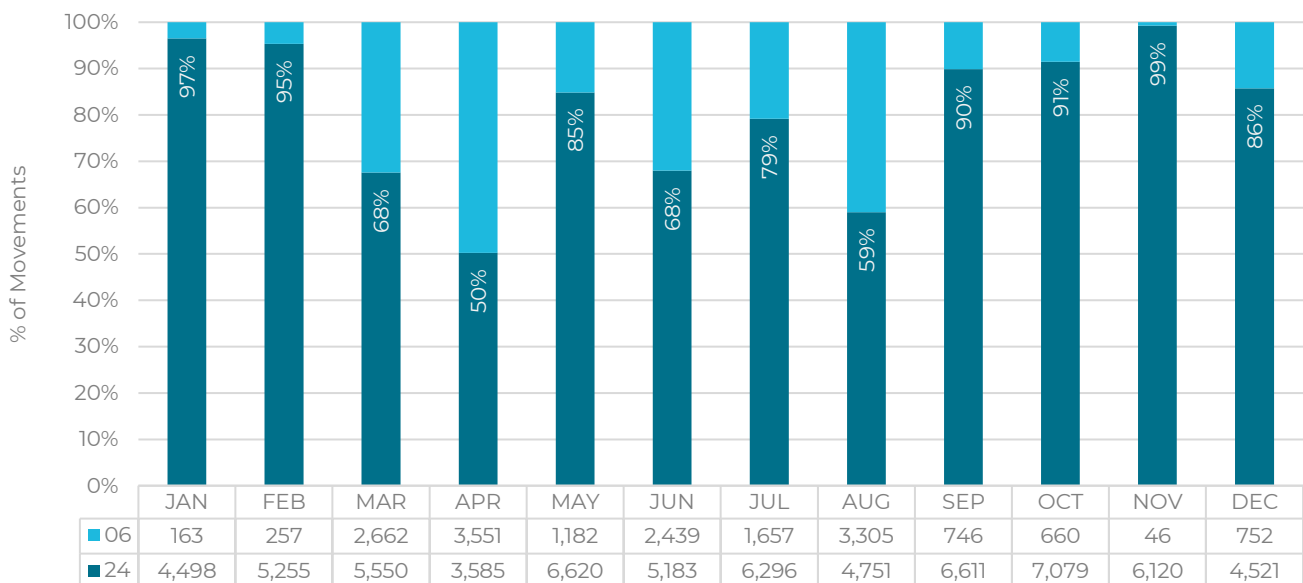


Figure 1.7: Runway use per month in 2022

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.¹

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 is to simplify the planning process for drone operators, and to visualize the planned drone operations for skeyes, the GeoZone manager for controlled airspace above and around the airports of Antwerp (EBAW), Brussels (EBBR), Charleroi (EBCI), Kortrijk (EBKT), Liège (EBLG) and Ostend (EBOS).^{2,3}

Figure 1.8 below shows the drone activity at and around the Belgian airports, as registered by the DSA tool. It also indicates the categories of risk involved in the operations. These categories are defined by the risk the drone activity forms for manned aviation in very low level zones. They are categorised 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

¹ Skeydrone, "Enabling safe drone operations", 2022. <https://skeydrone.aero/> (URL retrieved on 21/04/2022)

² UAS geographical zone statuses can be seen at <https://map.droneguide.be> (URL retrieved on 21/04/2022)

³ 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)

⁴ 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.

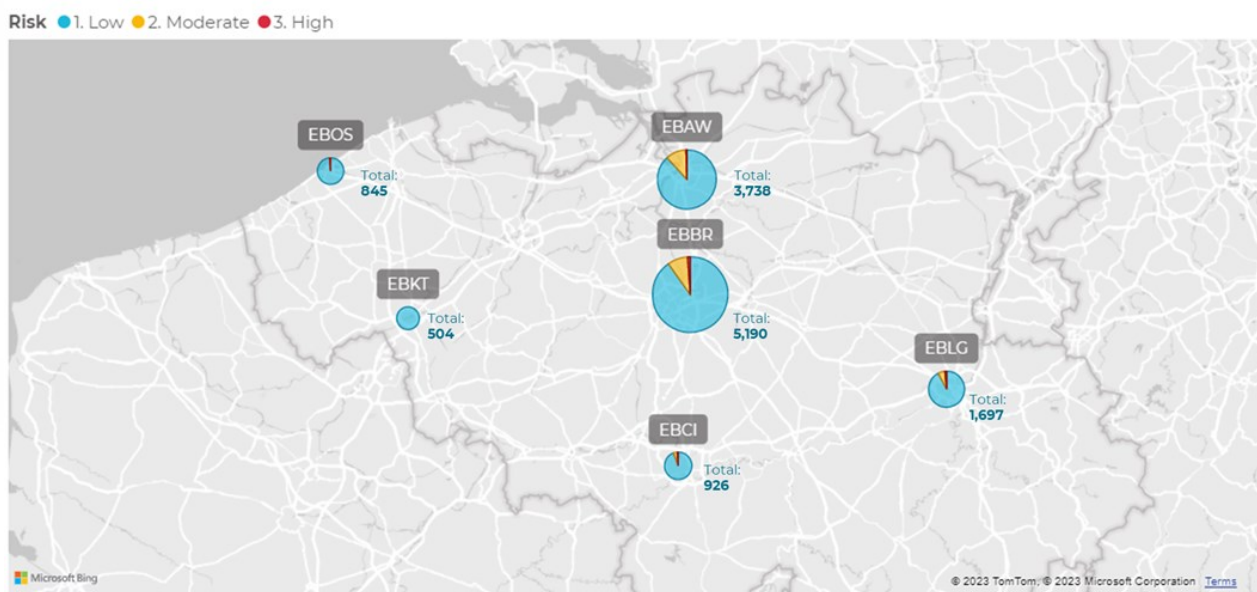


Figure 1.8: Drone activity in Belgian airports in 2022

In Brussels South Charleroi Airport area, there were 926 drone activities recorded in 2022. Those activities can also be classified into a different scheme, taking into account the complexity of the operation. There are three such categories, which are described as follows (as per EASA definition):

- **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.

In Brussels South Charleroi Airport, more than two-third of the drone activities – 461 – operated under the Open category. 245 (30%) were registered as Specific, and none were flown as Certified. Table 1-3 shows the drone activity and their category of operation in the main Belgian airports.

Table 1-3: Drone activities in Belgian airports in 2022

	2022			Total 2022	2021 Total 2021
	OPEN	SPECIFIC	FORMER CLASS 1		
EBCI	581	345	0	926	731
EBOS	652	182	11	845	1451
EBLG	1,161	536	0	1,697	852
EBKT	333	163	8	504	610
EBCI	581	345	0	926	731
EBBR	3,481	1,709	0	5,190	4,530
EBAW	2,557	1,181	0	3,738	4,157
OUT	1,354	281	26	1,661	156

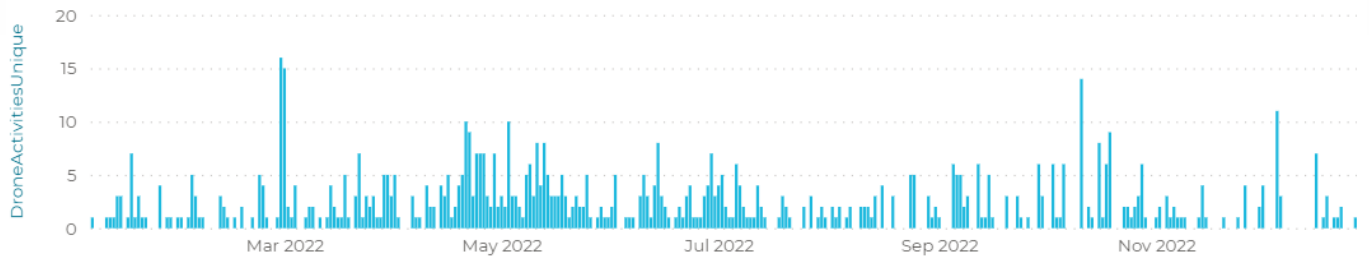


Figure 1.9.: Drone activities in Charleroi Airport in 2022



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).



The following definitions apply for the severity classification (as per EASA Acceptable Means of Compliance (AMC)). This classification scheme is applicable for the later mentioned operational occurrences.

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 are initiated by the pilot, when, for any reason, 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. All missed approaches are recorded by cause of event, and the internal reporting is done by the ATCOs.

The number of missed approaches in Brussels South Charleroi Airport since 2019 are as follows:

- 2019: 60 missed approaches (50 on runway 24, 10 on runway 06)
- 2020: 72 missed approaches (68 on runway 24, 4 on runway 06)
- 2021: 20 missed approaches (17 on runway 24, 3 on runway 06)
- 2022: 53 missed approaches (41 on runway 24, 12 on runway 06)

Figure 2.1 allows a comparison between the years, from 2019 to 2022, by showing the number of missed approaches per 1,000 arrivals. It can be observed that 2022 saw the second lowest rate in the last years, while 2020 had an exceptionally high one. This was in high extent due to strong south-westerly winds caused by storms Ciara and Dennis in February 2020.

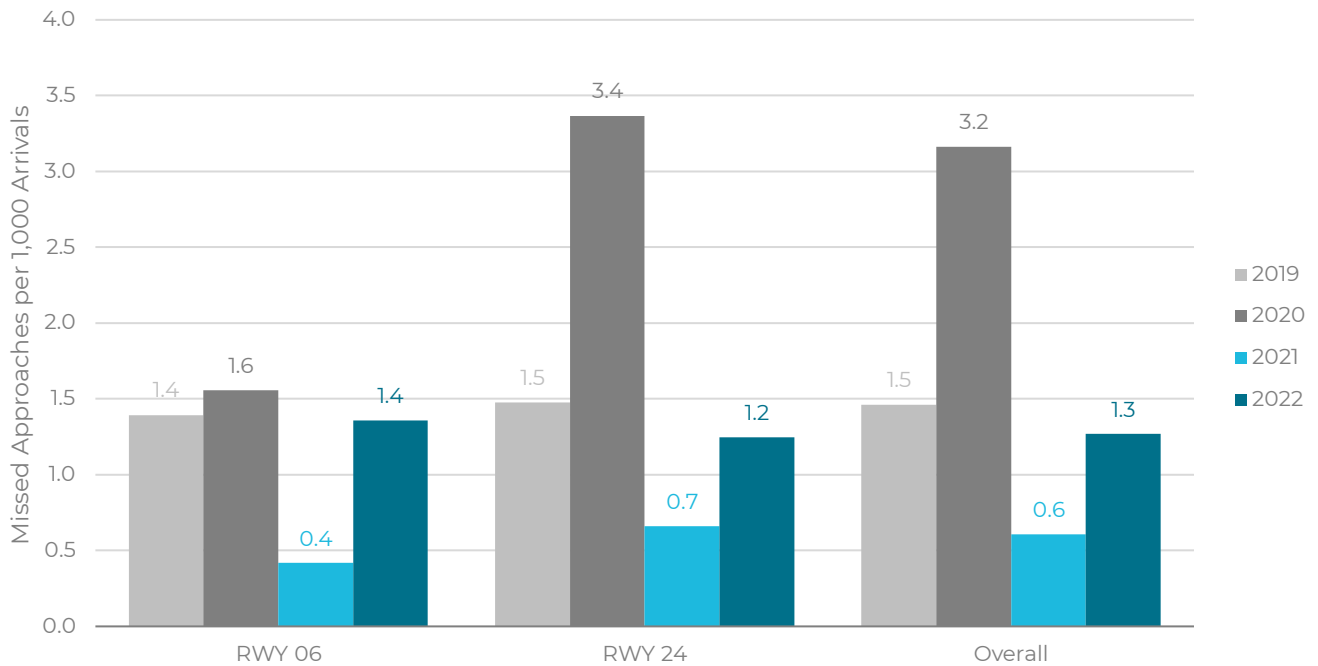


Figure 2.1: Missed approaches per 1,000 arrivals per year

The ratio of missed approaches occurring on runway 24 is in line with 2019. Table 2-1 shows the causes of the missed approaches on runway 24 and 06, ordered from the most to the least frequent in 2022, as well as the amount of missed approaches in the year 2022. There were 53 missed approaches in 2022, being unstable approach and weather (thunderstorm-windshear and poor visibility) the top reasons for missed approaches. The top reason in 2022 was 'Unstable Approach', accounting for the 46% of the occurrences on runway 24 with 24 occurrences.

