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Runway Performance Report **2023**

LIEGE AIRPORT

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Runway performance report

Liege Airport

EXECUTIVE SUMMARY

This report gives an overview of Air Traffic Management (ATM) Performance at Liege Airport (International Civil Aviation Organization (ICAO) code: EBLG). ATM Performance is driven by four Key Performance Areas (KPAs): safety, capacity, environment, and cost-efficiency. This report covers the first three of these four KPA's to provide skeyes' stakeholders and anyone of interest, with the traffic figures for 2023 and further relevant data on the performance of the operations at Liege Airport.

Traffic

Air traffic in Europe is on the rise and is expected to reach the traffic levels seen before the COVID-19 pandemic in 2025. Liege Airport, as an airport focussed mainly on freight, has seen a different trend than other airports in the last few years. In contrary to most, Liege Airport was affected positively during the pandemic in terms of traffic numbers. Due to its important role as one of Europe's major cargo hubs, Liege Airport witnessed growth and peaked in the number of movements during the COVID-19 crisis – handling pharmaceutical products, and medical equipment, as well as the increased demand for express parcel deliveries & e-commerce.

Since 2022 traffic in Liege Airport has reduced, the major contributing reasons to this decrease are the overall geopolitical instability due to the Russian invasion of Ukraine, disruptions of supply chains, and a restructuring of FedEx which moved its base out of Liege in March 2022. Nonetheless, Liege Airport keeps a major role in the needs of the European cargo market. Furthermore, the airport itself reported that more and more passengers are flying from and to Liege. With 35,824 movements in 2023, Liege Airport is at -18% of the traffic in 2019 and -13% of traffic in 2022.

The traffic patterns throughout the day and over the week are analysed in this report. Similar patterns can be observed throughout the years: The cargo traffic leaves clear peaks from Tuesday to Friday with the arrival rush at midnight and the departure wave at 04:00 in the morning.

As in the previous years, the most used runways are 22L (69%) and 04R (28%). The share of usage of runway 04R and 04L was 29% in 2023 in total, which is comparable to the previous years. Monthly variations of runway usage are also provided and reveal a strong correlation with wind patterns (e.g. highest usage of runway 04R with 64% in May due to north-easterly winds – high usage of runway 22L in July with 94% usage due to strong south-westerly winds).

Safety

Safety is an important 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 2023, 46 missed approaches were logged, which is a decrease of 21% compared to 2022. The rate of missed approaches per 1,000 arrivals decreased slightly. Unstable approaches and weather conditions were the most common reasons for a missed approach in 2023.

For safety occurrences, the report shows the events on runways and taxiways. Runway incursions decreased from 11 incursions in 2022 to eight in 2023 (same level as 2021). One runway incursion's cause is still under investigation, while the others had no ATM contribution. Besides the runway incursions, there was also one runway event, six taxiway/apron events, and one taxiway incursion.

Liege Airport became a full PBN (Performance Based Navigation) environment in 2023, The use of PBN procedures greatly improves predictability, and therefore, situational awareness can be enhanced.

Capacity and Punctuality

Capacity and delay go hand in hand when it comes to runway performance. As in previous years, the declared capacity is based on the airport lay-out and the traffic statistics in Liege Airport, providing the number of movements that can be handled within one hour of time. The declared capacity of Liege Airport (34 movements/hour for runway configuration 22 - 22; 35 movements/hour for runway configuration 04 - 04) is based on a theoretical throughput capacity, which uses certain assumptions in its calculation. For a more complete view, this report also shows the effectively used capacity per runway configuration, i.e. how many movements took place per hour throughout the year. In 2023, the declared capacity was never exceeded in Liege Airport.

Punctuality is affected by Air Traffic Flow Management (ATFM) delay. A fitting performance indicator for runway operations at Liege Airport is thus the arrival ATFM delay, which is defined as the average ATFM delay in minutes per flight, attributable to Liege tower under the control of skeyes. In 2023, the amount of arrival delay caused by Liege tower was 1,077 minutes. All this delay was due to weather, resulting in a delay of 0.07 minutes per arrival. No delay was due to causes with Air Navigation Service Provider (ANSP) contribution.

Aside from arrival delay, flights flying to and from Liege Airport can have delay that is caused by ATFM regulations in other sectors of their route. Even if this en-route delay is neither a runway nor an airport performance indicator, information on the punctuality of arrivals and departures is also provided. In 2023, a total of 20,119 minutes of ATFM delay was registered on arriving traffic. Of this delay, 7% (1,310 minutes) is attributable to skeyes while 93% was caused by ATFM measures placed by other ANSPs. On departures, a total of 39,000 minutes of delay was registered. Thereof, 2% (689 minutes) of is attributable to skeyes while 98% is attributable to other ANSPs. Reasons for the delay were mainly Air Traffic Control (ATC) disruptions due to lack of capacity, industrial actions, and weather-related reasons.

Environment

To avoid noise around the airport and to optimize the amount of fuel needed for landings, skeyes encourages Continuous Descent Operations (CDO). From this report, a new CDO indicator 'Average level-off time below certain altitude' is introduced and a new CDO flag has been incorporated, to consider only CDO-relevant flights. The percentage of arrivals performing a 'CDO Fuel' (i.e. flying a CDO from FL100 to 3000 feet) stayed at the same level in 2023 (54%) compared to 2022. The percentage of arrivals performing a 'CDO Noise' (i.e. flying a CDO from FL60 to 3000 feet) stayed at a level of 62%. CDO statistics are inherently variable because they are influenced by a multitude of external factors, such as the pilots' CDO flying experience and experience with the airport, ATC experience, aircraft type and equipment, traffic flows, etc. Nonetheless, skeyes is continuously trying to increase the number of CDOs flown, for example by promoting the use of PBN procedures.

The 'Average level-off time below certain altitude' indicator provides a value representing the average time a descending aircraft spends flying level-off within a specific altitude range. Runway 22L demonstrated slightly better CDO performance in terms of average level-off time compared to runway 04R. The other runways were used for only a fraction of CDO-relevant arrivals.

This report also shows the yearly and monthly wind patterns at Liege Airport, as they are strongly linked to the choice of the runway. Runways 22L and 22R are preferred over runways 04R and 04L in terms of limited noise above the city of Liege. Although winds are predominantly coming from the South-West at the airport, in recent years winds have blown more frequently from the North-East. This largely explains the higher usage of runway 04R and O4L in the last years than in the years before.

SYNOPSIS

Ce rapport donne un récapitulatif des performances de la gestion du trafic aérien (Air Traffic Management (ATM) Performance) à Liege Airport (code de l'Organisation de l'Aviation Civile Internationale (OACI) : EBLG). 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 couvre les trois premiers de ces quatre KPA afin de fournir aux stakeholders de skeyes, et à toute personne intéressée, les chiffres du trafic pour 2023 et d'autres données pertinentes sur la performance des opérations à Liege Airport.

Trafic

Le trafic aérien en Europe est en augmentation et devrait atteindre en 2025 les niveaux de trafic observés avant la pandémie de COVID-19. Liege Airport, en tant qu'aéroport principalement axé sur le fret, a connu une tendance différente de celle des autres aéroports au cours des dernières années. Contrairement à la plupart des autres aéroports, Liege Airport a été positivement impacté pendant la pandémie en ce qui concerne les chiffres de trafic. En raison de son rôle important en tant que l'une des principales plateformes de fret en Europe, Liege Airport a connu une croissance et un pic du nombre de mouvements pendant la crise du COVID-19, en traitant des produits pharmaceutiques et des équipements médicaux, ainsi que la demande accrue de livraisons de colis express et de l'e-commerce.

Depuis 2022, le trafic à Liege Airport a diminué. Les principales raisons de cette diminution sont l'instabilité géopolitique générale due à l'invasion russe de l'Ukraine, des perturbations sur les chaînes d'approvisionnement et une restructuration de FedEx qui a quitté sa base de Liège en mars 2022. Néanmoins, Liege Airport continue à jouer un rôle majeur dans les besoins du marché européen du fret. En outre, l'aéroport lui-même a indiqué que de plus en plus de passagers prennent l'avion au départ et à destination de Liège. Avec 35.824 mouvements en 2023, Liege Airport se situe à -18% du trafic en 2019 et à -13% du trafic en 2022.

Les tendances de trafic du jour et de la semaine sont analysées dans ce rapport. Des tendances similaires peuvent être observées tout au long des années : le trafic de fret connaît des pics importants du mardi au vendredi, avec l'heure d'affluence des arrivées à minuit et la vague des départs à 4h00 du matin.

Comme les années précédentes, les pistes les plus utilisées sont la 22L (69%) et la 04R (28%). La part d'utilisation des pistes 04R et 04L était de 29% au total en 2023, ce qui est comparable aux années précédentes. Les variations mensuelles de l'utilisation des pistes sont également fournies et révèlent une forte corrélation avec les régimes de vent (par exemple, l'utilisation la plus élevée de la piste 04R avec 64% en mai en raison de vents du nord-est – l'utilisation élevée de la piste 22L en juillet avec 94% en raison de forts vents du sud-ouest).

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 2023, 46 approches interrompues ont été enregistrées, ce qui représente une baisse de 21% par rapport à 2022. Le taux d'approches interrompues pour 1.000 arrivées a légèrement diminué. Les approches instables et les conditions météorologiques ont été les raisons les plus fréquentes d'une approche interrompue en 2023.

En ce qui concerne les événements liés à la sécurité, le rapport indique les événements survenus sur les pistes et les voies de circulation. Les incursions de piste ont diminué, passant de onze en 2022 à huit en 2023 (même niveau qu'en 2021). La cause d'une incursion de piste fait toujours l'objet d'une enquête, tandis que les autres ne sont pas imputables à l'ATM. Outre les incursions de piste, il y a également eu un événement sur piste, six sur voie de circulation/aire de trafic (taxiway), et une incursion sur voie de circulation.

Liege Airport est devenu un environnement PBN (Performance Based Navigation) complet en 2023. L'utilisation de procédures PBN améliore grandement la prévisibilité et, par conséquent aussi, la conscience situationnelle.

Capacité et ponctualité

Capacité et retard vont de pair lorsqu'il s'agit de la performance des pistes. Comme les années précédentes, la capacité déclarée est basée sur la configuration de l'aéroport et les statistiques de trafic à Liege Airport, fournissant le nombre de mouvements qui peuvent être traités en une heure de temps. La capacité déclarée de Liege Airport (34 mouvements/heure pour la configuration de piste 22 - 22 ; 35 mouvements/heure pour la configuration de piste 04 - 04) est basée sur un débit théorique, dont le calcul repose sur certaines hypothèses. Pour une vue plus complète, ce rapport montre également la capacité effectivement utilisée par configuration de piste, c'est-à-dire combien de mouvements il y a eu par heure tout au long de l'année. En 2023, Liege Airport n'a jamais dépassé la capacité déclarée.

La ponctualité est impactée par le retard ATFM (Air Traffic Flow Management). Un indicateur de performance adéquat pour les opérations de piste à Liege Airport est donc le retard ATFM à l'arrivée, qui est défini comme le retard ATFM moyen en minutes par vol, imputable à la tour de Liège sous le contrôle de skeyes. En 2023, le retard à l'arrivée causé par la tour de Liège était de 1.077 minutes. Tous ces retards étaient dus aux conditions météorologiques, avec pour résultat un retard de 0,07 minute par arrivée. Aucun retard n'était dû à des causes impliquant le prestataire de services de navigation aérienne.

Outre le retard à l'arrivée, les vols à destination et en provenance de Liege Airport peuvent subir des retards dus aux régulations ATFM dans d'autres secteurs de leur route. Même si ce retard en route n'est ni un indicateur de piste ni un indicateur de performance aéroportuaire, les informations sur la ponctualité des arrivées et des départs sont également fournies. En 2023, un total de 20.119 minutes de retard ATFM a été enregistré sur le trafic à l'arrivée. Sur ce total, 7% (1.310 minutes) sont imputables à skeyes, tandis que 93% ont été causés par des mesures ATFM prises par d'autres ANSP. Concernant les départs, un total de 39.000 minutes de retard a été enregistré. Sur ce total, 2% (689 minutes) sont imputables à skeyes, tandis que 98% le sont à d'autres ANSP. Les raisons de ces retards sont essentiellement des perturbations de l'Air Traffic Control (ATC) dues à un manque de capacité, à des actions de grève et à des raisons liées aux conditions météorologiques.

Environnement

Pour éviter le bruit autour de l'aéroport et optimiser la quantité de carburant nécessaire aux atterrissages, skeyes encourage les opérations de descente continue (CDO, Continuous Descent Operations). Ce rapport introduit un nouvel indicateur CDO 'Temps moyen de mise en palier en dessous d'une certaine altitude' et un nouvel indicateur CDO a été intégré, afin de ne prendre en compte que les vols pertinents pour les CDO. Le pourcentage d'arrivées effectuant une CDO Fuel (c'est-à-dire effectuant une CDO du niveau de vol 100 à 3.000 pieds) est resté au même niveau en 2023 (54%) comparé à 2022. Le pourcentage d'arrivées effectuant une CDO Noise (c'est-à-dire une CDO du niveau de vol 60 à 3.000 pieds est resté au même niveau de 62%. Les statistiques CDO sont intrinsèquement variables, car elles sont influencées par une multitude de facteurs externes, tels que l'expérience de vols CDO des pilotes et leur expérience de l'aéroport, l'expérience de l'ATC, le type et l'équipement de l'aéronef, les flux de trafic, etc. Néanmoins, skeyes s'efforce continuellement d'augmenter le nombre de CDO effectuées, par exemple en promouvant l'utilisation de procédures PBN.

L'indicateur 'Temps moyen de mise en palier en dessous d'une certaine altitude' fournit une valeur représentant le temps moyen qu'un avion en descente passe en palier dans une plage d'altitude spécifique. La piste 22L a démontré une performance CDO légèrement meilleure que la piste 04R en termes de temps moyen de mise en palier. Les autres pistes n'ont été utilisées que pour une fraction des arrivées pertinentes pour les CDO. Ce rapport montre également les régimes de vent annuels et mensuels à Liege Airport, car ils sont fortement liés au choix de la piste. Les pistes 22L et 22R sont préférées aux pistes 04R et 04L en termes de limitation du bruit au-dessus de la ville de Liège. Bien que les vents dominants soient du sud-ouest à l'aéroport, les vents ont soufflé plus fréquemment du nord-est ces dernières années. Cela explique en grande partie l'utilisation plus importante des pistes 04R et 04L au cours des dernières années par rapport aux années précédentes.