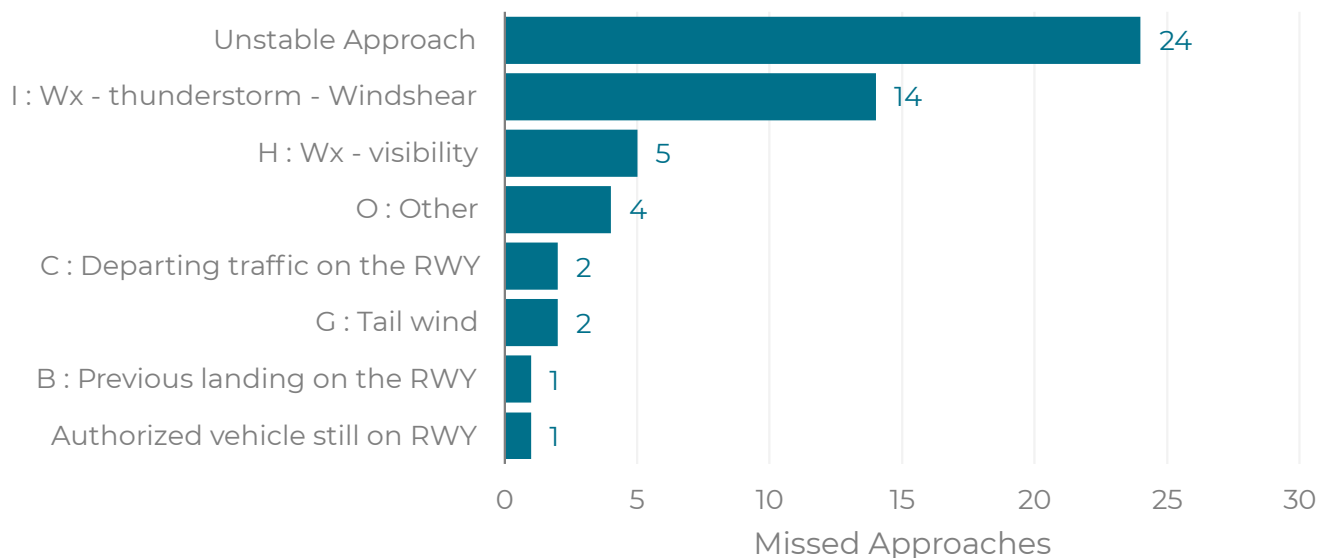


Figure 2.2: Missed approaches per reason

Thunderstorm-windshear was the second most common reason, accounting for 14 instances. Poor visibility was responsible for 5 missed approaches, while departing traffic and tail winds each caused 2 missed approaches. Other reasons were responsible for 4 missed approaches in 2022.

It is worth noting that unstable approach and thunderstorm-windshear have consistently been the main causes of missed approaches in previous years. In 2022, these factors accounted for 72% of all missed approaches, or a combined total of 38 instances. In 2021, unstable approach and thunderstorm-windshear accounted for 40% of missed approaches. In 2020, they accounted for 85% of missed approaches, while in 2019 they accounted for 68%.

Table 2-1: Other Reasons Missed approaches

Description	Reason	RWY
CAT D ACFT ON TWY SOUTH	O: Other	24
GOING AROUND DUE TO COMPANY CRITERIA - 3NM FINAL	O: Other	6
THERMAL ACTIVITY PLUS TCAS ALERT	O: Other	6
Turbulence (sudden direction of wind but NO windshear)	O: Other	24

Table 2-2: Missed approaches on runway 06 per reason

Top 5 causes in 2022 RWY 24	2019	2020	2021	2022
Total Missed Approaches	50	68	17	41
Unstable Approach	25	13	7	19
I: Wx - thunderstorm - Windshear	12	45		14
H: Wx - visibility	1	3	3	2
G: Tail wind				2
O: Other	2	1		2
Part top 5 causes of 2022	80%	91%	59%	95%

Top 5 causes in 2022 RWY 06	2019	2020	2021	2022
Total Missed Approaches	10	4	3	12
Unstable Approach	4	2	1	5
H: Wx - visibility	1	1	1	3
O: Other	1		1	2
C: Departing traffic on the RWY	2			1
Authorized vehicle still on RWY				1
Part top 5 causes of 2022	80%	75%	100%	100%

Runway Incursions (RI)

According to ICAO Doc 4444 – PANS-ATM, a Runway Incursion 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.

AMC 3 of EU Reg 2019/317 defines the “incorrect presence” as “the unsafe, unauthorised, or undesirable presence, or movement of an aircraft, vehicle, or pedestrian, irrespective of the main contributor (e.g., ATC, pilot, driver, technical system)”.

Brussels South Charleroi Airport experienced four instances of runway incursions in 2022, with two being categorized as E-severity incidents and the other two as N-severity incidents. Among the E-severity occurrences was a situation where a controller mistakenly permitted an aircraft to enter the runway while another plane was approaching to land. The first aircraft had already passed the holding point, resulting in the second aircraft being instructed to go around.

Figure 2.2 gives an overview of runway incursions and their severity, along with the number of movements per year.

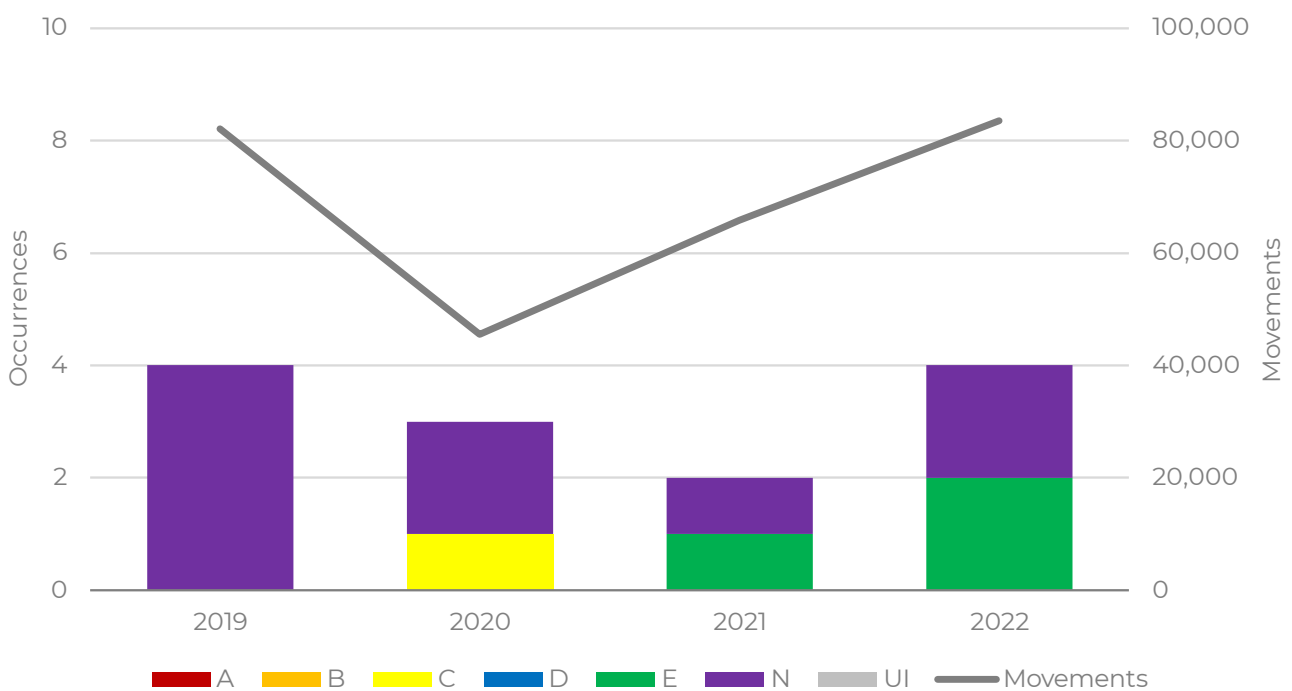


Figure 2.2: Runway incursions per severity category and year

Figure 2.3 allows to put the numbers above in perspective, by comparing the ratio of runway incursions per 100,000 flights, per year. The total ratio of runway incursions for 2022 is similar as for 2019, with almost 5 runway incursions per 100,000 movements. The ratio of runway incursion with ATM contribution increases to 2.4 runway incursions per 100,000 movements compare to 1.5 in 2021, 2.2 in 2020 and 0 in 2019.

The data suggests that ATM contributions to runway incursions remain a concern and addressing this issue should remain a priority to ensure safe operations at airports. Regular monitoring of runway incursions caused by both ATMs and non-ATMs is essential to maintain a high level of aviation safety.

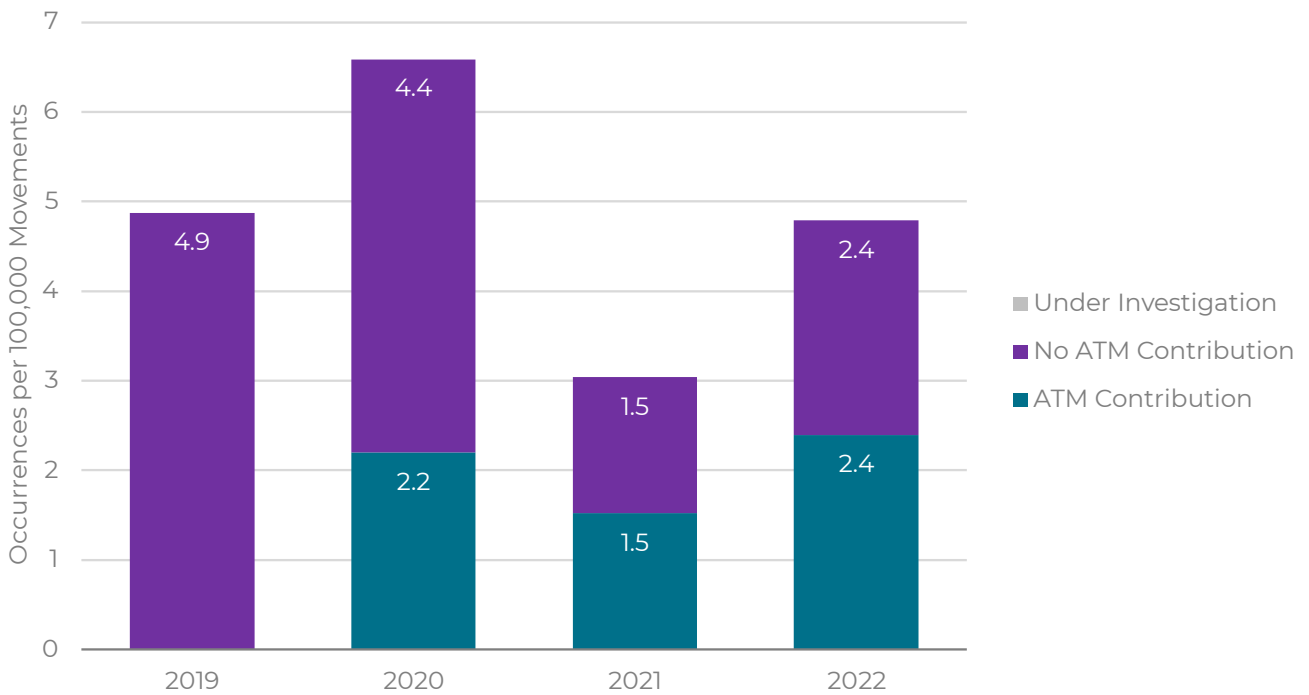


Figure 2.3: Ratio of runway incursions per 100,000 movements per year

Other Noteworthy Incidents

In addition to runway incursions, other runway incidents can happen and must be reported, such as runway events, runway excursions, taxiway/apron events, taxiway excursions and taxiway incursions.

Figure 2.4 gives a summary of those incidents in Brussels South Charleroi Airport, per year.

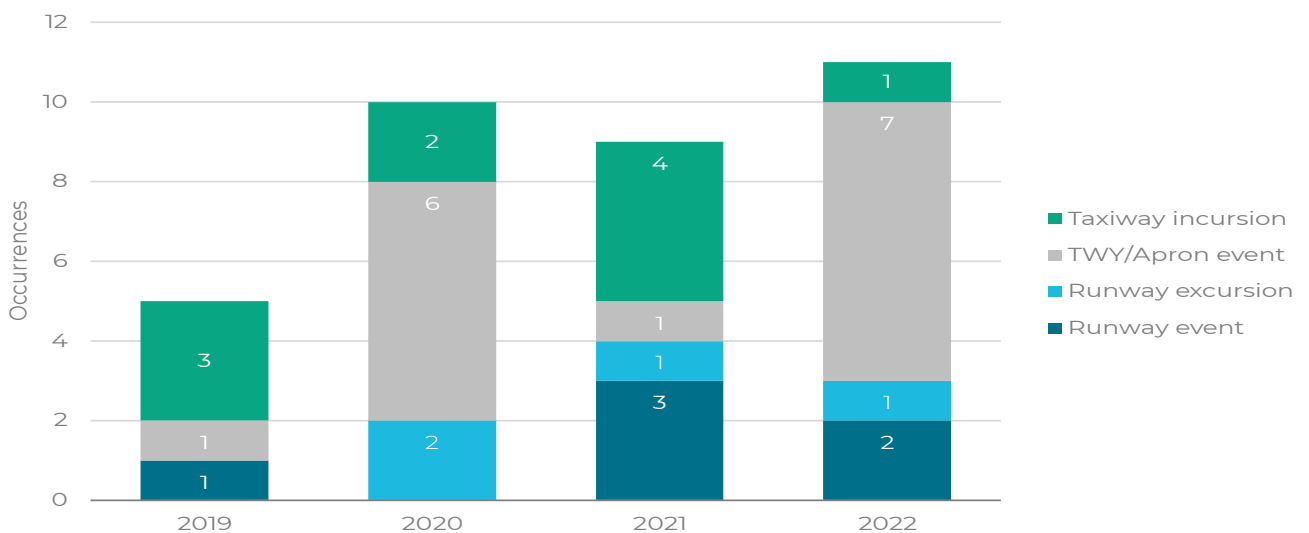


Figure 2.4: Incidents per type and year

In 2022, there were eleven events: two runway events, one runway excursion, seven taxiway/apron event and one taxiway incursions. Out of those occurrences, only one taxiway/apron event happened with skyes contribution, but was classified as severity E, no safety effect.

As seen in

Figure 2.5, the rate of Wildlife reports per 100,000 movements slightly increased to 69.5 in 2022 compared to the ratio of 54.7 in 2021. In absolute numbers, there were 58 reports related to wildlife in 2022 compared to the 36 in 2021 and 2019 and 37 in 2020.

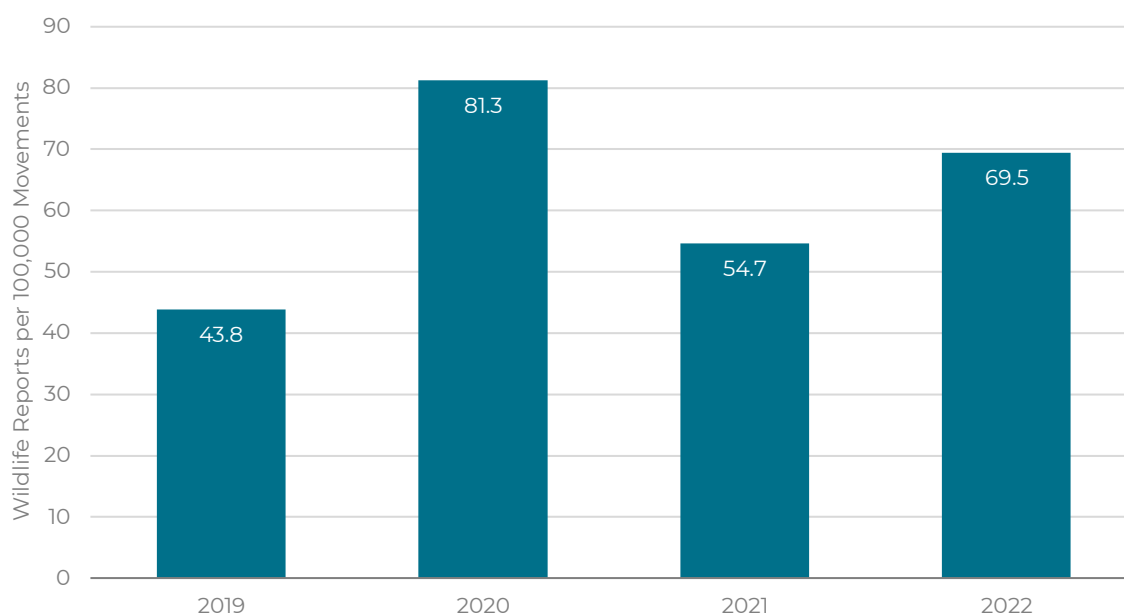


Figure 2.5: Rate of wildlife reports at Charleroi Airport

Recommendations and awareness

The Local Runway Safety Team, which meets every two months, is committed to increasing Runway Safety, and is composed of pilots, air traffic controllers and safety departments of 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 moment where safety issues are discussed between partners. Also, outcomes of the safety investigations are shared among all so that all parties may benefit from the lessons learnt. For example, the two taxiway incursions that occurred in 2020 led to the development of new towing procedures.

The Advanced-Surface Movements Guidance and Control System (A-SMGCS) at Brussels South Charleroi Airport became fully operational in 2022. This radar monitoring tool provides air traffic controllers with the means to guide and control aircraft and ground vehicles, particularly in poor visibility conditions. It optimizes capacities while ensuring a high level of safety, which is expected to reduce runway incursions. The A-SMGCS acts as a safety net, enhancing the controllers' situational awareness by monitoring every target on the movement surface.

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 and therefore situational awareness can be improved. Currently skeyes is working on the PBN transition at Brussels South Charleroi Airport.



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 South Charleroi Airport is studied. The arrival delay, delay due to regulations placed by Brussels South Charleroi 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 South Charleroi Airport caused by regulations not only at Brussels South Charleroi 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 of optimal conditions.

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 be 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.
- 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 Arrivals (ROTA) is based on assumptions.
- The average approach speed is 136 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 between take-off-clearance delivery and the aircraft reaching a given altitude.
-

The Declared Capacity is set as 90% of the Theoretical Capacity Throughput for each runway system. Here, it is noteworthy 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 displays this declared capacity per runway configuration at Brussels South Charleroi Airport.

To summarize, 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. The declared capacity is thus set at 90% of the optimum. As a performance indicator, we monitor how many operations have been performed within each hour of the year and check if the declared capacity has ever been exceeded.

Table 3-1: Declared IFR capacity

Runway Configuration	Runways		Declared Capacity [movements/hour]		
	DEP	ARR	Only Departures	Only Arrivals	Mixed Fleet
24	24	24	29	33	42
06	06	06	27	30	42

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. 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 flights⁴ are. 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.

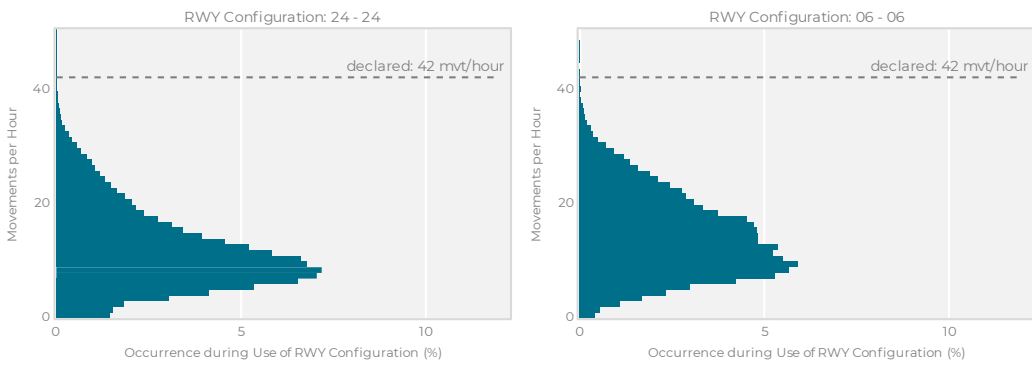


Figure 3.1: Arrivals, departures and declared capacities during peak hours in September 2022

In 2022, there were two days where the declared capacity for RWY06 was exceeded and four days where the declared capacity for RWY24 was exceeded. These days are listed in Table 3-2, which includes a list of every day where capacity has been exceeded at least once during the year, along with the extreme values (minimum/maximum) of interest for each day and configuration. It should be noted that during the hours where the declared capacity was exceeded, there was a high percentage of VFR movements, which do not require IFR separation rules, allowing for a higher throughput of traffic to be achieved.

Table 3-2: Days with hours exceeding the capacity at EBCI in 2022 per runway configuration.

EBCI					
runway configuration	date (local time)	extra movements (min)	percentage VFR (min)	percentage departures (min)	percentage departures (max)
06 - 06	24/01/2022	1	84%	49%	53%
06 - 06	11/04/2022	6	76%	53%	59%
24 - 24	15/01/2022	8	82%	46%	59%
24 - 24	26/02/2022	8	77%	42%	53%
24 - 24	05/03/2022	5	77%	52%	58%
24 - 24	20/03/2022	2	74%	47%	58%

⁴ 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.

Punctuality

Punctuality can be seen as a service quality indicator from a passenger perspective. This section observes one of the factors that influences punctuality: Air Traffic Flow Management (ATFM) delay. ATFM delay is defined as the time difference between estimated take-off time and calculated take-off time of the Network Manager (EUROCONTROL) and is due to ATFM measures that are classified according to the causes listed below:

- A - Accident
- C – ATC Capacity
- D - De-icing
- E - Equipment (non-ATC)
- G – Aerodrome Capacity
- I - Industrial Action (ATC)
- M - Airspace Management
- N - Industrial Action (non-ATC)
- O - Other
- P - Special Event
- R – ATC Routeing
- S – ATC Staffing
- T - Equipment (ATC)
- V – Environmental Issues
- W - Weather
- NA - Not Specified

The ATFM measures with Air Navigation Service Provider (ANSP) contribution are listed according to the Functional Airspace Block Europe Central (FABEC) performance plan:

- C – ATC Capacity
- R – ATC Routeing
- S – ATC Staffing
- T - Equipment (ATC)
- M - Airspace Management
- P - Special Event

In the remainder of the report, all causes with ANSP contribution are referred to as CRSTMP. Additionally the measures due to W – Weather are split in a separate category, resulting in three aggregated categories: CRSTMP, Weather and Other categories.

The discussion in this section starts with the key performance indicator: arrival delay. The Airport Arrival ATFM Delay is an indicator of ATFM delays on ground for a flight due to a regulation placed by the airport of arrival. In addition, this section gives an overview of the influence of ATFM measures on traffic arriving to or departing from Brussels South Charleroi Airport.