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GLOSSARY

AAE: — Above Aerodrome Elevation
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
BURDI — Belgium-Netherlands U-space Reference Design Implementation
CAA — Civil Aviation Authority
CANSO — Civil Air Navigation Service Organisation
CCO: — Continuous Climb Operations
CDO: — Continuous Descent Operations
CEM: — Collaborative Environmental Management
CISP — Common Information Service Provider
COVID-19: — Coronavirus Disease 2019
CRSTMP: — C-Capacity, R-Routeing, S-Staffing, T-Equipment, M-Airspace Management, P-Special Event
CTOT: — Calculated Take-off Time
CTR: — Control Zone
DSA: — Drone Service Application
DME — Distance Measuring Equipment
DVOR — Doppler Very High Frequency Omnidirectional Radio Range
EASA: — European Union Aviation Safety Agency
FIR — Flight Information Region
GNSS — Global Navigation Satellite Service
GeoZone — UAS geographical zone
EBLG: — Liege Airport ICAO Code
ETOT: — Estimated Take-off Time
EU: — European Union
ICAO: — International Civil Aviation Organization
IFR: — Instrument Flight Rules
ILS: — Instrument Landing Systems
KPA: — Key Performance Area
LRST: — Local Runway Safety Team
NM: — Nautical Mile
PBN: — Performance Based Navigation
PRU: — Performance Review Unit, EUROCONTROL
RAT: — Risk Analysis Tool
RP3: — Reference Period 3
RWY: — Runway
UAS: — Unmanned Aircraft System
USSP — U-Space Service Provider
VFR: — Visual Flight Rules
VLL: — Very Low Level

TRAFFIC

In this chapter, the traffic at Liege Airport (International Civil Aviation Organization (ICAO) code: EBLG) is presented, as recorded by the Airport Movement System (AMS) developed by skeyes. 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 Instrument 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 the Belgian Civil Aviation Authority's (BCAA) aerodrome movement definition:

- **one take-off = one departure movement**
- **one landing = one arrival movement**
- **one touch-and-go = two movements: one departure & one arrival**

Traffic Overview

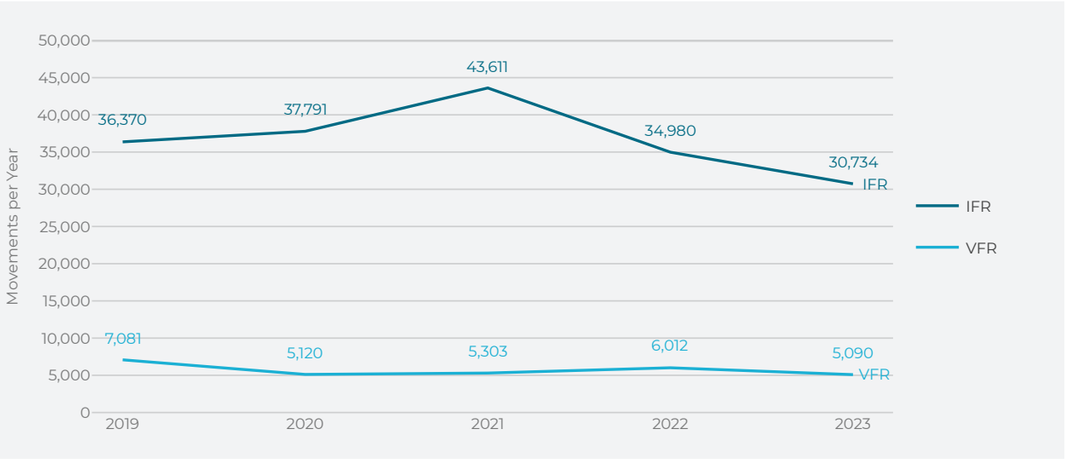
YEARLY FIGURES

The number of aircraft movements at Liege Airport for the last five years is as follows:

2019:	**43,451**	(36,370 IFR; 7,081 VFR);
2020:	**42,911**	(37,791 IFR; 5,120 VFR);
2021:	**48,914**	(43,611 IFR; 5,303 VFR);
2022:	**40,992**	(34,980 IFR; 6,012 VFR);
2023:	**35,824**	(30,734 IFR; 5,090 VFR);

In 2023, the total number of movements was at a level of -13% of 2022 and at -18% of the pre-COVID-19 year 2019. Traffic decreased for the second year in a row in Liege Airport. From ***Figure 1.1***, which provides further information on the historical numbers of IFR and VFR flights, it can be seen that the decrease in traffic is mainly a decrease in IFR traffic. After a drop in traffic in 2022, IFR traffic decreased further to 30,734 movements, 12% less than in 2022 (-4,246 movements). VFR traffic also decreased in 2023 to 5,090 movements, the lowest since 2014. VFR movements made up 14% of the traffic handled in Liege airport.

Figure 1.1: *Historical traffic overview for IFR and VFR movements*

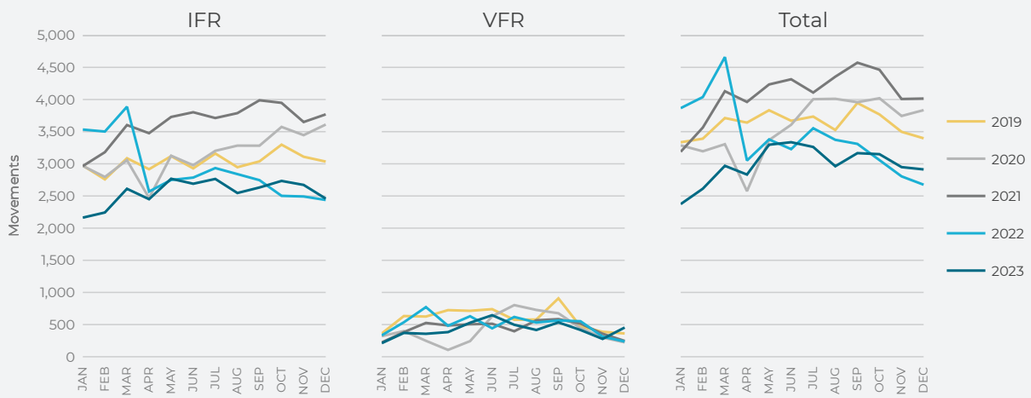


MONTHLY FIGURES

In 2022 FedEx partially moved its operations from Liege to Paris Charles de Gaulle, the war in Ukraine caused disruptions in air traffic activities, and a zero-Covid strategy in China disrupted the supply chains. In 2023, with the restructuring of FedEx in full effect, the ongoing geopolitical tensions, and economic disruptions, traffic further declined in Liege airport. Although total traffic decreased, Liege Airport reported an increase in passengers[1].

A monthly overview of the development of movements in 2023 is provided in ***Figure 1.2*** and ***Table 1.1***. It can be seen that traffic in 2023 is at the same level as 2022 after the move of FedEx in March 2022. From January to March, the monthly comparison of 2023 to 2022 yields a decrease of movements ranging from -35% to -39%. From April, the decrease is less negative and in June and after summer there was more traffic compared to 2022.

Figure 1.2: *Total monthly movements per year*



The number of VFR movements have ranged from -54% (in March) to +46% (in June) of the 2022 figures. A lot of variations in VFR traffic can usually be explained by weather conditions as a sunny sky and good weather conditions promote the number of VFR flights. June 2023 had remarkably nice weather, which resulted in a high volume of VFR traffic. March 2022 was also particularly nice, showing again a peak in VFR traffic.

1. https://www.liegeairport.com/corporate/fr/ (URL retrieved on 14/01/2023)

Table 1.1: *Monthly movements per year at Liege Airport*

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
IFR	**2019**	2,973	2,758	3,087	2,916	3,119	2,929	3,160	2,947	3,038	3,298	3,110	3,035	**36,370**
	2020	2,967	2,796	3,057	2,469	3,126	2,978	3,202	3,283	3,282	3,574	3,446	3,611	**37,791**
	2021	2,965	3,181	3,603	3,476	3,729	3,802	3,712	3,788	3,988	3,948	3,650	3,769	**43,611**
	2022	3,533	3,502	3,888	2,569	2,749	2,786	2,934	2,841	2,746	2,502	2,492	2,438	**34,980**
	2023	2,163	2,243	2,612	2,450	2,768	2,690	2,765	2,546	2,632	2,734	2,672	2,459	**30,734**
	2023 vs 2019	-27%	-19%	-15%	-16%	-11%	-8%	-12%	-14%	-13%	-17%	-14%	-19%	-15%
	2023 vs 2022	-39%	-36%	-33%	-5%	+1%	-3%	-6%	-10%	-4%	+9%	+7%	+1%	-12%
VFR	**2019**	362	633	625	725	714	740	575	579	908	470	388	362	**7,081**
	2020	320	399	248	106	243	629	803	728	676	446	298	224	**5,120**
	2021	223	383	526	486	505	513	396	567	585	515	358	246	**5,303**
	2022	333	536	772	482	630	442	619	532	564	552	313	237	**6,012**
	2023	211	370	357	383	529	646	497	416	534	416	277	454	**5,090**
	2023 vs 2019	-42%	-42%	-43%	-47%	-26%	-13%	-14%	-28%	-41%	-11%	-29%	+25%	-28%
	2023 vs 2022	-37%	-31%	-54%	-21%	-16%	+46%	-20%	-22%	-5%	-25%	-12%	+92%	-15%
Total	**2019**	3,335	3,391	3,712	3,641	3,833	3,669	3,735	3,526	3,946	3,768	3,498	3,397	**43,451**
	2020	3,287	3,195	3,305	2,575	3,369	3,607	4,005	4,011	3,958	4,020	3,744	3,835	**42,911**
	2021	3,188	3,564	4,129	3,962	4,234	4,315	4,108	4,355	4,573	4,463	4,008	4,015	**48,914**
	2022	3,866	4,038	4,660	3,051	3,379	3,228	3,553	3,373	3,310	3,054	2,805	2,675	**40,992**
	2023	2,374	2,613	2,969	2,833	3,297	3,336	3,262	2,962	3,166	3,150	2,949	2,913	**35,824**
	2023 vs 2019	-29%	-23%	-20%	-22%	-14%	-9%	-13%	-16%	-20%	-16%	-16%	-14%	-18%
	2023 vs 2022	-39%	-35%	-36%	-7%	-2%	+3%	-8%	-12%	-4%	+3%	+5%	+9%	-13%

Table 1.2: *Arrivals and Departures per month*

		JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	Total
Arrivals	**2019**	1,654	1,696	1,869	1,811	1,921	1,839	1,864	1,778	1,954	1,886	1,756	1,702	**21,730**
	2020	1,632	1,606	1,642	1,294	1,688	1,798	2,006	2,008	1,977	2,015	1,866	1,920	**21,452**
	2021	1,592	1,784	2,061	1,986	2,114	2,155	2,073	2,164	2,286	2,238	1,994	2,024	**24,471**
	2022	1,918	2,017	2,326	1,522	1,693	1,608	1,778	1,685	1,657	1,527	1,404	1,338	**20,473**
	2023	1,181	1,308	1,480	1,421	1,643	1,666	1,631	1,481	1,577	1,577	1,473	1,461	**17,899**
	2023 vs 2019	-29%	-23%	-21%	-22%	-14%	-9%	-12%	-17%	-19%	-16%	-16%	-14%	-18%
	2023 vs 2022	-38%	-35%	-36%	-7%	-3%	+4%	-8%	-12%	-5%	+3%	+5%	+9%	-13%
Departures	**2019**	1,681	1,695	1,843	1,830	1,912	1,830	1,871	1,748	1,992	1,882	1,742	1,695	**21,721**
	2020	1,655	1,589	1,663	1,281	1,681	1,809	1,999	2,003	1,981	2,005	1,878	1,915	**21,459**
	2021	1,596	1,780	2,068	1,976	2,120	2,160	2,035	2,191	2,287	2,225	2,014	1,991	**24,443**
	2022	1,948	2,021	2,334	1,529	1,686	1,620	1,775	1,688	1,653	1,527	1,401	1,337	**20,519**
	2023	1,193	1,305	1,489	1,412	1,654	1,670	1,631	1,481	1,589	1,573	1,476	1,452	**17,925**
	2023 vs 2019	-29%	-23%	-19%	-23%	-13%	-9%	-13%	-15%	-20%	-16%	-15%	-14%	-17%
	2023 vs 2022	-39%	-35%	-36%	-8%	-2%	+3%	-8%	-12%	-4%	+3%	+5%	+9%	-13%

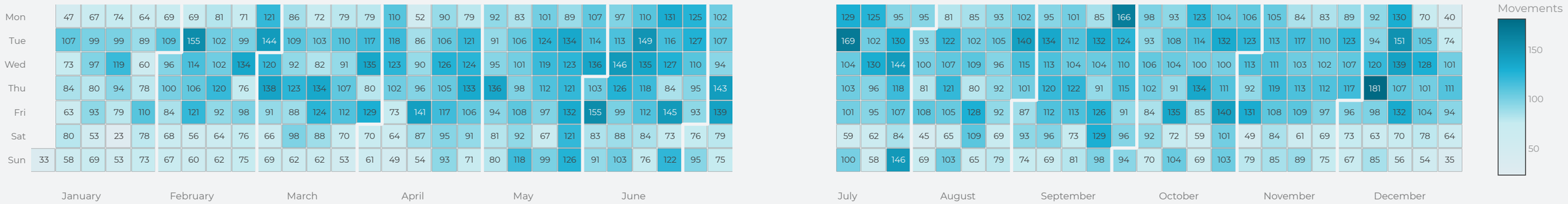


Figure 1.3: *Calendar view of movements per day in 2023*

Figure 1.3 provides more details on the traffic with a calendar view containing the daily number of movements at Liege Airport. The days have to be read from top to bottom first and then from the left to the right. The 21st of January 2023 recorded the lowest number of movements (23). The airport was blocked on this day due to heavy snow. The days with the most traffic were the 7th of December, the 11th of July and the 25th of September. Additionally, some patterns per weekday can be observed – for example that Tuesday to Friday is generally busier than the other days.

Looking forward, Liege airport has greenlit a development spanning 2023 to 2040 entailing an investment of 500 million euros with the aim to double flight frequency. This plan aims to position Liege Airport as a multimodal hub, prioritise environmental excellence, and generate employment opportunities for the region.

Night traffic

Since Liege Airport is active during the night, this section focusses on the nightly movements. The night is defined here from 23:00 local time to 06:00 local time. ***Figure 1.4*** shows a comparison of the number of night movements (23:00-06:00 local time) and the number of day movements (06:00-23:00 local time). In 2019 and 2020 night traffic accounted for most of the traffic. Since 2021, there are fewer night movements than day movements. In 2023, the airport recorded 28% night traffic.

The restructuring of FedEx resulted in a loss of nightly cargo traffic. This is also visible in ***Figure 1.5*** and ***Table 1.3*** where the number of movements per hour of the night are presented. There is an overall decrease of traffic in the night, except between 03:00 and 04:00. The slots that freed up were taken by ASL Airlines Ireland. The decrease is the strongest at the peak hours (midnight and from 04:00 to 05:00). The following sections further discusses the daily patterns of traffic at Liege Airport.