Arrival Delay

As of January 1st, 2015, skeyes is subject to an annual target with regard to ATFM arrival delay. ATFM arrival delay is the delay of a flight attributable to terminal and airport air navigation services and caused by restrictions on landing capacity (regulations) at the destination airport. 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. For reference period 3 (RP3), 2020-2024, the national target was initially 1.82 minutes/flight for all causes and 0.17 minutes/flight for CRSTMP causes with Brussels Airport the only contributing airport. After a revision of Union-wide performance targets, the arrival delay targets as of 2021 are 1.08 minutes/flight all causes and 0.12 minutes per flight for CRSTMP causes, and the only contributing airport is Brussels Airport.

Despite not having its own target, skeyes registers the arrival delays for Brussels South Charleroi Airport as part of a continuous monitoring of the ANSP's performance and internal performance indicator. 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 events⁵.

The number of arrivals and the arrival delay for the performance indicator for the years 2019 to 2022 are given in Table 3-2. The average arrival delay per flight is calculated by dividing the sum of arrival delay with ANSP contribution by the number of total flights calculated by the Network Manager (EUROCONTROL). Both the arrival delay and the included flights are provided by the Performance Review Unit (EUROCONTROL).⁶ This performance indicator is given in Figure 3.3 below.

Table 3-3: Arrival delay per cause and year:

		Minutes of Arrival Delay				IFR Arrivals (With flight plan)
		CRSTMP	Weather	Other categories	Total	
Arrivals	2019	0	0	426	426	27,364
	2020	0	0	0	0	12,402
	2021	0	0	836	836	16,569
	2022	0	0	0	0	28,744

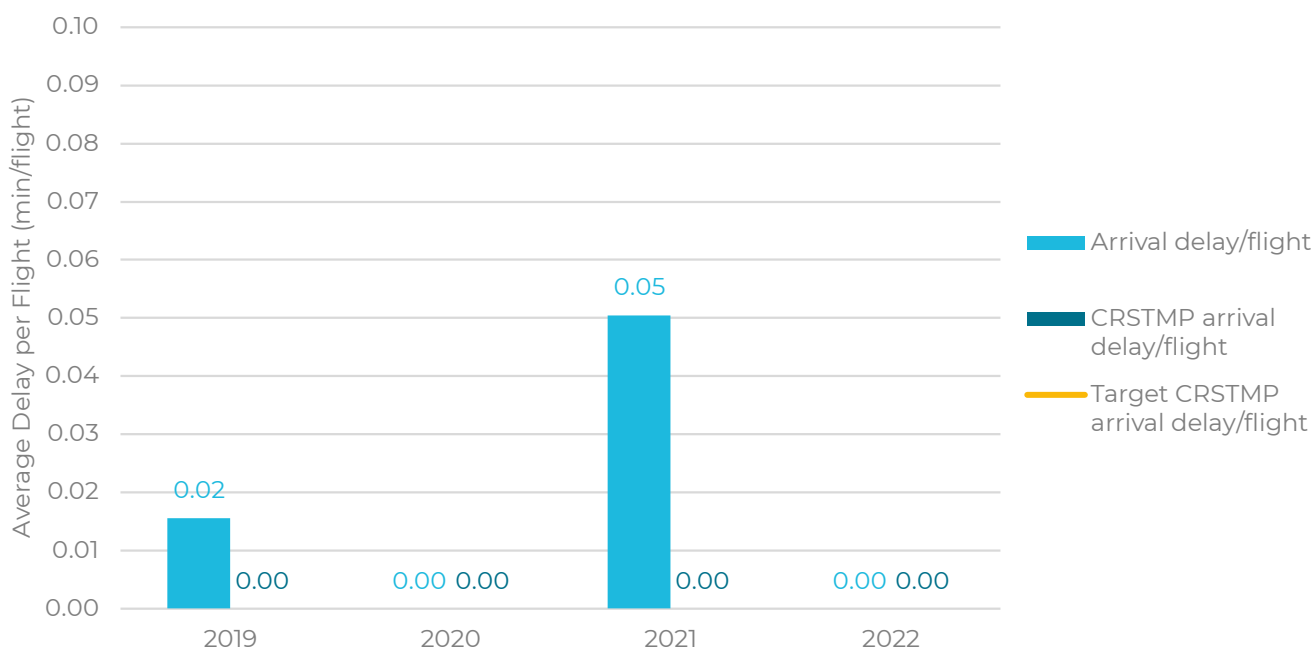


Figure 3.2: Arrival delay performance indicator

⁵ European Commission, "Regulations," Official Journal of the European Union, p. 67, 2019

⁶ Note that in chapter 1, movements are defined by the AMS and the BCAA criteria. In this chapter, the Network Manager (EUROCONTROL) is taken as source for traffic numbers and only accounts for flights with a registered flight plan.

In 2022, zero minutes of arrival delay was registered by the Network Manager at Brussels South Charleroi Airport. In 2021, a total of 836 minutes of delay at the airport due to N-Industrial Action (non-ATC)-AD.

ATFM impact on traffic

The impact of ATFM measures go beyond the restrictions placed by the airport of destination. In this section of the report, a view is given on the ATFM delay for all departing and arriving traffic in Brussels South Charleroi Airport. Regulations can be put in place at all ATC sectors on the flight plan: en-route sectors, departure and/or destination airport. The impact of all these regulations give the total ATFM delay of the airport. With the traffic downturn since 2020, the need for regulations was very low.

This can also be seen in the delay figures. Figure 3.4 shows the total ATFM impact for all traffic arriving in Brussels South Charleroi Airport for the years 2019 to 2022. In 2022, a total of 118,976 minutes of delay hit arriving traffic (802% more than in 2021), of which 5,990 due to skeyes, representing 5% of the total delay.

In the previous section, we showed the amount of delay caused by regulations placed by the airport on the arriving traffic, which was zero with ANSP contribution. Therefore, the 5,990 minutes of delay caused by skeyes were due to en-route regulations.

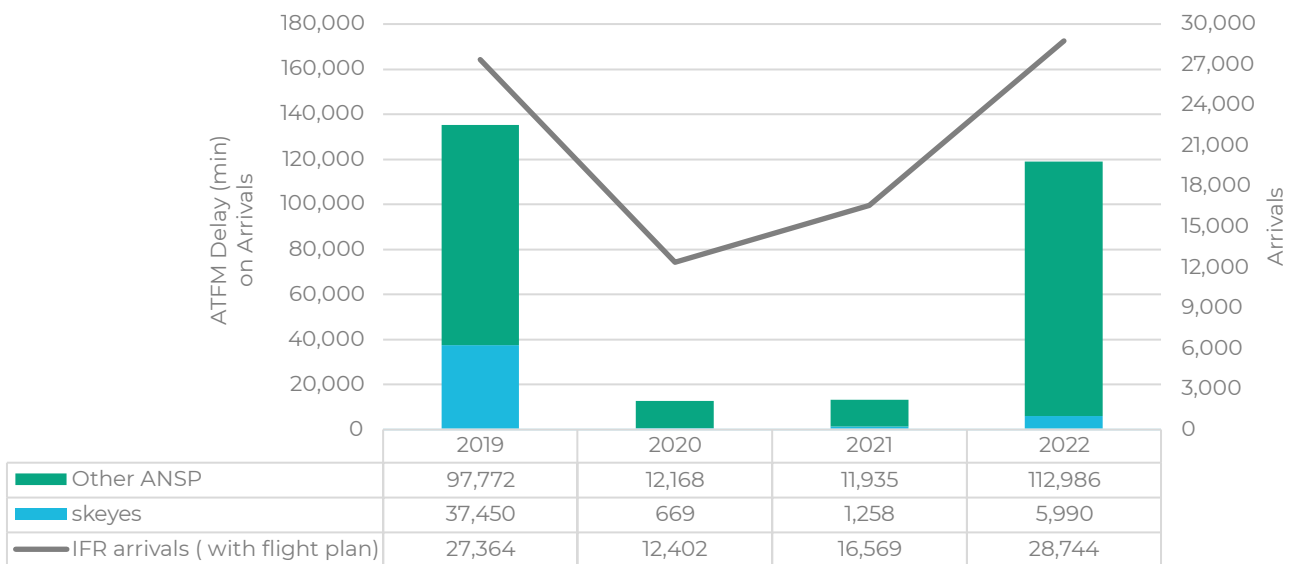


Figure 3.3: ATFM delay for arriving traffic per year and origin

Following the same logic, Figure 3.4 shows the total ATFM impact for all traffic departing from Brussels South Charleroi Airport for the years 2019 to 2022. A similar trend as previously can be seen, with the total of 126,646 minutes of delay representing an increase of 731% compared to 2021. This is also an 82% increase compared to the 2019 total of 120,494 minutes of delay. The 4,483 minutes on skeyes' side were also due to en-route regulations, representing 4% of the total delay.

Focusing only on the regulations placed by the tower at airports such as Charleroi provides a limited perspective, as flights can still experience delays due to air traffic control (ATC) regulations beyond the airport's control. This is why we also examine the impact of any European en-route regulations that may cause delays for flights arriving or departing from Charleroi. In fact, the impact of such regulations has increased significantly in 2022 compared to 2020 and 2021, returning to 2019 levels. Specifically, delays for arrivals in 2022 were 12% lower than in 2019, while delays for departures in 2022 were 5% higher than in 2019. The increase in delay is a trend observed across Europe in 2022, driven primarily by rising traffic levels. Although traffic had been too low in 2020 and 2021 to necessitate regulations in the European network, it was back to approximately 83% of 2019 levels in 2022, with additional

complexities arising from the war in Ukraine, the 4-flight in France, and with the congestion problems present before covid popping up again. It is worth noting, however, that skeyes is responsible for only a small proportion of the ATFM delay that Charleroi arrivals and departures experience. The main contributors last summer were Germany and France. Specifically, skeyes' share of the ATFM delay that impacted arrivals decreased from 28% in 2019 to 5% in 2022, while its share of the ATFM delay impacting departures decreased from 20% in 2019 to 4% in 2022.

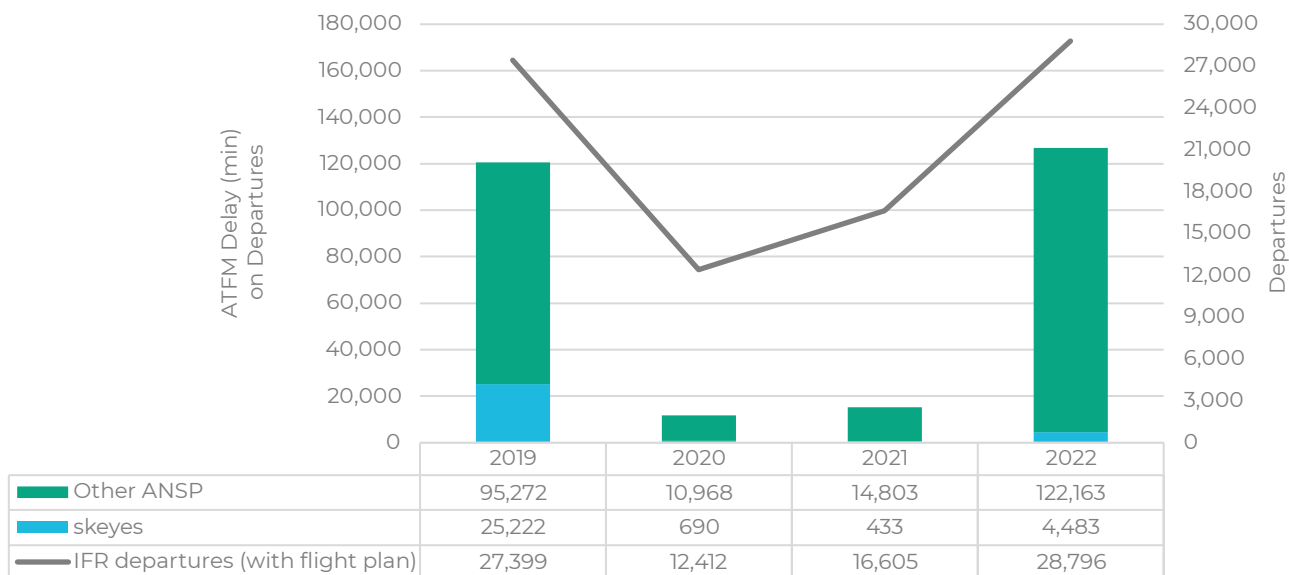


Figure 3.4: ATFM delay for departing traffic per year and origin

In total in 2022, 6,927 arrivals were impacted by ATFM delay, and 6,733 departures flights by ATFM delay. Those can be categorised by severity, based on the duration of the delay. There are four categories:

- 1-15 minutes of delay
- 15-30 minutes of delay
- 30-60 minutes of delay
- More than 60 minutes of delay

The figure below show those categories respectively for arriving and departing traffic.

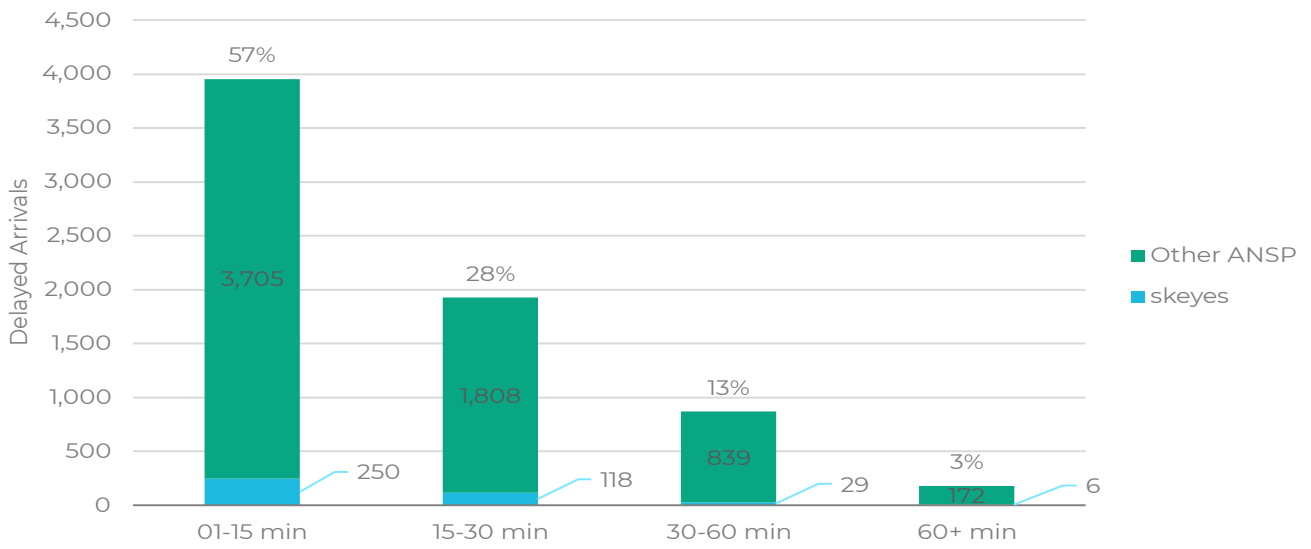


Figure 3.5: Arrival delay per category

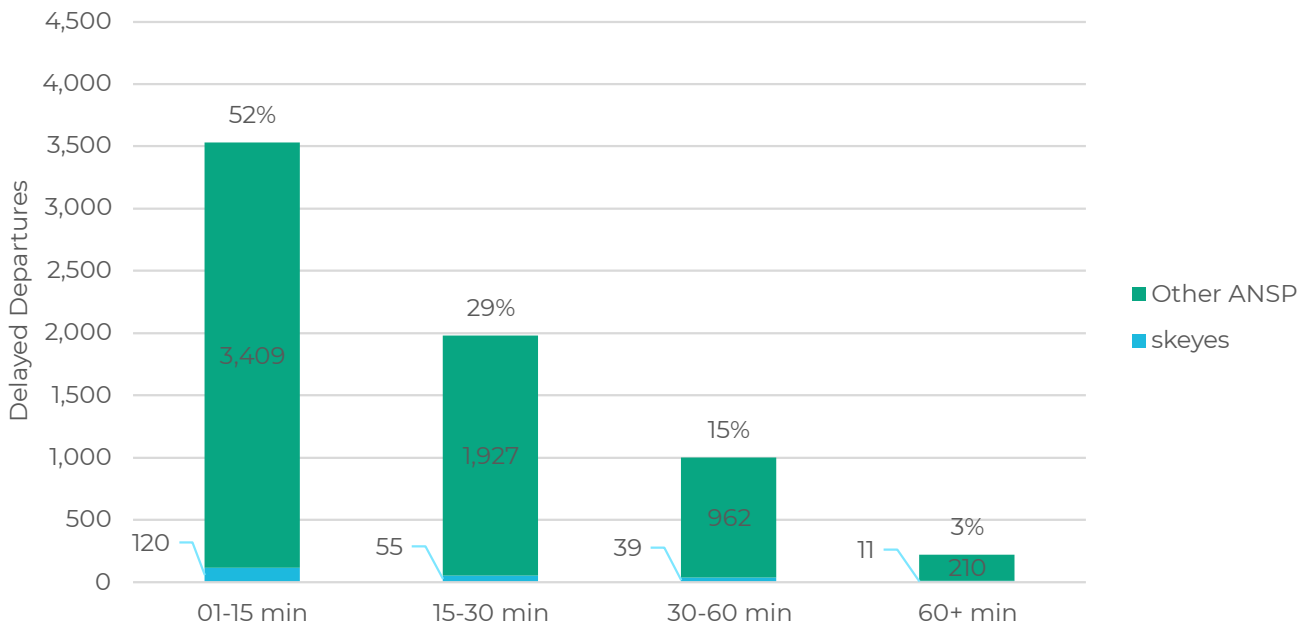


Figure 3.6: Departure delay per category





4. Environment

The first part of this chapter is dedicated to the runway configuration scheme in use at Brussels South Charleroi Airport. The airport is geographically located near populated areas, It is therefore all the more important to consider noise and its reduction, as far as possible, in the vicinity of the airport. For that purpose, a monthly and yearly overview of the use of the Preferential Runway System (PRS) is included in this chapter. 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.

Night movements are also part of this chapter.



Preferential Runway System

According to the Aeronautical Information Publication (AIP) for Brussels South Charleroi Airport, runway 24 shall be used as preferred runway for take-off and landing in case it is dry and the cross or tailwind components do not exceed ten and eight knots, respectively. When the runway is wet, the maximum tailwind threshold is five knots. For safety reasons, if one of the above-mentioned criteria is not met, the Preferential Runway System (PRS) will not be followed and the most suitable runway in the given case will be used.

The runway use was already discussed in Chapter 1. Figure 1.5 and Figure 1.6 show the runway usage per year for the period from 2019 until 2022 and the runway use per month in 2022. These fractions are based on the number of movements on each runway. In 2022, 79% of the movements used the preferential runway.

The start of the change of the runway in use is also logged, giving the opportunity to look at the use of the runway in time rather than movements. For 2022, runway 24 was used for 79% of the time the airport was open. Figure 4.1 shows the percentage of movements that followed PRS.

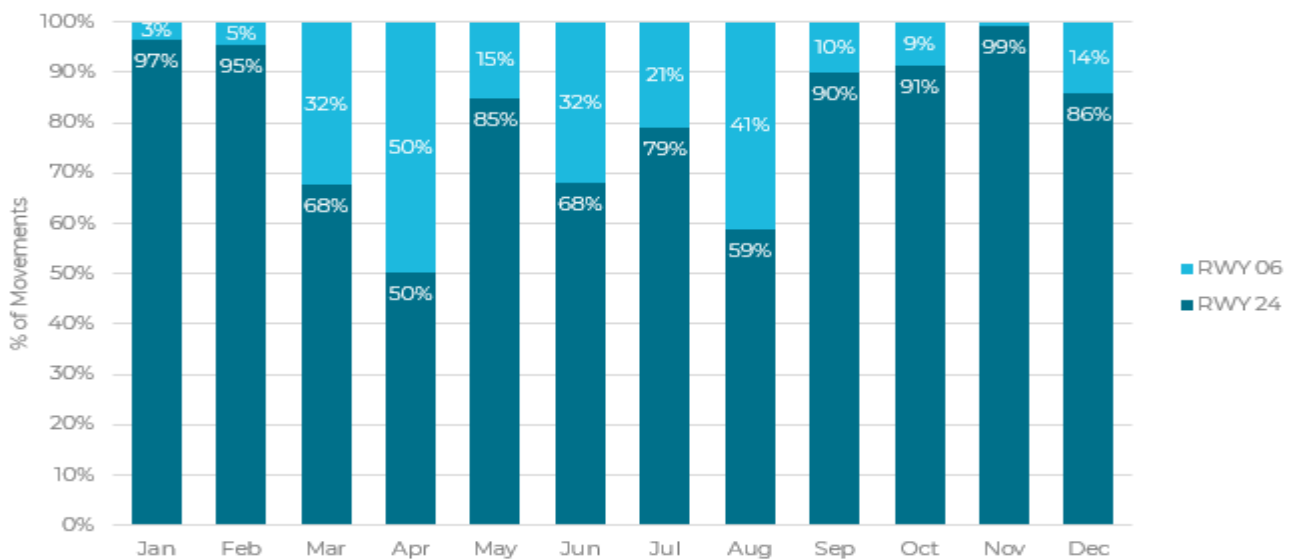


Figure 4.1: Runway use (based on % of movements)

Winds

According to the wind rose diagram in Figure 4.3, south-westerly winds were frequent in 2022, resulting in a high share of the use of runway 24. It is noteworthy that, although the use of this runway was not higher than in previous years, the frequency of these winds was still significant. Additionally, in 2022, there were also more north-easterly winds compared to 2020 or 2019, which led to an overall higher use of runway 06. This information is crucial for safe and efficient airport operations, and pilots should be aware of prevailing wind conditions to adjust their flight operations accordingly.