Figure 1.4: *Day and night movements at Liege Airport per year*

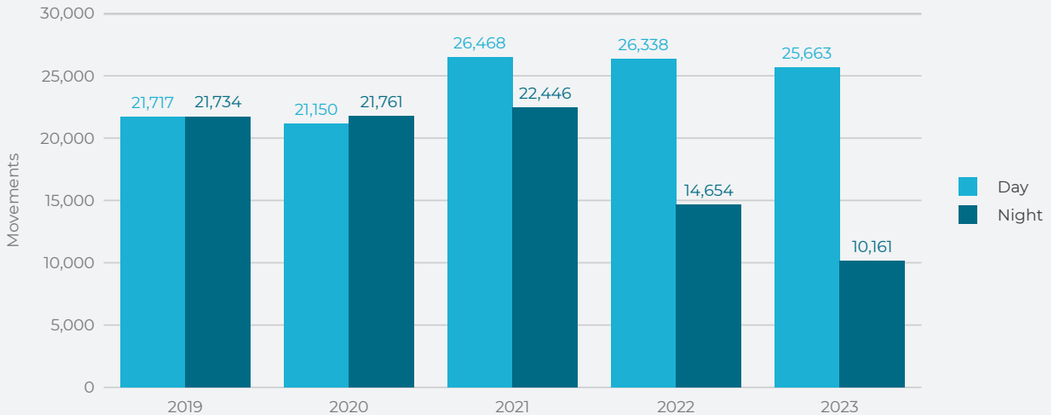


Figure 1.5: *Night movements at Liege Airport per hour and year*

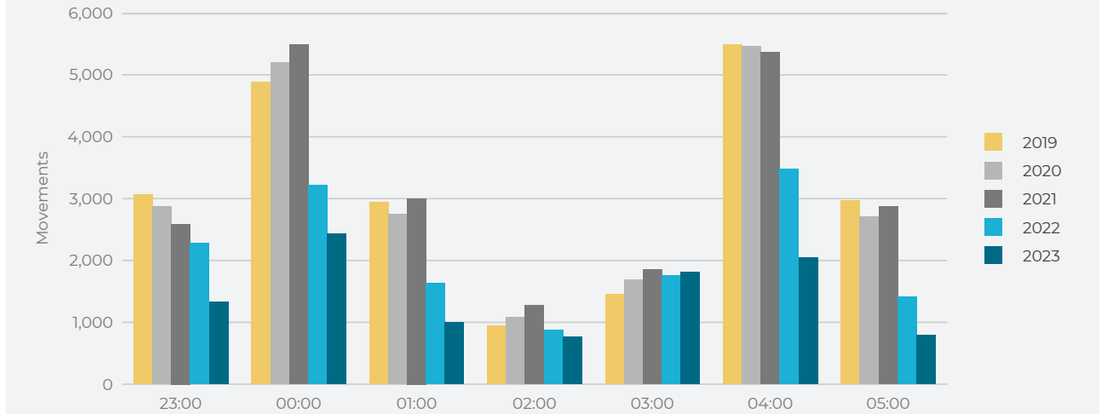


Table 1.3: *Night movements at Liege Airport per hour and year*

Year	23:00	00:00	01:00	02:00	03:00	04:00	05:00
2019	3,060	4,877	2,939	946	1,457	5,483	2,972
2020	2,875	5,199	2,745	1,083	1,690	5,466	2,703
2021	2,590	5,490	3,003	1,270	1,851	5,365	2,877
2022	2,277	3,214	1,630	879	1,757	3,481	1,416
2023	1,325	2,426	1,000	763	1,809	2,042	796

Traffic Patterns

Figure 1.6 shows the average hourly movements of traffic throughout the hours of the day (in local time) for the years 2019 until 2023. ***Figure 1.7*** and ***Figure 1.8*** show the yearly average for IFR movements and VFR movements.

The IFR traffic distribution, shows two pronounced peaks, representing the wave of cargo flight arrivals at midnight and a second rush hour at 04:00 in the morning when those flights depart from Liege. Although these peaks are still present, it is noticeable that the number of movements of these peaks are much lower than in the years before. In the years 2019 to 2021 the yearly average from midnight to 01:00 and from 04:00 to 05:00 was almost 15 movements per hour while in 2023 this was only 6 to 7 movements. The main reason for this drop is the earlier mentioned FedEx restructuring and negative developments on cargo activity.

For VFR traffic, the movement pattern is similar to the previous years; Most traffic occurs during the day with a small morning bump at 08:00 and a wide spread distribution until the evening. In the evening hours from 18:00 to 00:00 some slight differences throughout the years can be observed – the trend seems to make more use of late evening hours, which were freed up by the reduction in IFR traffic.

The traffic pattern at Liege Airport can also be decomposed depending on the days of the week, as shown in ***Figure 1.9***. From Tuesday to Friday, the traffic is similar. During these days, cargo companies perform most of their operations, which leads to the peak for arrivals and the peak for departures, which have already been explained previously. Over the weekend, there is less traffic and no peak is present on Saturday and Sunday. On Monday mornings, the aircraft take off continuously between 00:00 and 04:00. At around 23:00, traffic numbers then rise again to reach the arrival peaks of Tuesday nights.

Figure 1.6: *Yearly average of movements per hour in the day (local time)*

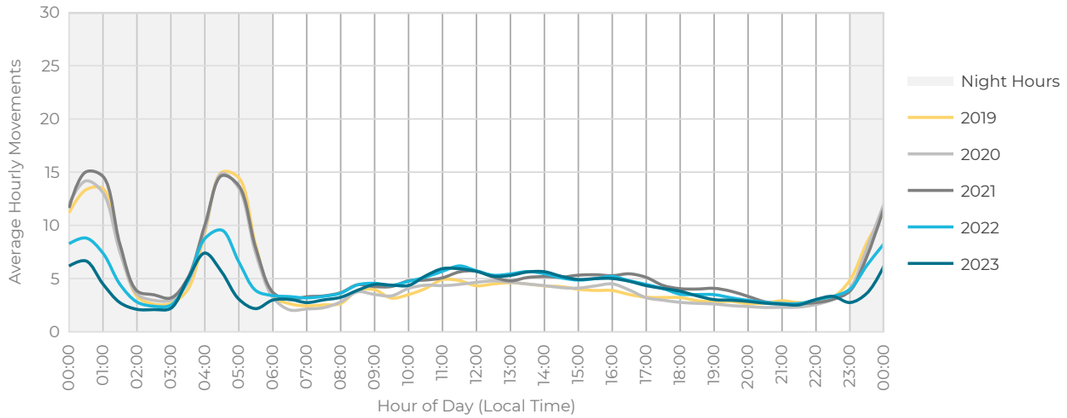


Figure 1.7: *Yearly average of IFR movements per hour in the day (local time)*

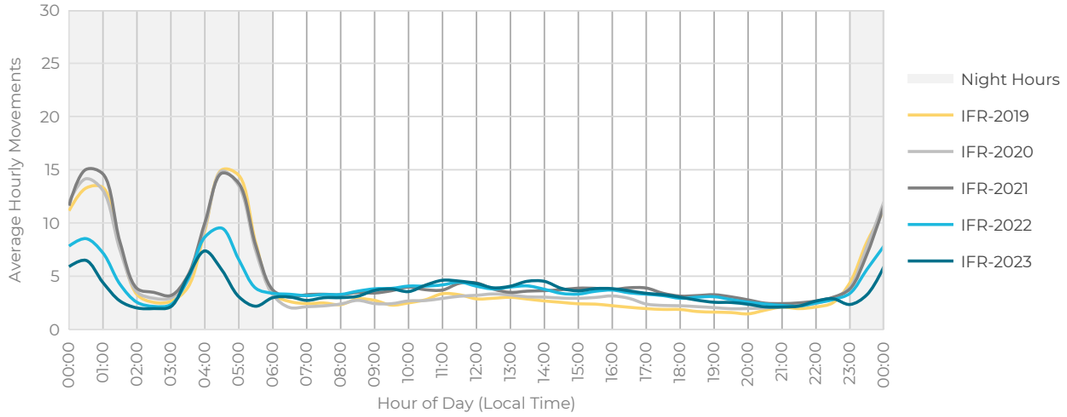


Figure 1.8: *Yearly average of VFR movements per hour in the day (local time)*

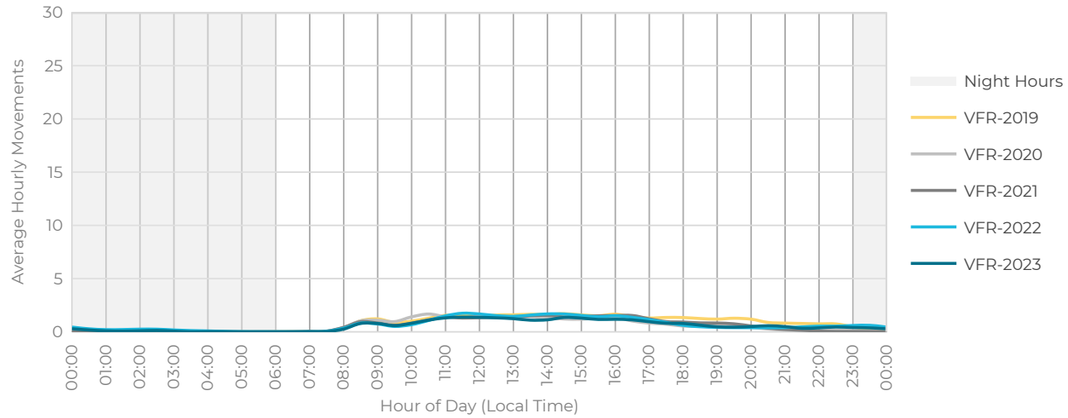
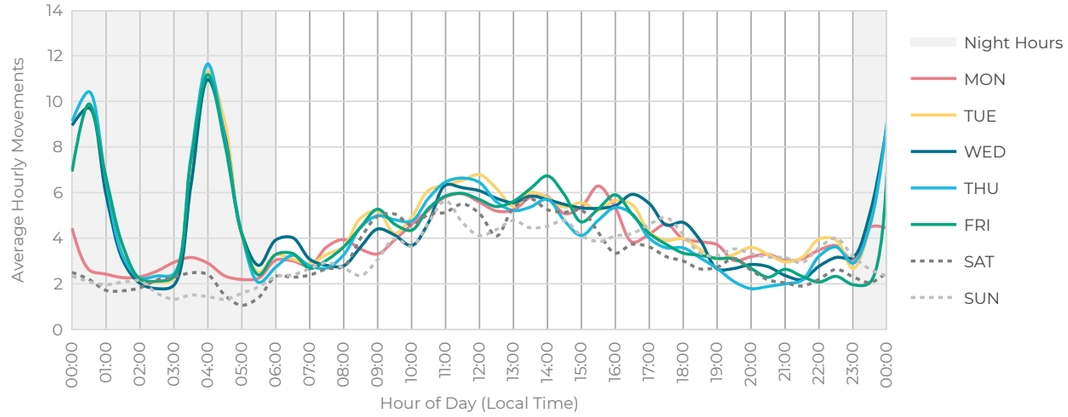


Figure 1.9: *Yearly average of IFR and VFR movements per hour in the day per weekday for 2023 (local time)*



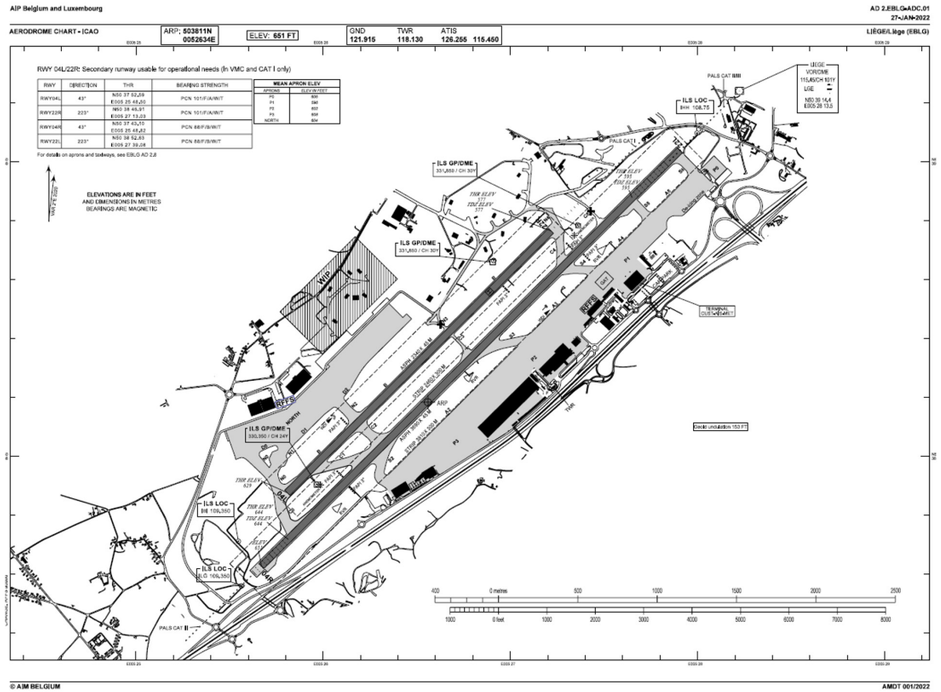
Runway Use

There are two parallel runways at Liege Airport, 04L/22R and 04R/22L (see ***Figure 1.10*** for the according ICAO chart). The use of runways depends on several factors like wind direction, airport layout, approach and departure routes, works on taxiways, visibility, etc.

Due to the proximity of the parallel runways at Liege, these are so-called "dependent runways", which means that operations on one runway affect the operations on the other. Regarding Liege Airport, only one runway at a time may be used: i.e. either 04L or 04R, but not both at the same time.

Although runways 04L/22R and 04R/22L are easily interchangeable, there is a clear preference at Liege Airport for runway 04R/22L. The reason for this preference is that the runway for 04R/22L is longer, and furthermore, 04R/22L is equipped with the CAT III instrument landing systems (ILS).

Figure 1.10: *Aerodrome chart – ICAO*



The number of movements per runway can be seen in ***Figure 1.11***. The most used runway was runway 22L, which registered 24,890 movements (69% of the total) in 2023. Runway 22L is the main runway because at Liege Airport, winds are mainly observed from a South-Westerly direction and flights should depart and land with headwind for aeronautical reasons. The wind roses underneath the bar chart (see also ***Figure 4.7*** in ***Chapter 4*** for bigger graphs and further explanations on the wind roses) further demonstrate the influence of different wind patterns on the runways in use: In 2019 and 2020 there was less wind blowing from the North-East and accordingly, runway 22L and runway 22R were also more used during these years. In 2023, runway 04R served 9.871 (28%) of the movements. The less preferred runways, runway 22R and runway 04L welcomed 816 (2%) and 247 (1%) movements.

Figure 1.11: *Runway use per year*

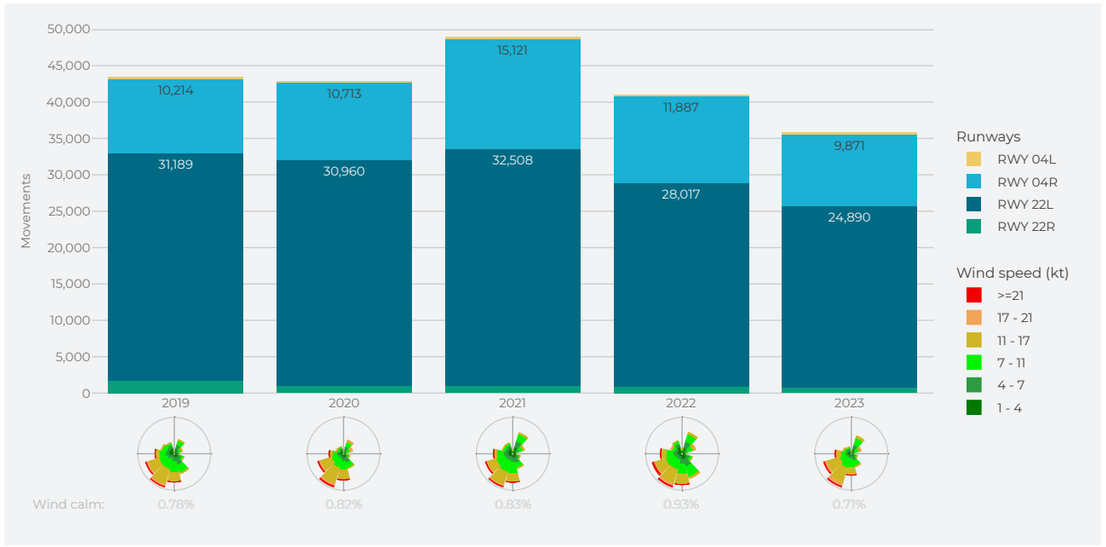
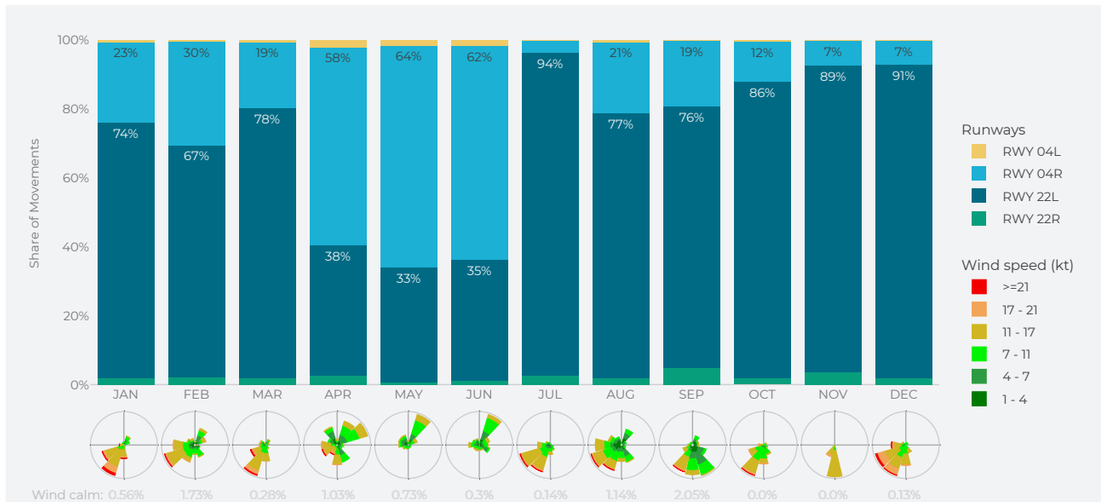


Figure 1.12 depicts the information on runway usage in 2023 on a monthly basis. Again, a strong correlation of runway usage with wind can be observed. Particularly in April, May, and June, the runways 04L and 04R were used more than 50%, with a maximum usage of 66% in May. The wind roses – which can also be seen in a bigger format in ***Figure 4.8***, ***Chapter 4***– reveal that in these months, strong North-East winds prevailed, which explains this high use of runways 04L and 04R. On the other extreme, July experienced strong winds (above 21 knots) from the South-West, which is why the share of usage of runways 22L and 22R was 97% during this month.

Figure 1.12: *Runway use per month in 2023 (22L & 22R and 04L & 04R combined) and monthly wind roses*



Cargo

Liege Airport is Belgium's largest cargo hub and one of the top 20 cargo airports in Europe. Therefore, a closer look at cargo movements is taken based on the air traffic market segmentation rules from STATFOR/EUROCONTROL[2] and the flight plan information captured by skeyes' airport movement system. The EUROCONTROL's Market Segment Rules provides a definition for air traffic market segments based on lists of aircraft types, aircraft operators and the flight types filed on flight plans.

For this study, cargo refers to "all-cargo" segment, not taking into account cargo moved in the hull of passenger aircraft.

Figure 1.13 and ***Table 1.4*** provide an overview of the yearly evolution of cargo traffic, other market segments (i.e. mainline, business aviation, low-cost scheduled, non-scheduled, regional, military, and other) and the share of cargo over all IFR traffic. The year of 2022 witnessed a significant drop

Table 1.4 *Cargo movements per year at Liege Airport*

	Cargo	Other IFR	% of Cargo
2019	30,449	5,921	**84%**
2020	33,416	4,375	**88%**
2021	35,481	8,130	**81%**
2022	24,454	10,526	**70%**
2023	19,893	10,843	**65%**

Looking back, the year 2020 was the year with the highest share of cargo at Liege Airport (88%): Due to the COVID-19 pandemic, there were many lockdowns and travel restrictions on the one hand, but also a high need for transportation of medical goods and other parcels on the other hand. Cargo traffic was higher than in 2019 and traffic of other market segments dropped to a minimum, which explains the peak in the share of cargo. Then, in 2021, the total number of cargo movements continued to rise (to the maximum of 35,481 movements), but traffic of other market segments also started to pick up again (likely also due to an increase in business aviation thanks to the opening of the business terminal that year), so that the share of cargo dropped to 81% although the total number of movements increased. In 2022, traffic of other market segments than cargo was still on the rise. Cargo movements, however, dropped to 24,454 movements, such that the share of freight movements at Liege Airport in 2022 was only 70%. In 2023, the same trend is seen, traffic of other market segments than cargo increased, however, with the restructuring of FedEx combined with a difficult international economic context the number of cargo movements decreased to 19,893.

2. https://www.eurocontrol.int/publication/market-segment-rules (URL retrieved on 17/02/2023)

Figure 1.13: *Yearly number of cargo movements and other segmentations at Liege Airport*

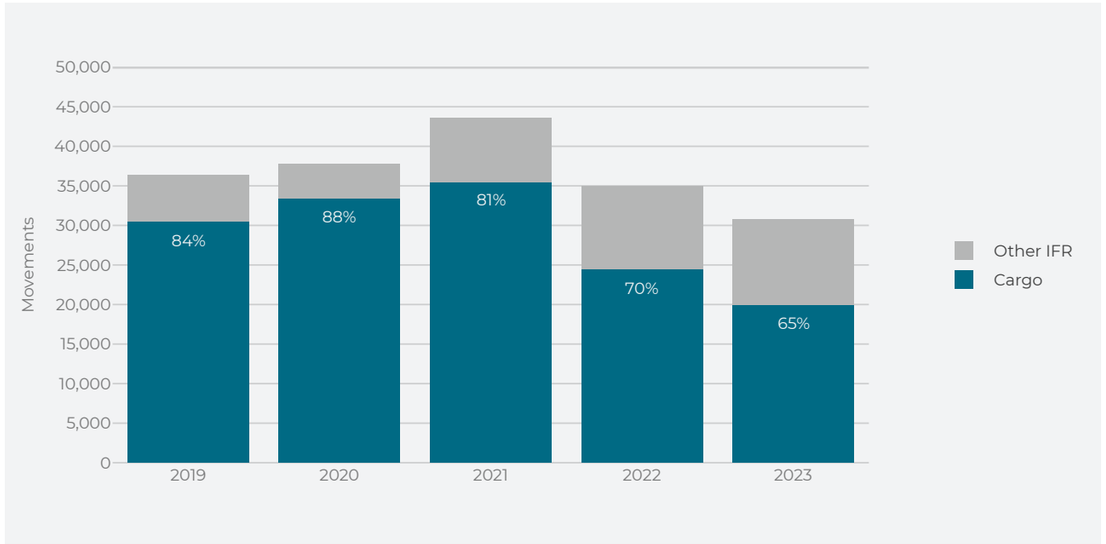
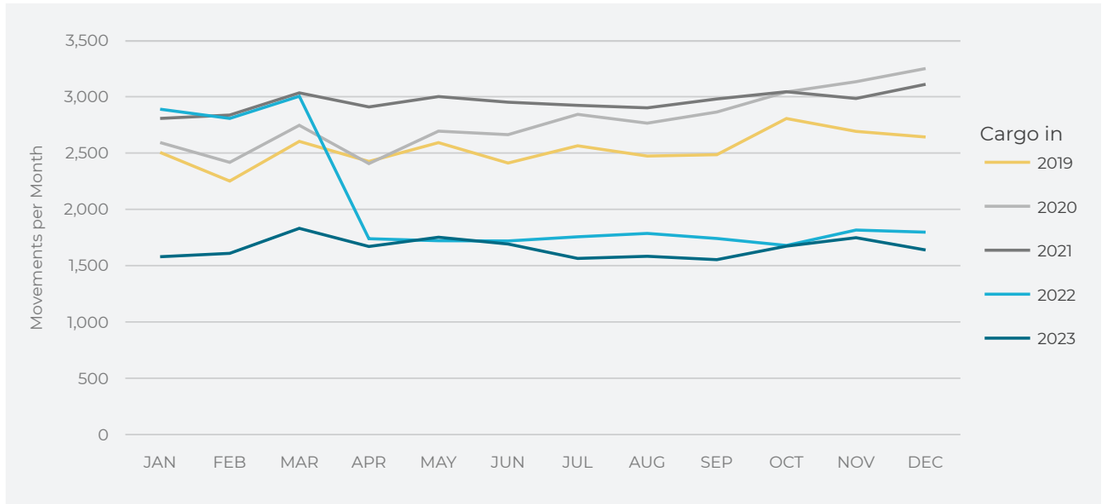


Figure 1.14 provides a more in-depth view on the evolution of the cargo figures per month per year. Very noticeable is that the beginning of the year 2022 started off as well as in 2021 with high traffic figures in January, February, and March. In April 2022, however, with the move of FedEx from Liege to Paris Charles de Gaulle, cargo movements decreased. After this, the level of movements stayed stable at this level until the end of 2023.

Figure 1.14: *Monthly number of cargo movements at Liege Airport per year*



Drone Activities

The emerging activities of unmanned aircraft systems (UAS) and the variety of their operations is one of the challenges driving the future of Air Navigation Service Providers (ANSP). To enable a reliable and efficient UAS integration, a framework is designed at European Union level: U-space. U-space is a set of specific services and procedures designed to ensure safe and efficient access to airspace for a large number of drones. Implementing U-space airspace requires states to define and designate U-space airspaces with mandatory service provision. For the provision of these mandatory services, the deployment of U-space will entail the integration of two new service providers into the system: the common information service provider (CISP) and the U-space service provider (USSP). The CISP will be in charge of making available the common information required to enable the operation and provision of U-space services in U-space airspaces wherever it has been designated[3].

skeyes is playing a central role in the development of the U-space as manager of UAS geographical zones in Belgium and by actively participating in the BURDI Project. The BURDI project which stands for Belgium-Netherlands U-space Reference Design Implementation, is dedicated to implementing a U-space airspace concept to ensure a reliable and efficient UAS integration.[4] Additionally, since 2023, skeyes has been working on obtaining the certification to become the CISP in Belgium.

The controlled airspace above and around an airport is a UAS geographical zone, also called “GeoZone”. UAS geographical zones are zones that are only accessible to drones complying with technical and operational criteria called access conditions, and that can be restricted with regard to the use of drones. skeyes is the GeoZone manager for controlled airspace above and around the airports of Antwerp, Brussels, Charleroi, Liege, Ostend, and the Radio Mandatory Zone of Kortrijk.[5,6]

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

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

Drone activities are authorised to operate in a certain category. These categories are defined by the risk the drone activity forms for manned aviation in very low level (VLL) zones. For Liege airport, 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

Table 1.5 shows the number of drone operations per VLL zone for the years 2021, 2022 and 2023. Drone operations are an area in the aviation that is growing and this is also true near Liege Airport. In 2023 there were 26% more drone operations authorized compared to 2022.

Table 1.5: *Authorized drone activities in 2023 per VLL zone risk level*

	Low	Moderate	High	Total
2021	750	13	0	**763**
2022	1,565	68	17	**1,650**
2023	1,973	98	14	**2,085**
2023 *vs* 2021	+163%	+654%	-	+173%
2023 *vs* 2022	+26%	+44%	-18%	+26%

3. https://www.ecac-ceac.org/activities/unmanned-aircraft-systems/uas-bulletin/22-uas-bulletin/504-uas-bulletin-2-what-is-u-space (URL retrieved 16/02/2024)
4. https://www.sesarju.eu/projects/BURDI (URL retrieved 16/02/2024)
5. UAS geographical zone statuses can be seen at https://map.droneguide.be (URL retrieved on 21/04/2024).
6. skeyes, “skeyes drone service application, https://www.skeyes.be/en/services/drone-home-page/you-and-your-drone/drone-service-application/ (URL retrieved on 21/04/2024)

Figure 1.15: *Authorized airspace polygons of drone activities near Liege Airport in 2023*

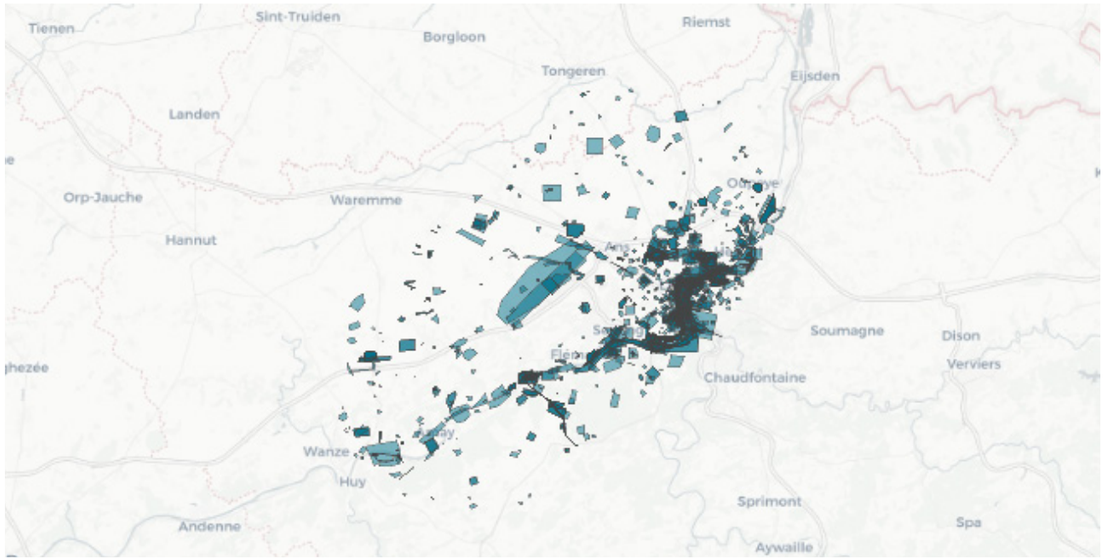


Figure 1.15 display a map with the airspace polygons of drone activities, which were authorized in the DSA. A higher concentration of activities is seen alongside the river. The missions of these activities are oftentimes related to photo- and videography, but also serve security reasons (e.g. crowd or road traffic management), scientific research, mapping purposes, or maintenance and inspection missions (e.g. of power lines, solar panels, wind turbines, air quality), etc.

As per European Union Aviation Safety Agency (EASA) definition[7], 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 ... An au... from the Civil Aviation Authority ... not requi...

SPECIFIC — More complex operatio... ... aspects of ...tion fall outside the boundaries of the Open Cate... ...orisation is required from the CAA.

FORMER CLASS 1 — Very complex operations, present... ...equivalent risk to that of manned aviation.

Table 1.6 provides an overview of the complexity of ...tions at Liege Air... An overall growth of activities can be observed (+26%).

***Table 1.6**: Authorized drone activities per EASA risk category near Liege Airport*

	Open	Specific	Former Class 1	Total
2021	521	223	19	**763**
2022	1,137	513	0	**1,650**
2023	1,483	602	0	**2,085**
2023 *vs* 2021	+185%	+170%	-100%	+173%
2023 *vs* 2022	+30%	+17%	-	+26%

7. EASA, "Drones - regulatory framework background". https://www.easa.europa.eu/domains/civil-drones/drones-regulatory-framework-background (URL retrieved on 21/04/2024)

Missed Approaches

Runway Incursions

Other Noteworthy Incidents

Improvements And Recommendations

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 can be examined whether 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 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 Regulation 376/2014 and EU Regulation 2019/317). This chapter indicates 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 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, 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 missed approaches are monitored on a weekly basis. This report gives a yearly overview and a comparison over five years for each runway at Liege Airport (runways 04L, 04R, 22L, 22R).

In 2023, there were 46 missed approaches. ***Figure 2.1*** shows the number of missed approaches per cause. Unstable approaches were the main reason of missed approaches in 2023 at Liege Airport, accounting for a share of 28%. Oftentimes, unstable approaches occur due to tailwind at higher altitudes or when the aircraft takes a very direct route and is therefore unable to reduce its speed/altitude sufficiently. The second most common reason for missed approaches in 2023 is visibility.