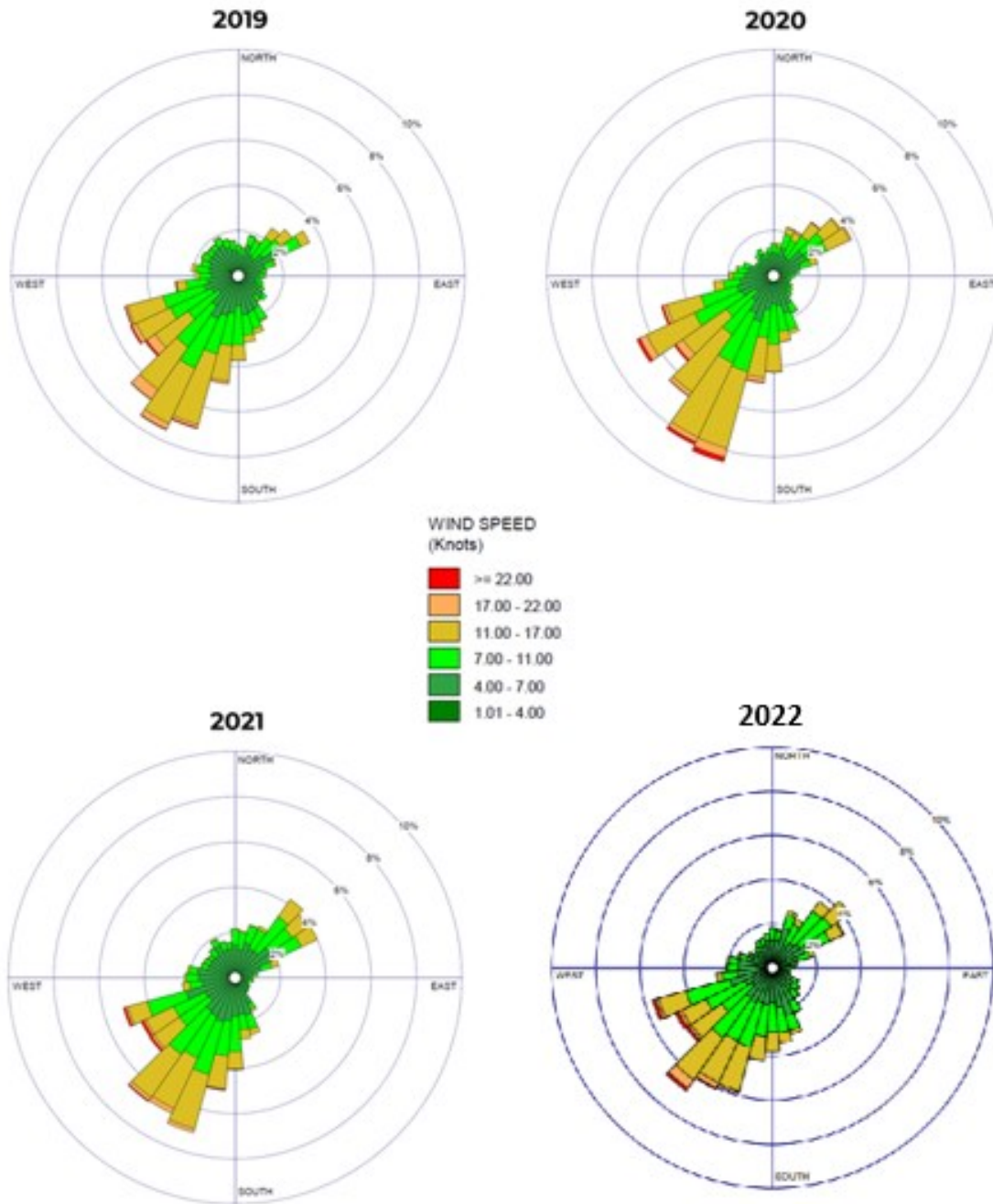


Figure 4.2: Wind roses 2019 - 2022

It is also interesting to look at the wind patterns of each month in 2022, as pictured in Figure 4.4. In fact, we see that in most months, the main wind direction was south-westerly. There are a few exceptions however, like March, April, June and August, where winds from the north-east were more present. This explains the higher use of runway 06 in those months, as presented in Figure 1.6 from Chapter 1.

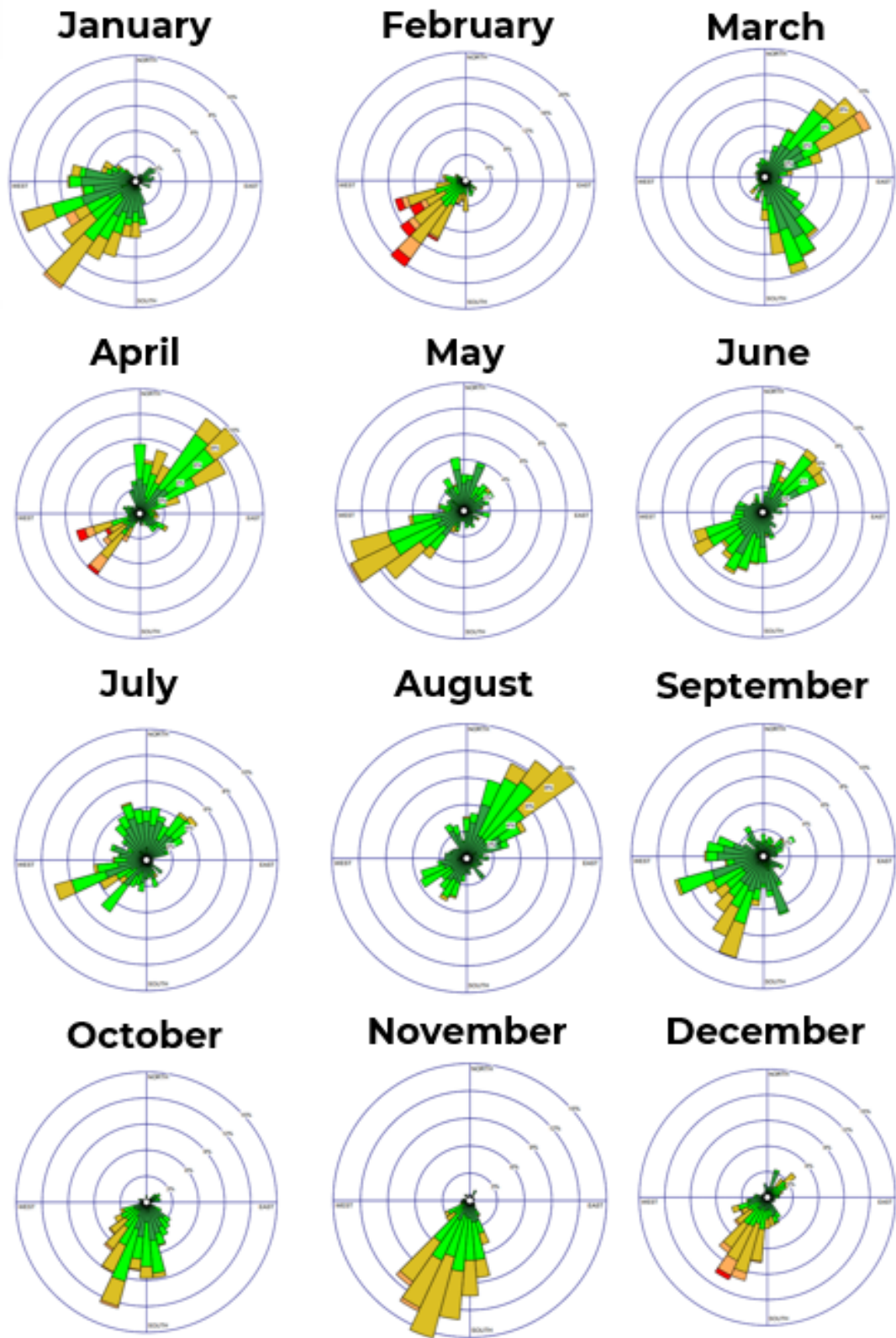


Figure 4.3: Wind roses per month 2022

Opening times and night movements

The usual operational opening hours of Brussels South Charleroi Airport are from 06:30 until 23:00 local time. Several reasons can lead to adapted opening and/or closing times, as for example works in or in the vicinity of the airport, or aircraft arriving outside those defined hours. In the latter case, air traffic services operational hours are extended until the last flight has landed.

A visualisation of the opening hours is given in

Figure 4.4 below. It can be seen that between the months of May to October, the airport's closing time is delayed due to the late arrival of Ryanair flights. As a result, the airport may remain open for an additional period beyond the usual closing time of 23:00 to accommodate these late arrivals.

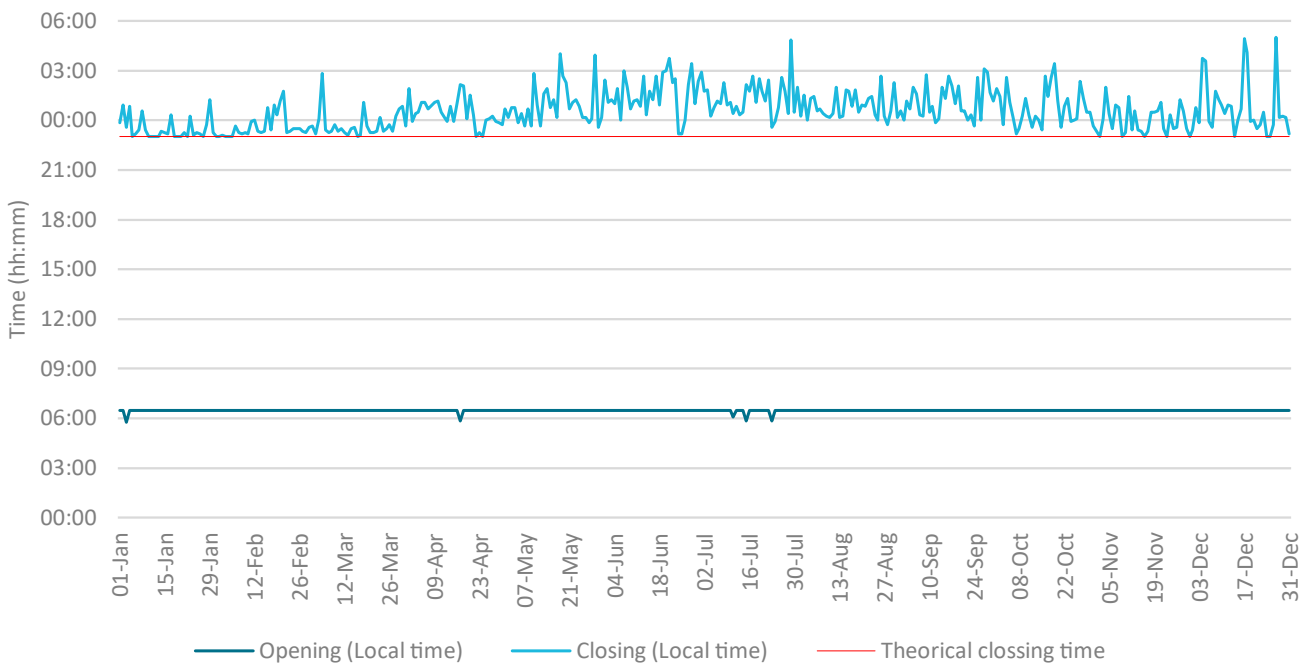


Figure 4.4: Opening and closing times of Charleroi Airport in 2022

In 2022, there were in total 337 days where the operational hours of the airport were extended.

Figure 4.5 shows the amount of days with extension times per month, for the years 2019 until 2022. The number of days with extension is close to 2019 levels with 349 days of extensions.

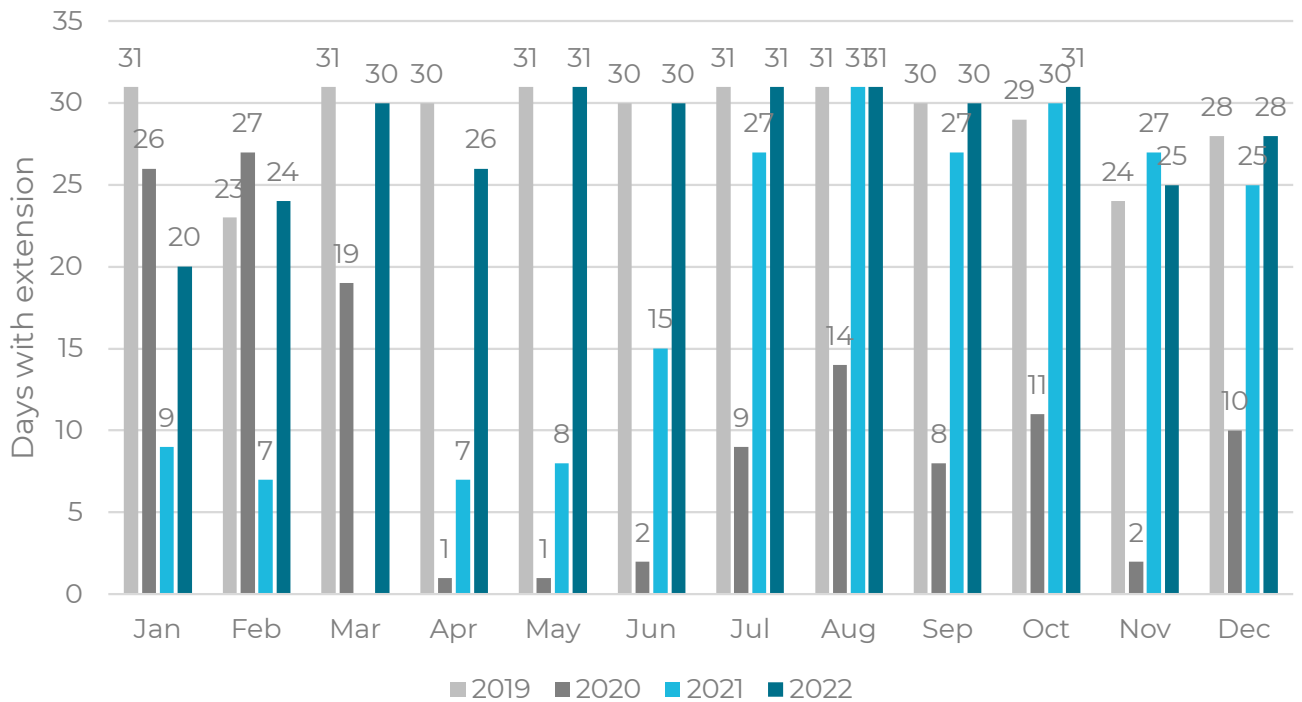


Figure 4.5: Days with extension of operational hours in Charleroi Airport per year

On top of the amount of days with extensions, it is also interesting to look at the extra time the airport was actually open. Figure 4.7 depicts the duration of those extensions, per category of time: <30 min, 30 – 60 min, 1 – 2 h, 2- 3 h and >3 h. In 2022, most of the extensions, 119 occurrences representing 35% of the total, lasted between one and two hours. On 47 occasions, 14% of the total, the opening times were extended by more than three hours.

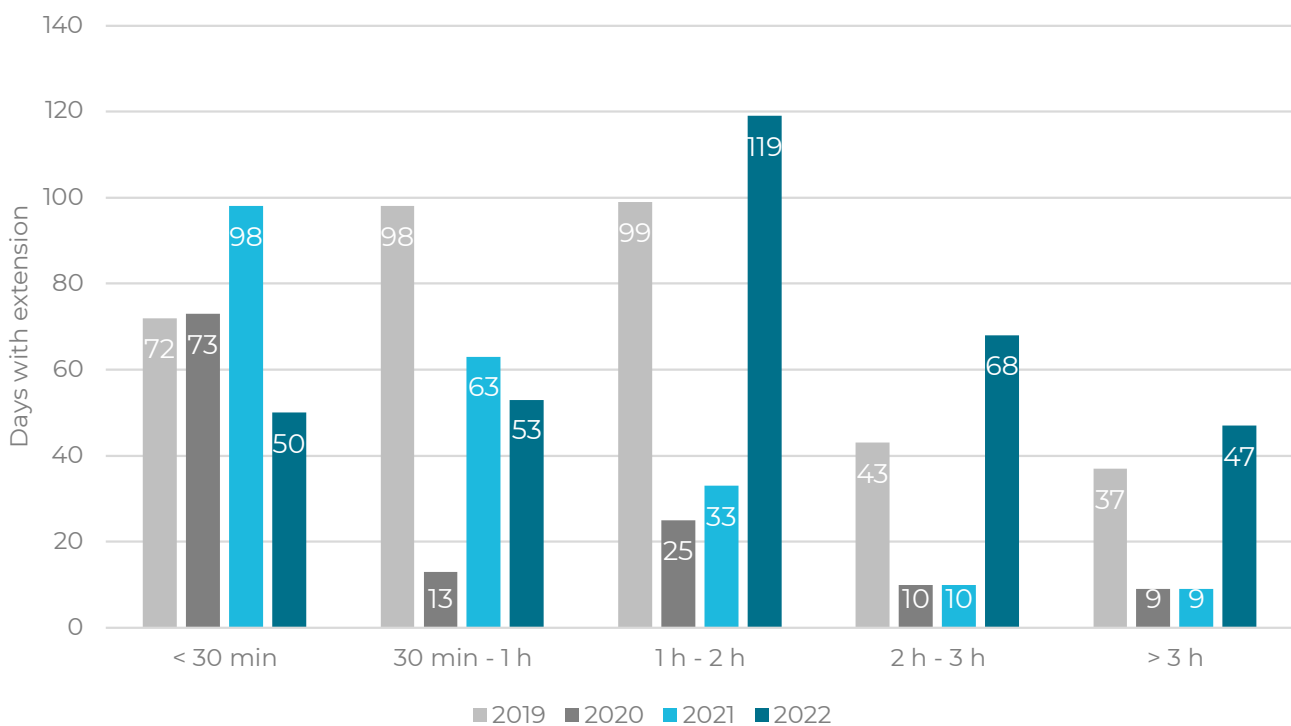


Figure 4.6: Duration of opening hours extensions in Charleroi Airport per year

A direct link to the opening times and possible extensions is the number of night movements. The nighttime is defined as the time where the airport is closed (in normal operations), therefore from 23:00 to 06:30 local time. Table 4-1 shows the number of movements per 30 minutes during the night hours (the hour indicates the start of the interval) for the years 2019 to 2022. During the nights hours, the movements are only IFR movements, as VFR traffic needs clear visibility. The night traffic in 2022 increased by 58% compared to 2019.

Table 4-1: Night movements per year on a 30 min basis (in local time)

	23:00	23:30	00:00	00:30	01:00	01:30	02:00	02:30	03:00	03:30	04:00	04:30	05:00	05:30	06:00
2019	891	267	104	55	40	21	17	7	7	6	1	1	1	1	0
2020	167	41	19	10	5	4	3	3	1	1	1	0	0	0	0
2021	361	78	19	14	3	7	3	0	1	0	2	0	1	0	0
2022	1,166	507	288	133	60	42	23	16	6	5	0	3	0	0	0



Continuous Descent Operation (CDO)

A continuous descent operation (CDO) is an aircraft operating technique enabled by airspace design, instrument procedure design and facilitated by air traffic control to allow aircraft to follow an optimum flight path that delivers environmental and economic benefits (reduced fuel burn, gaseous emissions, noise and fuel costs) without any adverse effect on safety. A CDO allows arriving aircraft to descend continuously from an optimal position with minimum thrust. By doing so, the intermediate level-offs are reduced and more time is spent at more fuel-efficient higher cruising levels, hence reducing fuel burn (i.e. lowering emissions and fuel costs) and producing less noise⁷.

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

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

The total number of arrivals that performed a CDO is given in Figure 4.7, along with the arrivals that are considered in the scope of the CDO analysis. The CDO analysis does not include Touch-and-Go flights, missed approaches (approach following go-around and helicopters. The total of arrivals is therefore different than the figures given in Chapter 1)

The total arrivals and number of flights that performed a CDO increased in 2022, compared to previous years, for both CDO performance indicators.

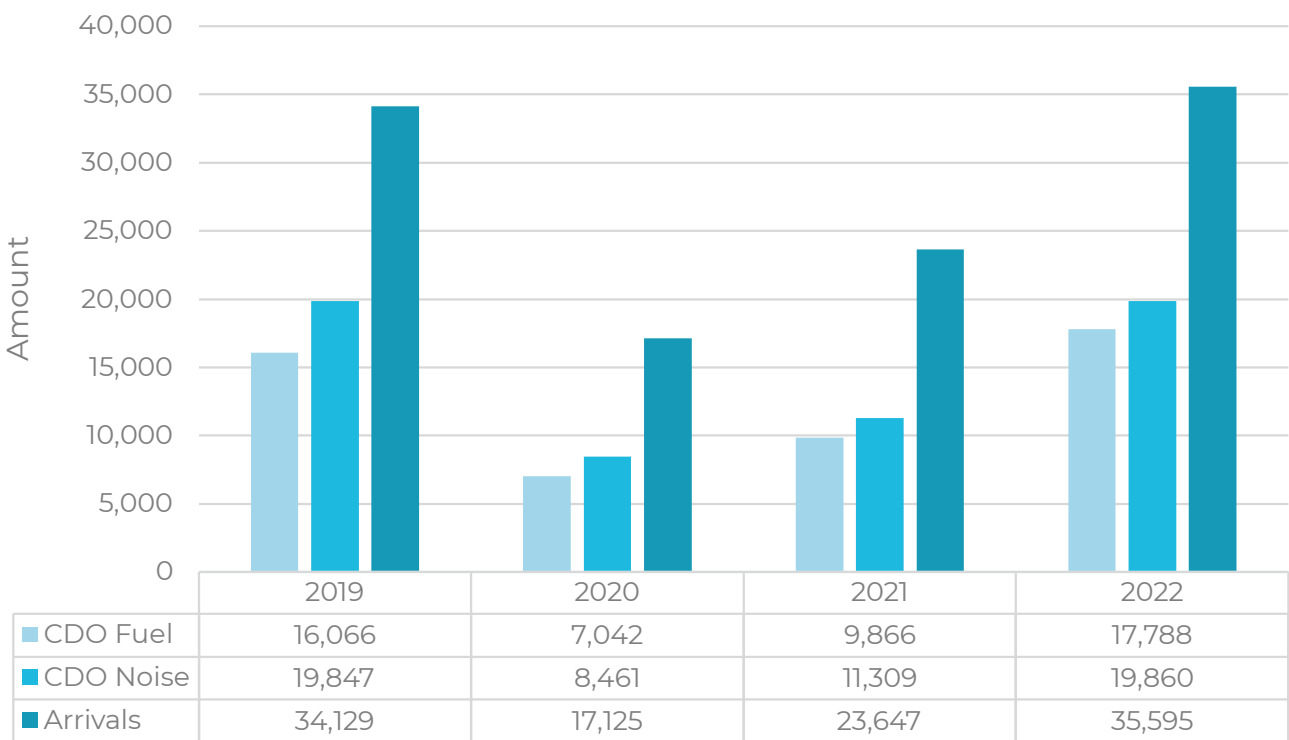


Figure 4.7: CDO figures per year:

⁷ EUROCONTROL, "Continuous climb and descent operations," [Online]. Available: eurocontrol.int/concept/continuous-climb-and-descent-operations

As can be seen in the next figures, the overall CDO frequencies in 2022 were higher than previous years'. Figure 4.9 shows the share of arriving traffic performing CDO Fuel and Noise per runway. The statistics for both indicators are higher on runway 24 than runway 06.