Figure 2.1: *Missed approaches per cause in 2023*

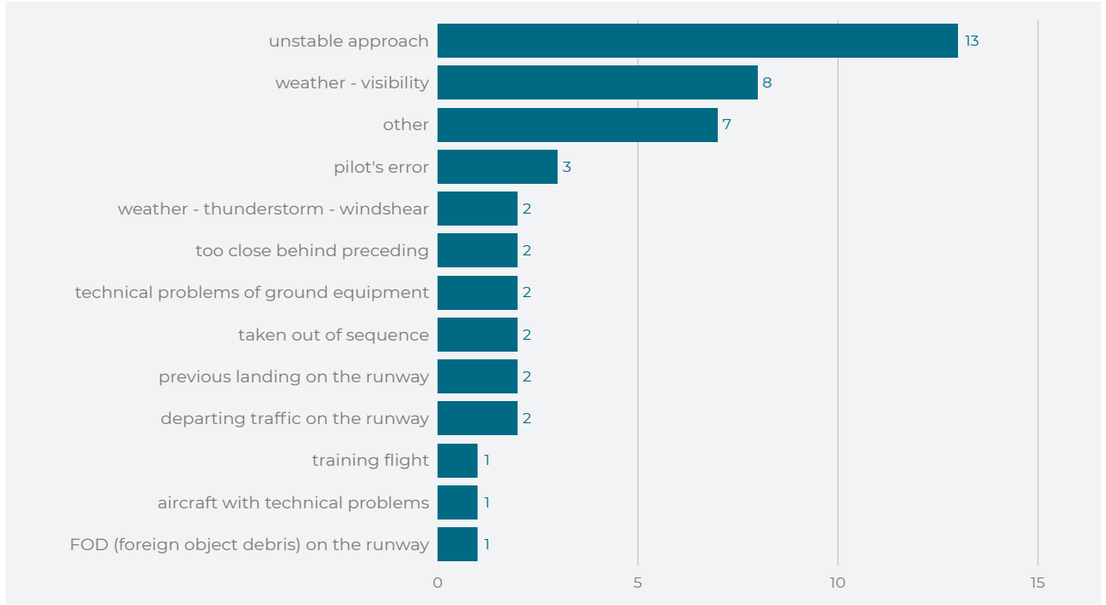
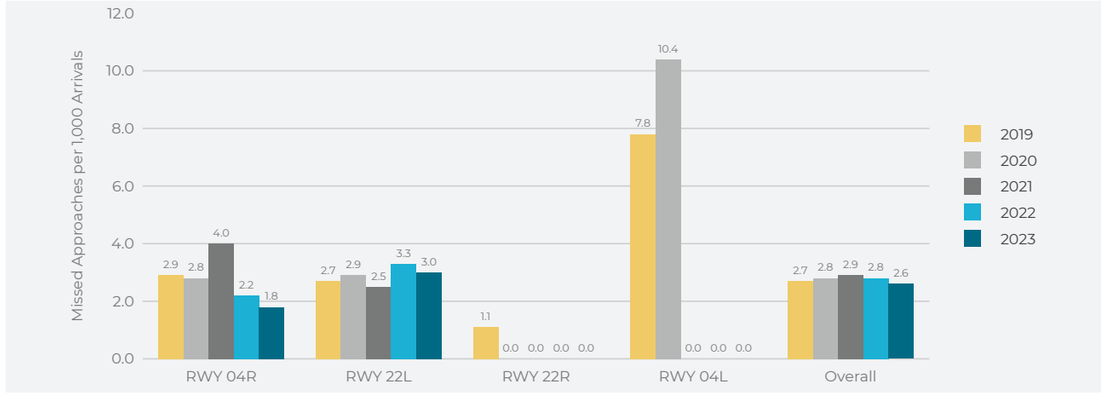


Figure 2.2 gives the yearly rate of missed approaches per 1,000 arrivals. The number of arrivals is provided by the AMS under the BCAA's aerodrome movement definition. The overall rate in 2023 was slightly lower (2.6 missed approaches per 1,000 arrivals) compared to the previous years where it ranged from 2.7 to 2.9 missed approaches per 1,000 arrivals. In 2023, no missed approaches were recorded on these runways. Comparing the figures for runways 04R and 22L in 2023 with the previous year, the rate of missed approaches dropped from 2.2 to 1.8 for runway 04R and from 3.3 to 3.0 for runway 22L. The decrease of missed approaches on runway 04R can be explained by a lower number of missed approaches due to unstable approaches. For runway 22L the missed approaches due to unstable approaches and weather conditions were lower in 2023. Although, there is a higher number of missed approaches due to Pilot's error and the reason Other which includes the reasons that could not be attributed to predefined reasons like passengers not ready, flight criteria not met (e.g. flaps) or not confirmed (clear runway).

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



Runway Incursions

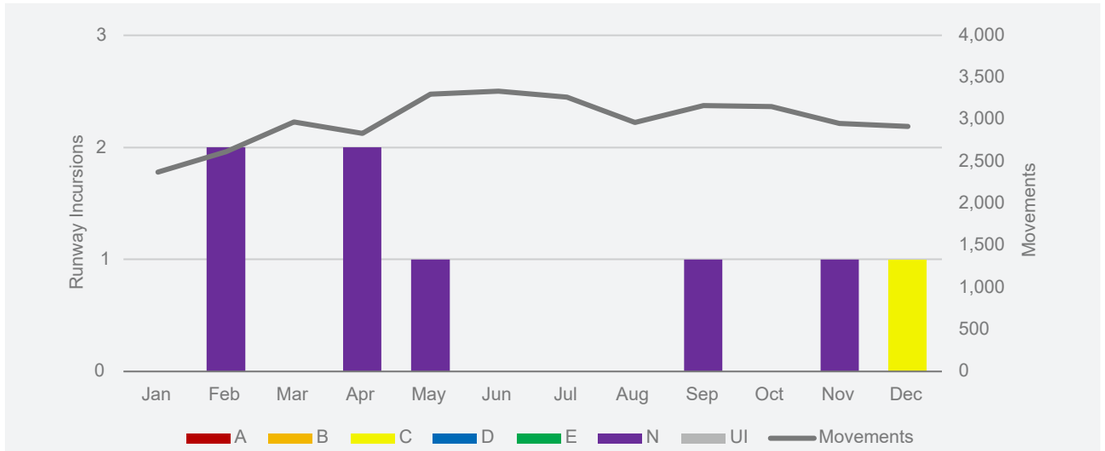
According to ICAO[8], a runway incursion is defined as "any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle or person on the protected area of a surface designated for the landing and take-off of aircraft". According to the Acceptable Means of Compliance (AMC)[9], an incorrect presence is hereby defined 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).

A monthly overview of the runway incursions in 2023 can be seen in ***Figure 2.3.*** A total of eight runway incursions happened in 2023. The colours of the bar chart indicate the severity as defined in ***Table 2.1.***

One runway incursion of the eight in 2023 is considered to have indirect Air Traffic Management (ATM) contribution, being classified as C-Significant Incident, where an aircraft stopped at a holding point but part of it was already beyond the holding point.

The other seven runway incursions in 2023 are without Air Traffic Management (ATM) contribution, one was a take-off without the required clearance (in May), four times it was an aircraft entering the runway without clearance (twice in April, once in September, and once in November), on two occasions an aircraft crossed a red stop-bar without clearance (in February), and one involved aircraft that stopped at the holding point but a part of them was already beyond the holding point (in December).

Figure 2.3: *Runway incursions in 2023 per month, per category*



8. ICAO Doc 4444 – PANS–ATM
9. AMC 3 of EU Reg 2019/317

Figure 2.4: *Runway incursions 2019-2023, per year, per category*

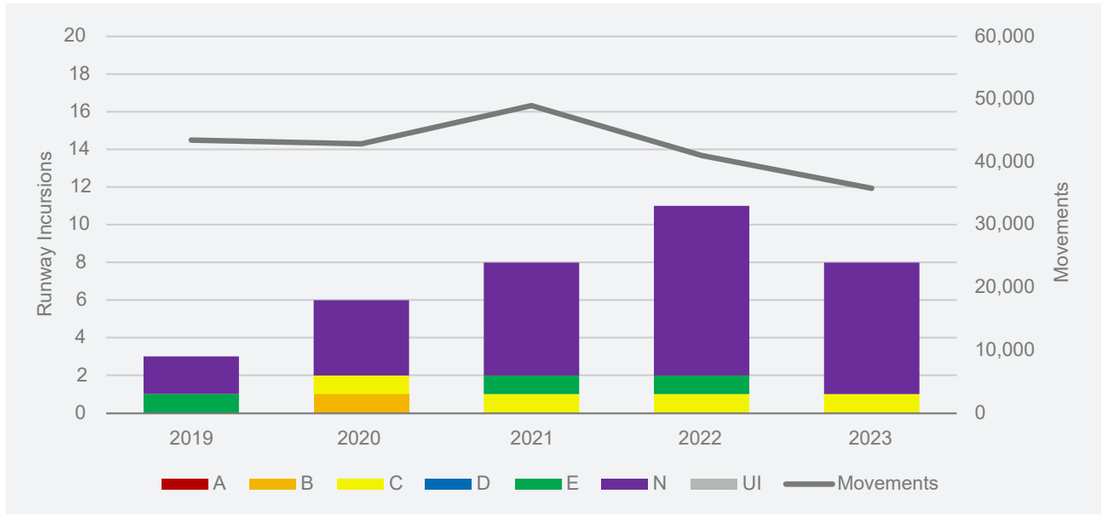
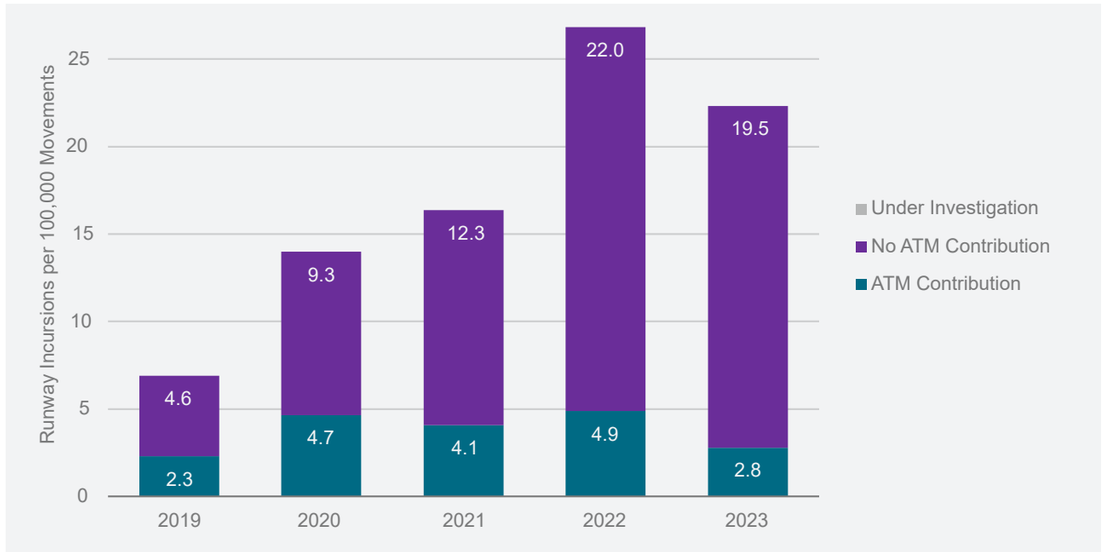


Figure 2.4 gives a yearly overview of the runway incursions from 2019 until 2023. For the first time since 2019, a decrease is seen. After 11 runway incursions in 2022, there are eight runway incursions in 2023. Three of these runway incursions took place at holding point C0 while there were four of these runway incursions in 2022.

A better way of comparing these figures, though, is the rate of runway incursions. ***Figure 2.5*** shows the rate per 100,000 movements for Liege Airport for the period from 2019 until 2023. Whereas the rate of incursions without ATM contribution increased, the rate of runway incursions with ATM contribution in 2023 decreased to 2.8.

Figure 2.5: *Rates of runway incursions per 100,000 movements, per year*



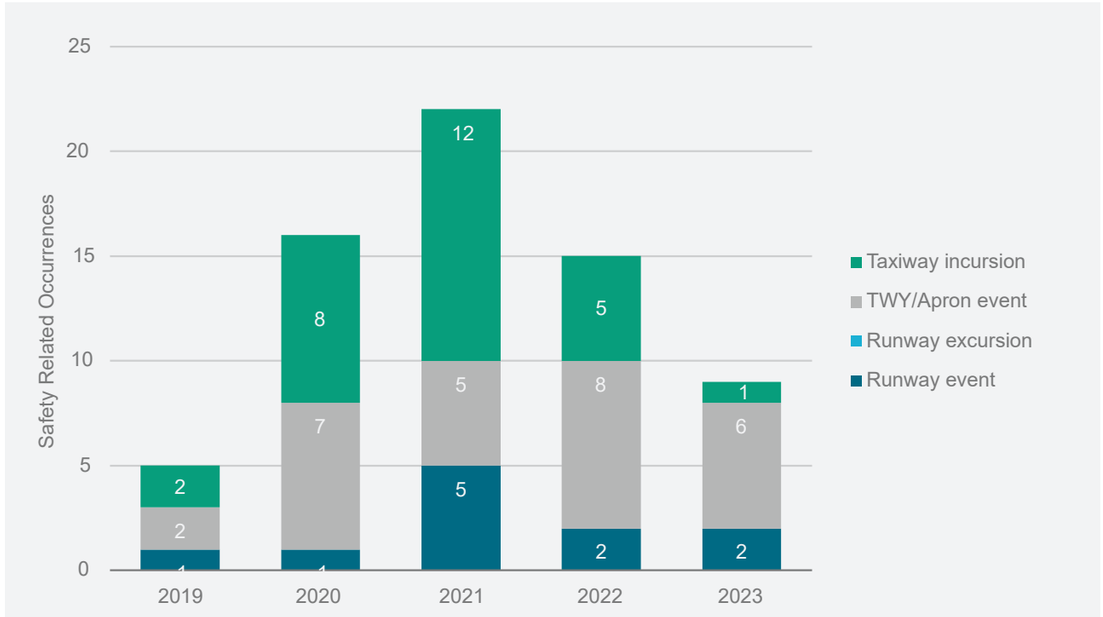
Other Noteworthy Incidents

In 2023, there was one runway event which happened in January. The event was with no ATM contribution. No runway excursions occurred in 2023, nor in the other years.

Concerning taxiways and aprons, one taxiway incursion was reported in 2023 where an aircraft followed the marshaller beyond a stopping point without clearance and six taxiway/apron events were recorded in 2023. One of them had ATM contribution and was classified as category E where an instruction was given to taxi over a closed taxiway.

Figure 2.6 provides an overview over the previously mentioned incidents over the past five years. The incidents continued to decrease since 2021.

Figure 2.6: *Runway and taxiway incursions and events over the past five years*



Improvements And Recommendations

skeyes has established a Local Runway Safety Team (LRST) together with the stakeholders at Liege Airport. All apron events, taxiway incursions, runway incursions, and more if deemed useful, are discussed in the LRST to present the view of each stakeholder. As such, each stakeholder can focus more easily on possible actions to be taken on their side. One such action is the attempt to reduce the runway incursions at C0 by conducting an awareness campaign and modifying the phraseology used by the ATCOs to enhance the pilots' awareness about where to stop. Additionally, new paintings at the holding point have been implemented to enhance awareness. skeyes' safety team together with the safety office of Liege Airport jointly monitor the effect of the new painting.

Furthermore, the Advanced Surface Movement Guidance and Control System (A-SMGCS), which was implemented by skeyes and Liege Airport and partially came into operation on March 16th 2021, has been operational since February 2022 with the safety nets in operational validation. This system continues to increase the controllers' situational awareness regarding every target on the movement surface and thus helps to limit the number of runway incursions with ATM contribution.

The upgrade of the ILS on runway 04R from CAT I to CAT III back in 2017 has already shown clear benefits by reducing the rate of missed approaches on that runway: While there were 11 missed approaches due to low visibility in 2017, there have only been 11 from 2018 to 2023 altogether. There is an ongoing project to analyse possible ILS improvements for Liege Airport for 2024.

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

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

CAPACITY & PUNCTUALITY

This chapter addresses the airport capacity and punctuality.
In the 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 Liege Airport is studied. The arrival delay, delay due to regulations placed by Liege Airport on the arrivals, is analysed and the delay from the airport's point of view is given, i.e. the impact on traffic to or from Liege Airport caused by regulations not only at Liege Airport but also in the Belgian en-route airspace and by other 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:

- *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.*
- *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.*

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

In practice, such optimal conditions are rarely reached. Therefore, the declared capacity is set at 90% of the optimum. As it only represents the capacity of IFR flights it is also referred to as "**Declared IFR Capacity**". ***Table 3.1*** shows the declared capacity at Brussels Airport for most of the used runway configurations. Note that this is only a theoretical calculation and currently not used for schedule coordination purposes.

Table 3.1: *Declared IFR capacity*

Runway Configuration		Declared IFR Capacity (movements/hour)		
Departures	Arrivals	Only Departures	Only Arrivals	Mixed Fleet
04	04	28	28	35
22	22	28	28	34

Besides the calculated theoretically possible capacity, the Effectively Used Capacity is an important performance indicator for the airport and the air navigation service provider handling the arrivals and departures. ***Figure 3.1*** and ***Figure 3.2*** show 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 2023 and during which there was at least one movement.

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

Figure 3.1: *Effectively used capacity in 2023 for the runway configuration 22L,22R – 22L, 22R*

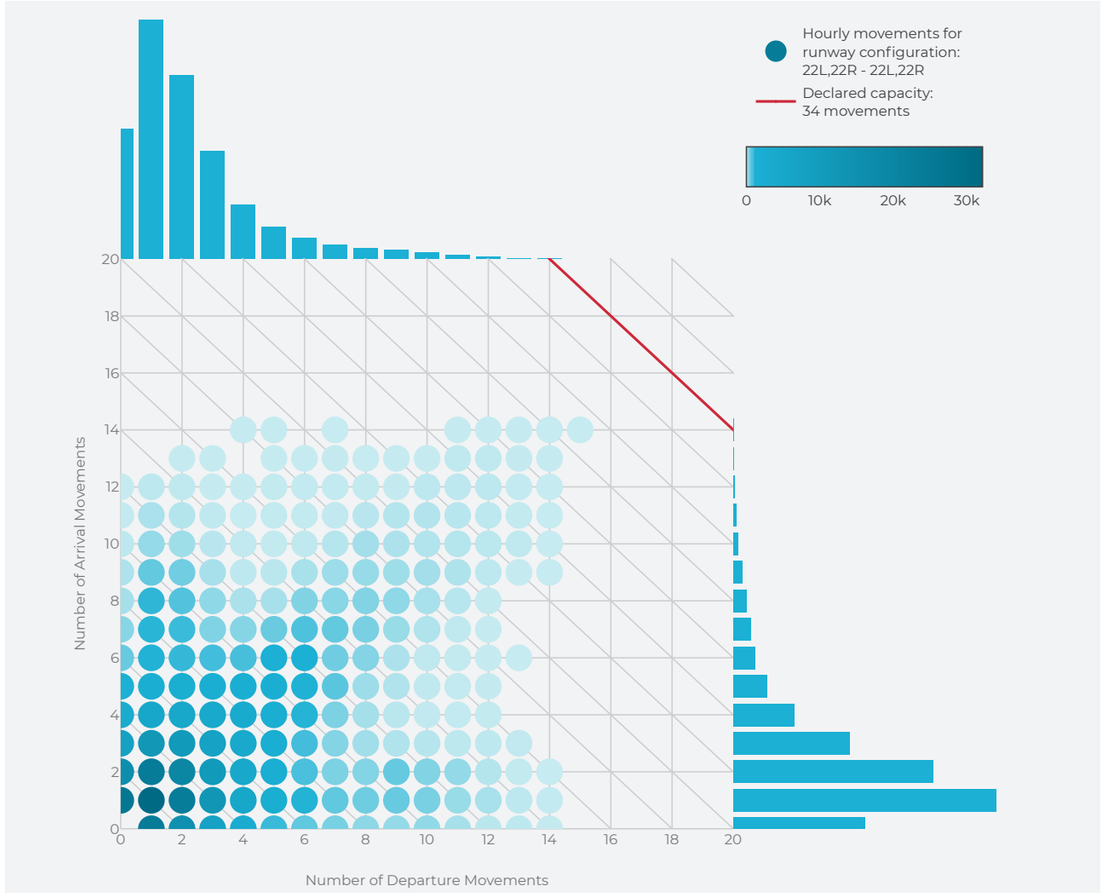
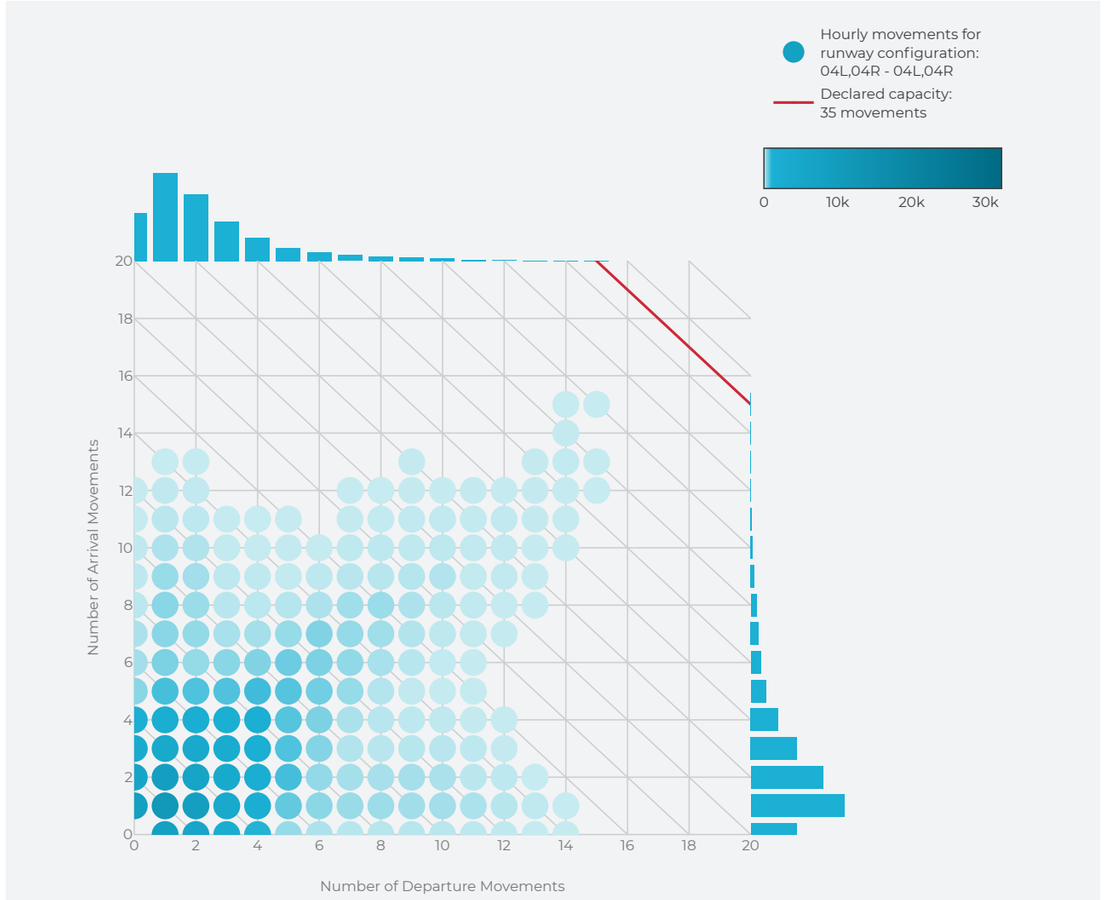


Figure 3.2: *Effectively used capacity in 2023 for the runway configuration 04L,04R – 04L, 04R*



In 2023, the declared capacity has never been exceeded in Liege Airport. In recent years, occasionally the declared capacity was exceeded, however, this occurred at moments where the movements consisted of a very high share of VFR movements for which the IFR separation rules do not apply, such that a higher throughput could be reached. The maximum movements in one hour was recorded on the 13th of June 2023 with 30 movements. At this time, 80 % of the movements were VFR movements. The busiest moment based on IFR traffic was the 7th of October 2023 from 12:25 until 13:25 local time. This is a moment with many touch and gos performed by one aircraft.

Punctuality

Punctuality can be seen as a service quality indicator from a passenger's perspective. This section observes one of the factors that influence punctuality: air traffic flow management (ATFM) delay. ATFM delay is defined as the time difference between estimated take-off time (ETOT) and calculated take-off time (CTOT) of the Network Manager (EUROCONTROL) and is due to ATFM measures that are classified according to the respective 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)
P - Special Event
R – ATC Routeing
S – ATC Staffing
T - Equipment (ATC)
V – Environmental Issues
W - Weather
NA - Not Specified
Other

According to the FABEC Performance Plan, the causes with ANSP contribution are (in the order as listed in the Performance Plan):

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

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). The discussion in this section starts with the performance indicator: arrival delay. Arrival delay is the delay of a flight due to a regulation placed by the airport of arrival. In the second part, the impact of ATFM measures from an airport's point of view is given, showing the ATFM delay on arrivals to and departures from Liege Airport.

Airport arrival ATFM 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 due to a regulation from the arrival airport. The target is defined as the average arrival delay per IFR flight, as defined in the FABEC Performance Plan, §3.1. (C). (ii), which is in accordance with the European Performance Regulation (EU) no 317/2019, Annex 1, section 1, §3.1(b).

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 only Brussels Airport and Liege Airport were considered as contributing airports. The target for Liege Airport on CRSTMP arrival delay was 0.06 minutes/flight. For reference period 3 (RP3), 2020-2024, only Brussels Airport is considered as a 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 air traffic, the European Commission requested a revision of Union-wide performance targets for RP3. The current proposal only includes arrival delay targets for Belgium as of 2022 (1.08 minutes per flight for all causes and 0.12 minutes per flight for CRSTMP causes) and the only contributing airport remains Brussels Airport.

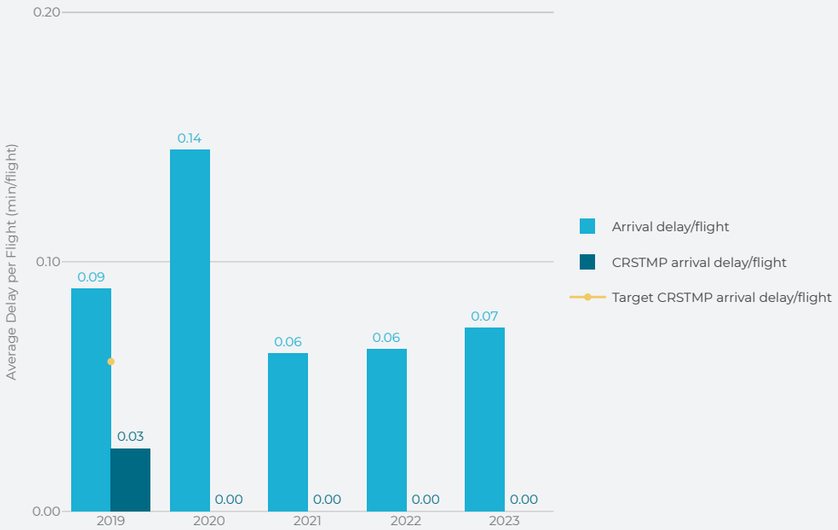
For this performance indicator, a comparison is made over the last five years. ***Table 3.2*** gives the amount of arrival delay of Liege Airport and the total number of arrivals per year. Note that in this section, the number of arrivals and the arrival delay for each flight are calculated by the Network Manager nd have been provided by the Performance Review Unit (PRU / EUROCONTROL) . In 2023, a total of 1,077 minutes of arrival delay at Liege Airport were registered. Like in previous years, the only reason for arrival delay was weather.

Table 3.2: *Arrival delay Liege Airport per year and cause*

	Minutes of ATFM Arrival Delay				IFR Arrivals
Year	**CRSTMP**	**Weather**	**Other categories**	**Total**	**(with flight plan)**
2019	439	1,117	0	**1,556**	17,439
2020	0	2,658	0	**2,658**	18,341
2021	0	1,325	0	**1,325**	20,969
2022	0	1,076	0	**1,076**	16,568
2023	0	1,077	0	**1,077**	14,642

Translated into the key performance indicator delay per arrival, this results in a total arrival delay of 0.07 minutes per arrival in 2023. As the only reason was weather, the CRSTMP (reasons with ANSP contribution) arrival delay was zero minutes per arrival. This can be also be seen in ***Figure 3.3***, which shows the arrival delay rates for the past five years. It shall be recalled that for 2020 to 2023, there were no arrival delay target set for Liege Airport.

Figure 3.3: *Arrival delay KPI at Liege Airport for 2019-2023 per year*



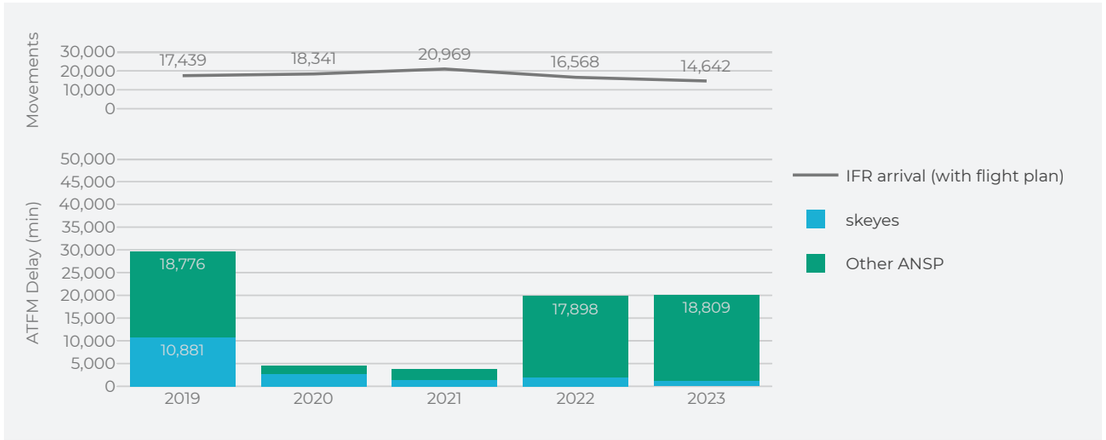
All ATFM impact on traffic at Liege Airport

In this section of the report, the ATFM delay for allBesides being delayed by Liege tower, flights to or from Liege Airport can 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. Regulations can be put in place at all ATC sectors of the flight plan: en-route sectors, departing airport and destination airport. The impact of all of these regulations give the total ATFM delay of traffic at Liege Airport.

Although traffic in Liege Airport decreased in 2023 compared to 2022, traffic in Europe increased a 10%. According to an overview published by EUROCONTROL the ATFM delays in terms of delay per flight is stable versus 2022 despite the increase in number of flights. In 2023, strikes (ATC) in France and extreme weather events in the summer months had a significant impact on the network.[11].

Figure 3.4 and ***Figure 3.5*** provide a view on the delay on departing and arriving traffic from/to Liege Airport over the last five years. The delay figures are given in the bottom graph, the top graph shows the flights with a flight plan going to or departing from Liege Airport.

Figure 3.4: *ATFM delay for IFR arrivals per year and delay origin*

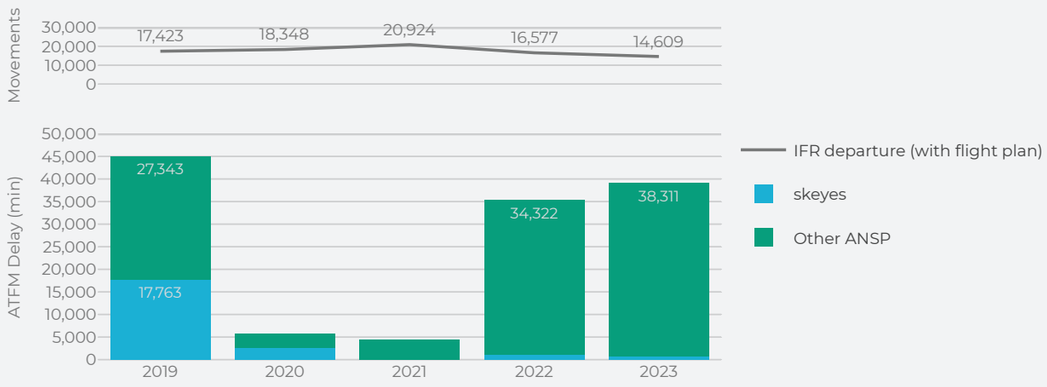


In 2023, 14,642 flights (with a flight plan) arriving at Liege Airport were delayed with a total of 20,119 minutes of ATFM delay. 7% (1,310 minutes) of this delay is attributable to skeyes while 93% (18,809 minutes) is attributable to ATFM measures placed by other ANSPs.

10. Hence the difference with figures in Chapter 1, where movements are counted using the AMS and the BCAA criteria. The Network Manager only accounts for flights with a registered flight plan.

11. https://www.eurocontrol.int/publication/eurocontrol-european-aviation-overview (URL retrieved on 24/01/2024)https://www.eurocontrol.int/publication/european-cco-cdo-action-plan (URL retrieved: 26/02/2024)

Figure 3.5: *ATFM delay for IFR departures per year and delay origin*



Of the 14,609 departures from Liege Airport, 2,061 flights were delayed by ATFM regulations resulting in a total of 39,000 minutes of delay. Thereof, 2% (689 minutes) is attributable to skeyes while 98% (38,311 minutes) is attributable to other ANSPs.

The impact of all these regulations give the total ATFM delay of traffic at Liege Airport. Traffic was mainly impacted by ATC disruptions due to lack of capacity and staffing as well as weather related reasons. Other factors that resulted in ATFM delay on Liege traffic were industrial actions in France, the implementation of 4-flight in France and the implementation of iCAS in Germany. Regulations were put in place (particularly in France and Germany) to protect that airspace and also the neighbouring from an overload.

To give a view on the severity of the impact, the delayed flights can be categorised based on the length of their delay. The following four categories have been established:

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

It is clear that for both arriving traffic (***Figure 3.6***) and departing traffic (***Figure 3.7***), a similar distribution is seen:

More than half of delayed flights going to Liege Airport had a delay that did not exceed 15 minutes (57%). For 83%, the delay was below 30 minutes and only 3% of flights going to Liege Airport were delayed by more than 60 minutes.

Similarly, more than half of delayed flights departing from Liege Airport had a delay that did not exceed 15 minutes (52%). For 80%, the delay was below 30 minutes and 4% of flights departing from Liege Airport were delayed by more than 60 minutes.

Figure 3.6: *Delayed IFR departures per category of delayed time in 2023*

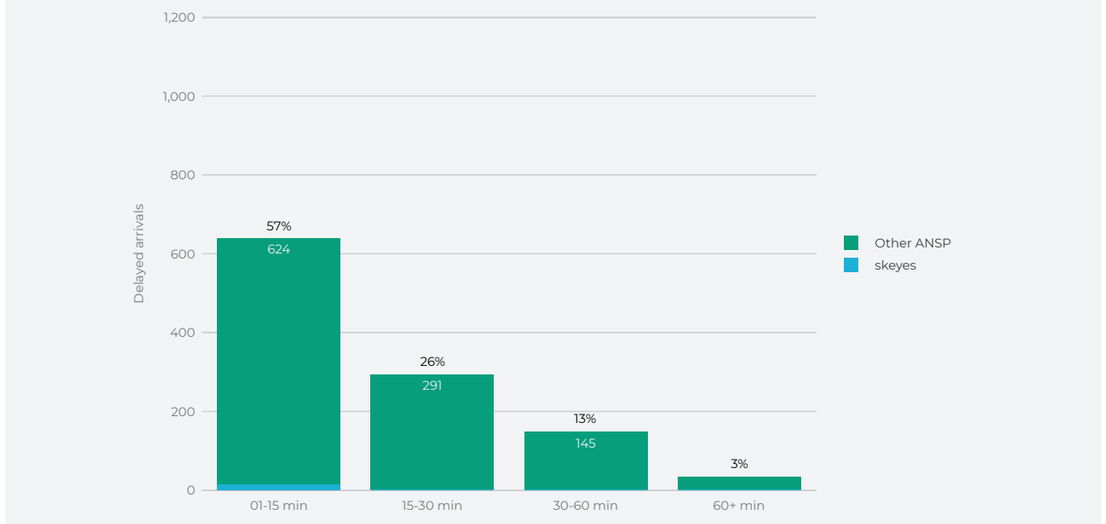
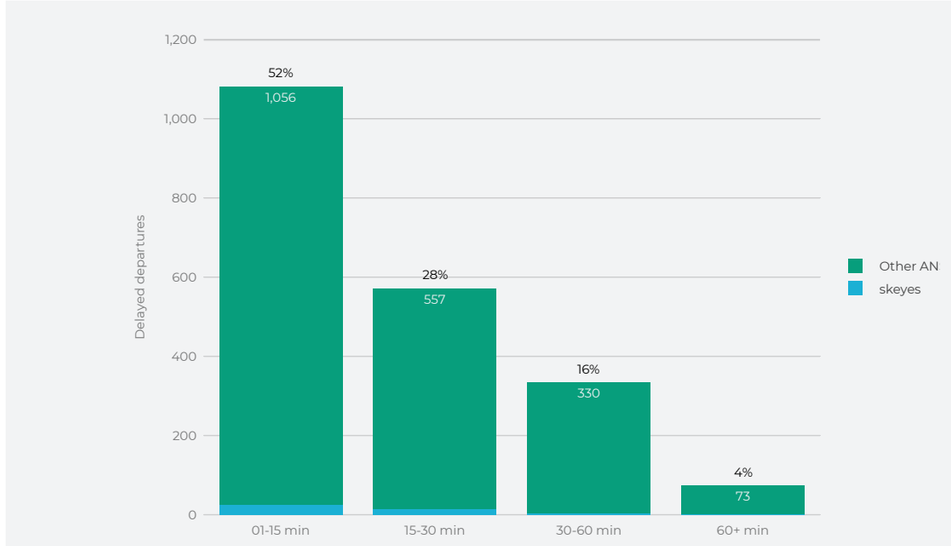


Figure 3.7: *Delayed IFR arrivals per category of delayed time in 2023*



- *Continuous Descent Operations (CDO)*
- *Wind Pattern*
- *Improvements And Recommendations*

ENVIRONMENT

The first part of this chapter is dedicated to Continuous Descent Operations (CDO), also called green approaches. 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. As of this report, a new indicator is used.

The second part focusses on of predominant winds at Liege Airport, as wind is a leading factor in the choice of runway use, which in turn has an influence on the noise above the city of Liege. Runways 22L and 22R are preferred over runways 04L and 04R in this context. Furthermore, there are ongoing processes that aim to ensure a continuous dialogue with all the stakeholders and communities for more and more clarity in the runway configuration choice and other incentives, like environmental fees, to reduce noise pollution.

Continuous Descent Operations (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 noise[10].

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

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

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

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

The CDO indicators CDO Fuel and CDO Noise are given in ***Figure 4.1.*** The graph shows the number of arrivals that flown a CDO Fuel, a CDO Noise, and the number of arrivals relevant for the CDO statistics. For consistency, historical CDO statistics are calculated based on the CDO flag. Note that this counting of arrivals differs from the BCAA movements definition used in the previous chapters. The yearly number of CDO Fuel and CDO Noise decreased in absolute number at a rate similar to the decrease of relevant arrivals.

The rate of CDO Noise and CDO Fuel flown per relevant arrivals per runway is shown in ***Figure 4.2*** and ***Figure 4.3*** respectively. The most used runway, runway 22L, shows a similar rate in 2023 compared to 2022. Although the rate is lower compared to the years before. On runway 04R, the rate decreased notably in the last five years.

Figure 4.1: *Total number of CDO Fuel and CDO Noise flown per year*

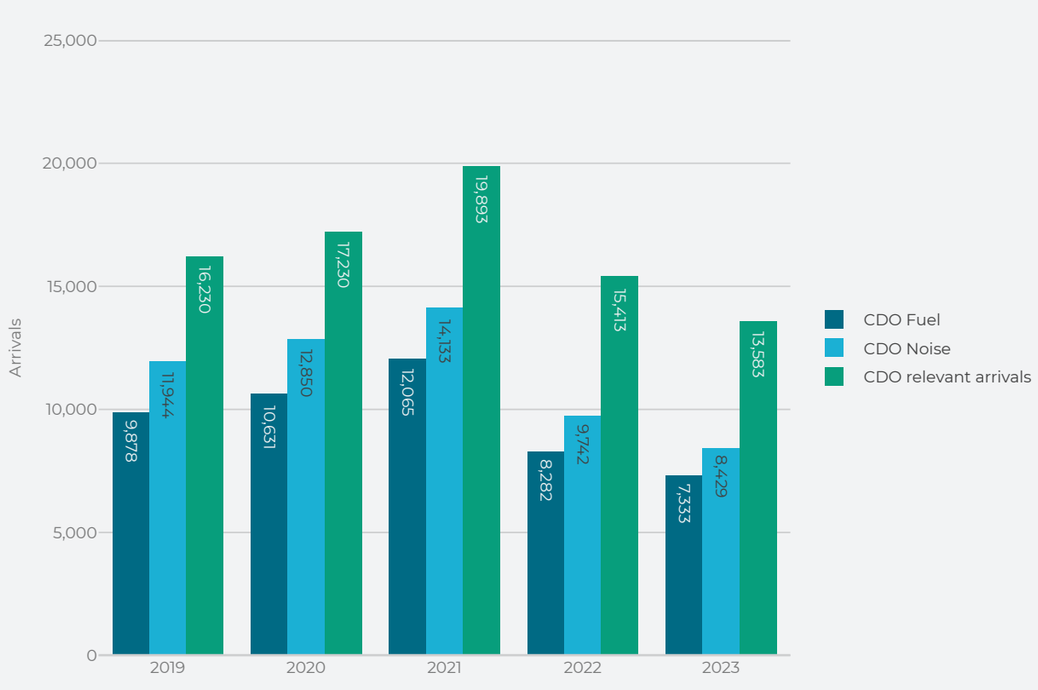


Figure 4.2: *CDO Noise flown per runway per year as percentage of arrivals*

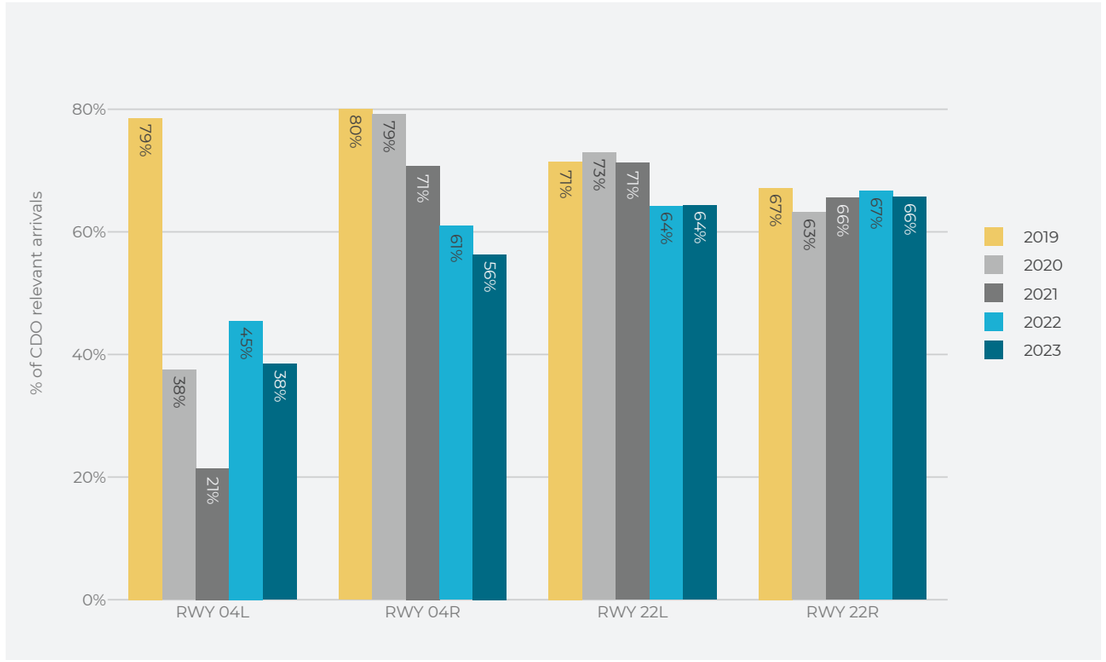
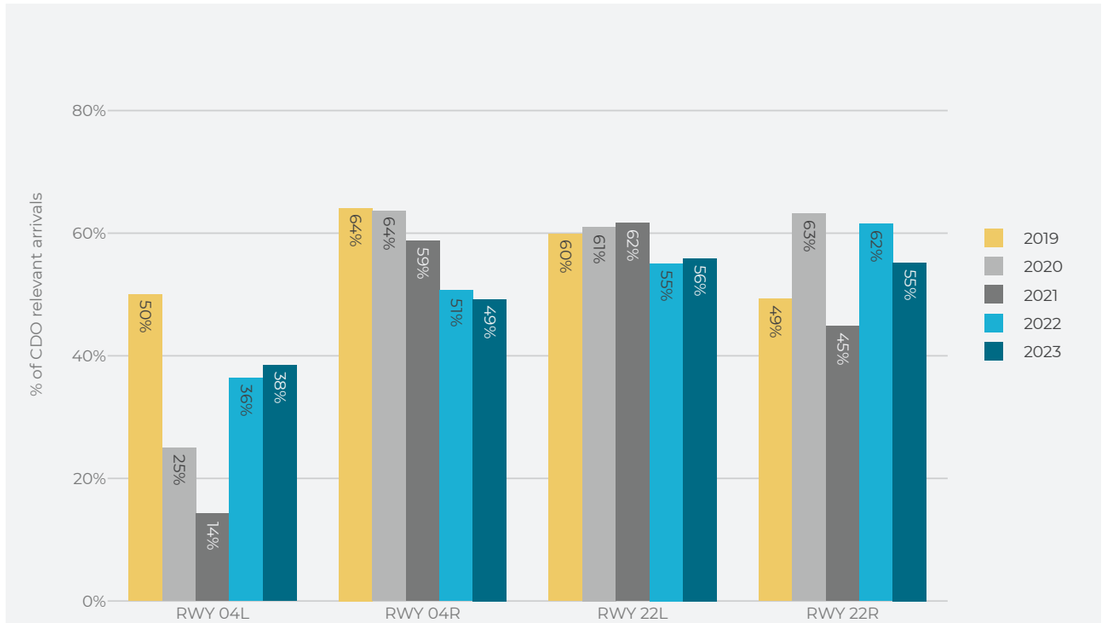
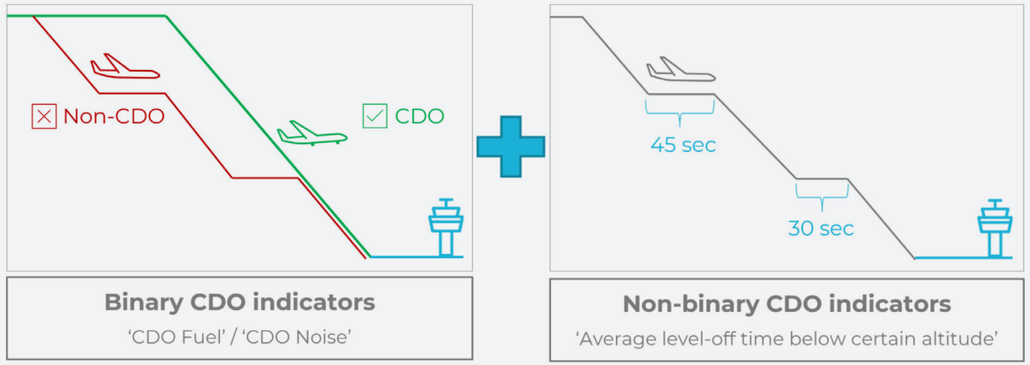


Figure 4.3: *CDO Fuel flown per runway per year as percentage of relevant arrivals*



As mentioned above, a new indicator for CDOs is introduced in this report. This indicator is the **'Average level-off time below certain altitude'**. While CDO Fuel and CDO Noise categorize arrivals in a binary way (as CDO yes/no), the new indicator considers CDO performance in a non-binary means, delving into the duration during which an aircraft operates in level-off segment(s). The characteristics of binary and non-binary method of CDO measuring is also illustrated in ***Figure 4.4***

Figure 4.4: *Binary/non-binary CDO indicator illustration*



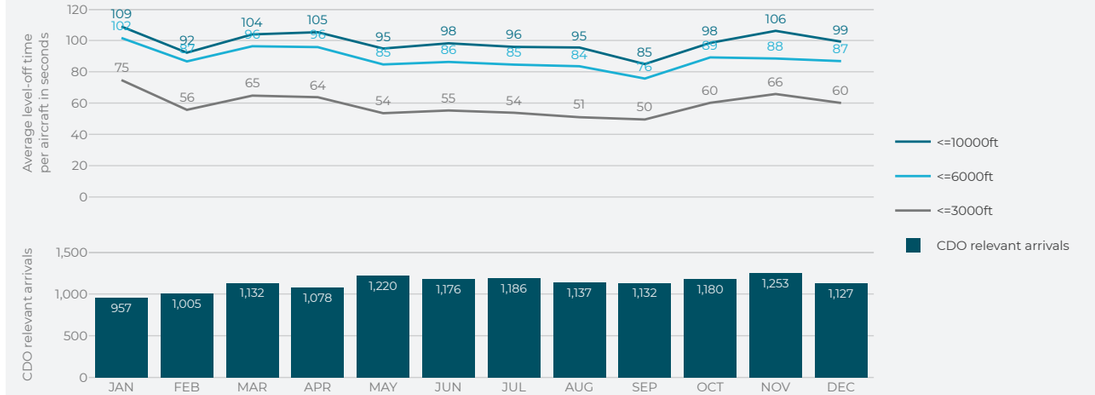
The **'Average level-off time below certain altitude'** indicator provides a value representing the average time a descending aircraft spends flying level-off within specific altitude ranges. Three distinct altitude ranges are monitored:

- ***10,000 ft to Ground (GND)***
  The upper boundary aligns with the altitude ceiling of 'CDO Fuel'
- ***6,000 ft to GND***
  The upper boundary aligns with the altitude ceiling of 'CDO Noise'
- ***3,000 ft to GND***
  This altitude range focuses on level-off segments in low altitudes, which are excluded from 'CDO Fuel' and 'CDO Noise'.

The development of the 'Average level-off time below certain altitude' indicator is based on recommendations from the European CCO/CDO Action Plan and Eurocontrol ENV Transparency Working Group[12], emphasizing its alignment with industry best practices and standards.

Figure 4.5 shows the monthly evolution of average level-off time in 2023, below the three monitored altitudes at Liege Airport. The chart is accompanied by the count of CDO-relevant arrivals, considered for the calculation of the average values.

Figure 4.5: *Monthly average level-off time in 2023*

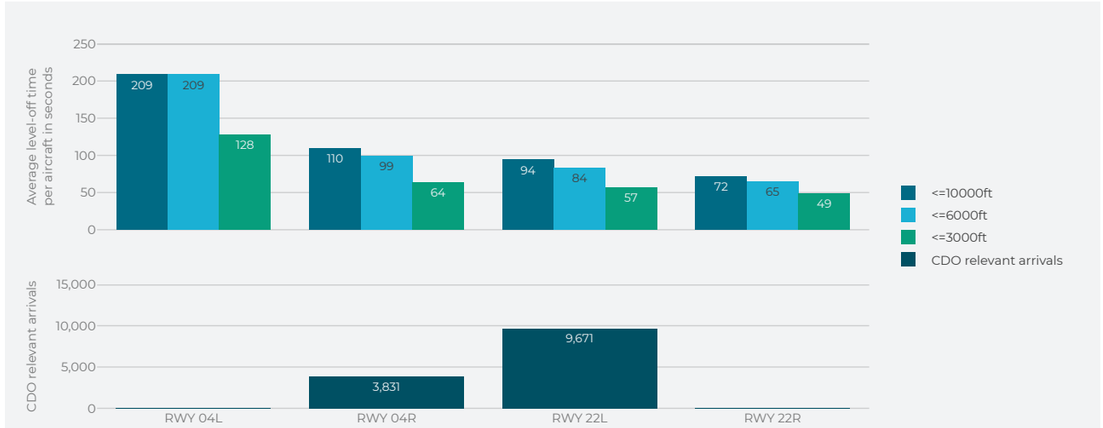


The monthly chart reveals a consistent evolution of average level-off time across all three monitored altitudes, emphasizing that the month-to-month variations were primarily driven by changes in level-off time at low altitudes (≤ 3,000 ft), where the majority of level-off time occurred.

12. https://www.eurocontrol.int/publication/european-cco-cdo-action-plan
(URL retrieved: 26/02/2024)

In ***Figure 4.6***, the distribution of average level-off time across runways (RWYs) in 2023 is depicted, along with the number of considered CDO relevant arrivals.

Figure 4.6: *Average level-off time per Runway*



At Liege Airport in 2023, the highest percentage of CDO-relevant arrivals landed on RWY 22L (71%), followed by RWY 04R (28%). The other runways were used for only a fraction of CDO-relevant arrivals. Between the two most used runways, RWY 22L demonstrated slightly better CDO performance in terms of average level-off time compared to RWY 04R.

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

- Assisting the aircraft operators in improving their flight efficiency in general, and CDO in particular, is an integral part of skeyes' Environmental Action Plan (set up in 2021);
- skeyes continues to be one of the core partners of the 'Collaborative Environmental Management' (CEM) platform at Liege Airport, launched in September 2020. The objective is to increase cooperation with airlines and the airport in undertaking joint initiatives that further reduce the environmental impact of airport operations. Stakeholders in the discussions are Liege Airport, skeyes, SOWAER, and the main airlines operating at Liege Airport;
- skeyes promotes the increased use of PBN procedures, also during the CEM platform. 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. More on this can be read at the end of this chapter.
- skeyes monitors and adapts, where feasible, operations to enhance flight efficiency. E.g., during COVID travel restrictions, some constraints were relaxed due to the reduction of traffic in the Belgian airspace, 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 increasing awareness amongst ATCOs through courses, and by informing them of the current statistics and performance;

Wind Pattern

One of the main factors for the choice of the runway is wind. At Liege Airport, the wind typically blows in the north-easterly or south-westerly direction, with predominant winds from the South-West. This can also be seen in the wind roses in ***Figure 4.7.*** The wind roses show the average wind strength in knots (colour-coded) and the direction the wind is blowing from as the angle of the petal. This way the wind of the years 2019 to 2023 is summarized.

A monthly view on winds in 2023 is given in ***Figure 4.8***. In January, March, July, and December, there were a lot of stronger winds from the South-West or South. In September, some winds from the South-East led to cross winds. April, May and June were months with winds mainly coming from the North-East, which explains the higher runway usage of 04L & 04R during this month (see ***Chapter 1*** – Runway Use). In general, runway usage heavily correlates with wind patterns since the aeronautics of the aircraft favour head wind for take-off and landings.

Figure 4.7: *Wind roses at Liege Airport 2019-2023*

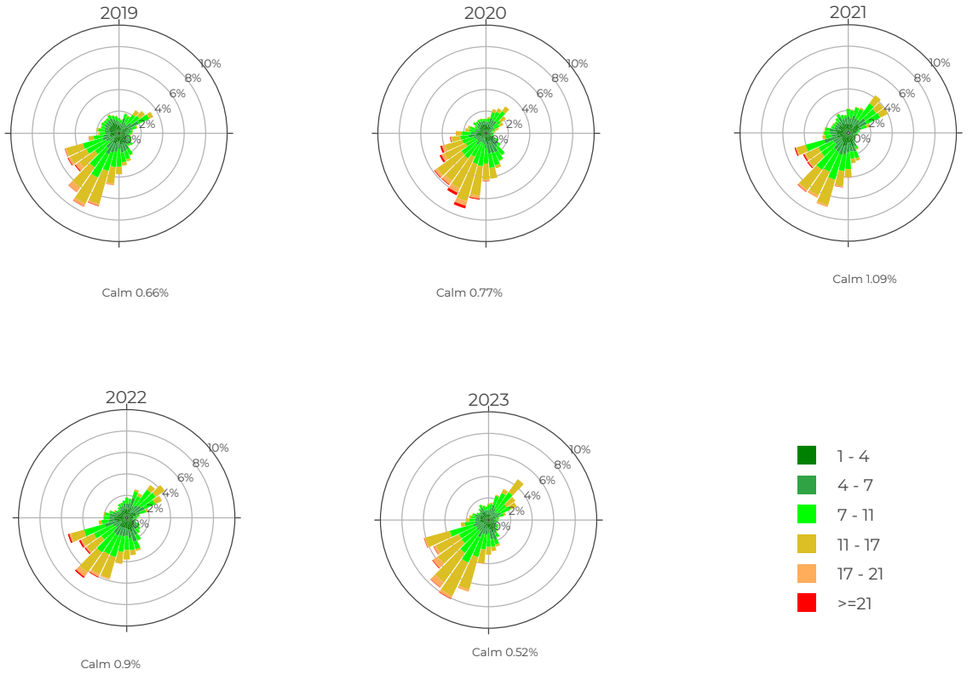
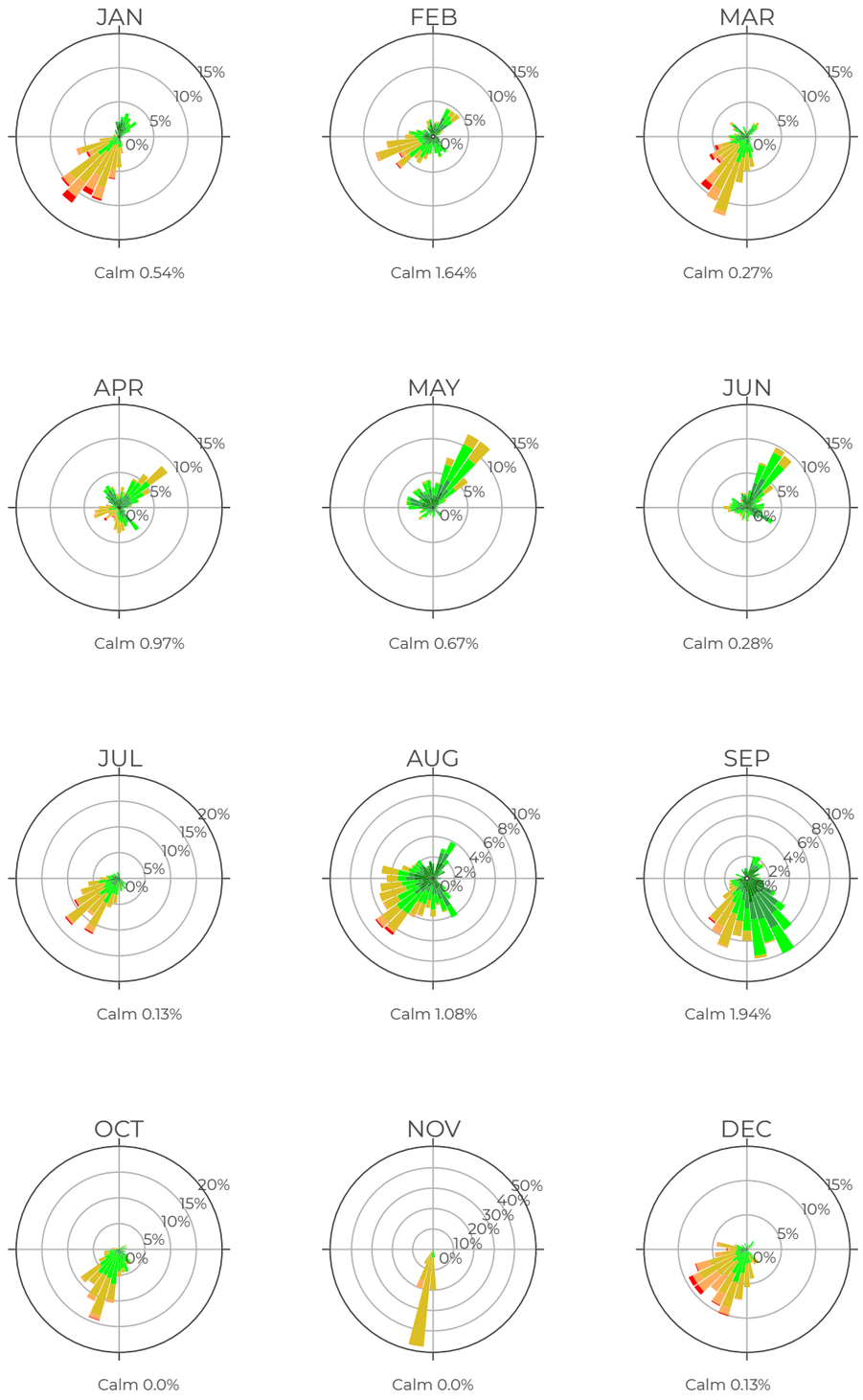


Figure 4.8: *Wind roses at Liege Airport per month of 2023*



Improvements And Recommendations

Skeyes takes an active role in reducing the environmental impact of airspace users and improving flight efficiency where possible. As such, skeyes is implementing PBN environments and participated in the GreenATM environment accreditation programme of the Civil Air Navigation Services Organisation (CANSO). This program is designed to provide an independent assessment of ANSP's efforts to reduce its environmental footprint and minimise excess emissions in the airspace for which they are responsible. In 2023, skeyes was, as one of the first ANSPs, awarded with Level 3. This achievement is awarded to ANSPs that strive to reduce both their direct impact on the environment and the emissions of the airspace users under their control.

In December 2020, skeyes released the first version of its national PBN implementation and transition plan 2024/2030 for the