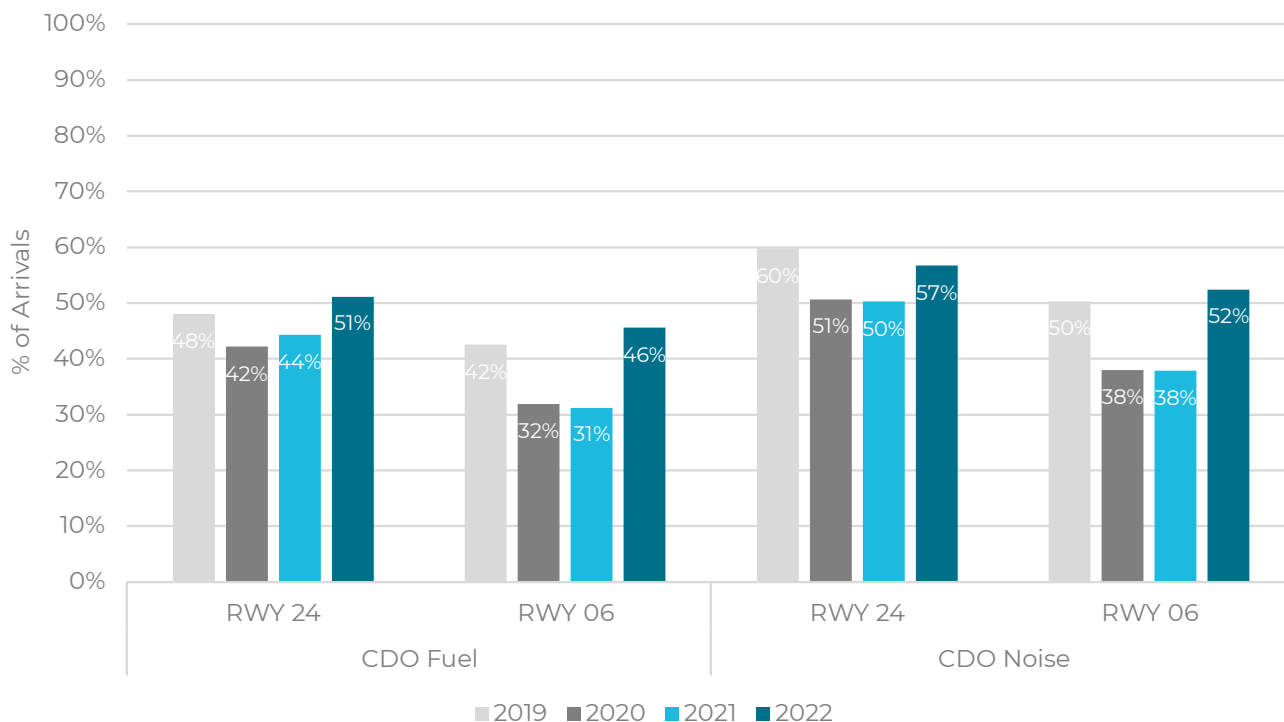


Figure 4.8: CDO fuel and CDO noise per runway per year

A multitude of external factors influence CDO statistics, such as:

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

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

Figure 4.10 and Figure 4.11 show a view per month of CDO Fuel and Noise respectively. The lowest number of CDO rates in 2022 were in the months of February and March. The lower levels of CDO observed during the months of February and March can be attributed to the traffic composition, with a higher proportion of VFR flights and fewer IFR flights during these months. (seeTable 1-1).

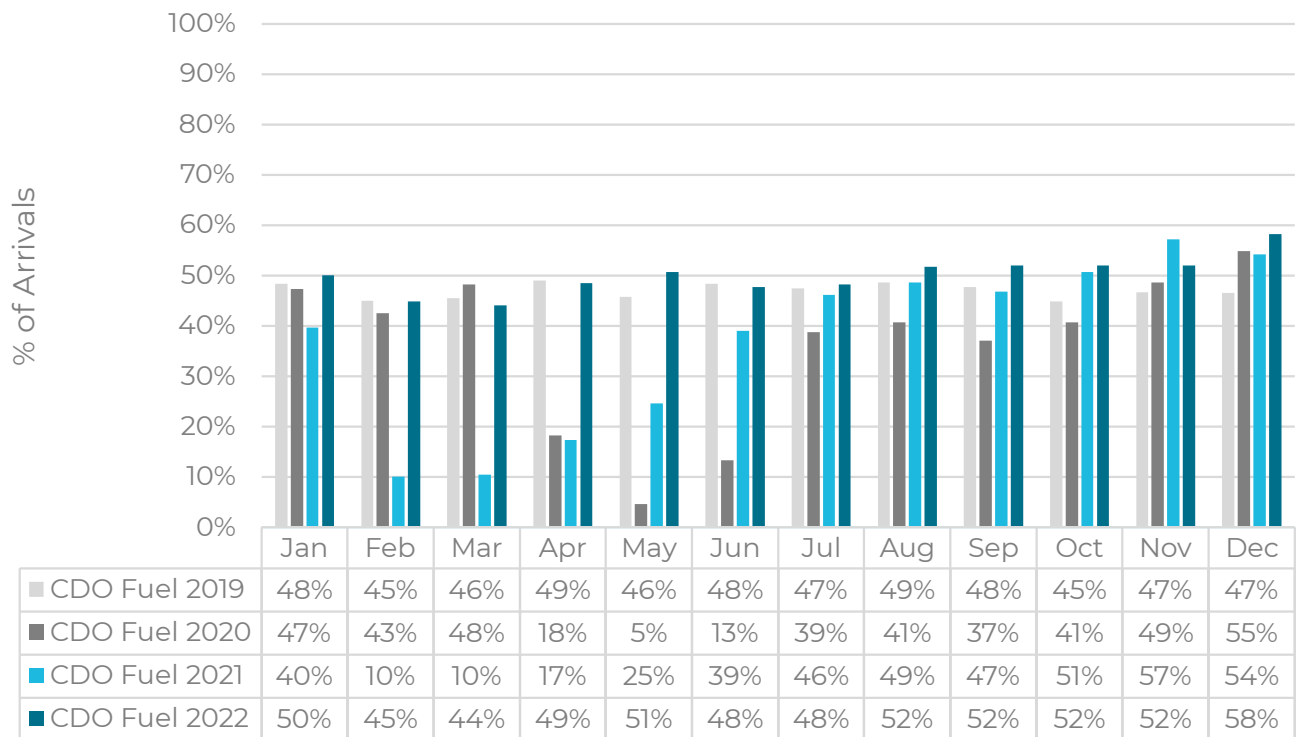


Figure 4.9: Monthly share of arrivals performing CDO Fuel per year

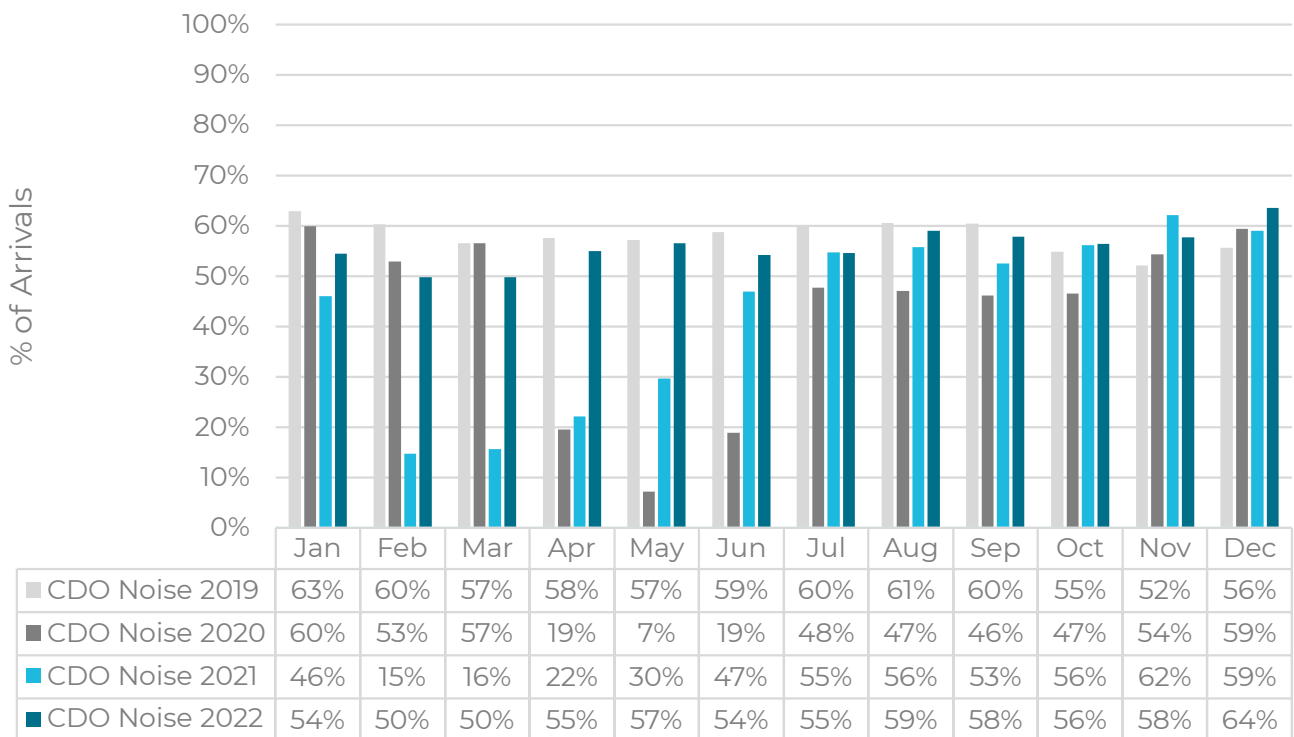


Figure 4.10: Monthly share of arrivals performing CDO Noise per year

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

- skeyes also monitors and adapts, where feasible, operations to enhance flight efficiency. I.e. due to the reduction of traffic in the Belgian airspace (COVID travel restrictions), some constraints could be relaxed, and both air traffic controllers and pilots were encouraged to pro-actively facilitate and fly CDO/CCO (continuous descent operations/continuous climb operations), as well as more direct routings.
- skeyes is in contact with airlines presenting CDO statistics and communicating the phraseology, and is increasing awareness amongst ATCOs through courses, and by informing them of the current statistics and performance.
- As a member of FABEC, skeyes actively participated to the 2nd workshop on Vertical Flight Efficiency in December 2021. During this workshop, numerous ongoing initiatives, and best practices to improve – amongst others – CDO performance were exchanged between airlines, air navigation service providers, military authorities, etc.





Annex



Annex: Fact sheet 2022

Traffic



Yearly evolution

- 27% increase in movements compared to 2021

Movements	2019	2020	2021	2022	2022 vs 2021	2022 vs 2019
Total	82,108	45,534	65,842	83,489	+27%	+2%
IFR	54,948	25,070	33,585	57,674	+72%	+5%
VFR	27,160	20,464	32,257	25,815	-20%	-5%

Quarterly comparison

- Largest increase in the first half of the year compared to 2021 and 2019

Movements	2019	2020	2021	2022	2022 vs 2021	2022 vs 2019
Q1	17,147	14,865	12,573	18,385	+46%	+7%
Q2	22,606	4,454	15,598	22,560	+45%	-0%
Q3	23,075	16,913	21,101	23,366	+11%	+1%
Q4	19,280	9,302	16,570	19,178	+16%	-1%

Safety



Missed Approaches

- 53 missed approaches in 2022 (-12% vs. 2019)
- TOP 3 causes in 2022:
 1. Unstable approach (24)
 2. I : Wx - thunderstorm - Windshear (14)
 3. H : Wx - visibility (5)

Safety Occurrences

- 4 runway incursions, 2 with ATM contribution (severity E)
- 7 TWY/Apron event, an increase compared to 1 in 2021 and 1 in 2019.

Capacity & Punctuality



Capacity

Runway Configuration	Declared IFR Capacity	Maximum Movements/Hour in 2022
24-24	42 movements/hour	50 movements/hour
06-06	42 movements/hour	48 movements/hour

Capacity exceeded on 4 days for 24-24 and on 2 days for 06-06 only due to majority VFR traffic. IFR capacity was never exceeded.

Punctuality:

Arrival delay:

- Arrival Delay: 0 min/flight
- CRSTMP delay: 0 min/flight

ATFM impact:

- Departures 118,976 minutes ATFM delay, 4% (4,483 min) due to skeyes' regulations
- Arrivals: 126,646 minutes ATFM delay, 5% (5,990 min) due to skeyes' regulations)

Environment



PRS

- 79% of the movements used the PRS

Extensions of operational times

- 337 days with extension of operational times, with 234 extensions > 1 hour
- 2249 night movements, with 576 between 00:00-06:00

CDO

- Decrease of CDO numbers in comparison with 2021, due to descend in total movements, but increase of CDO statistics (percentage of arrivals) in comparison with 2021

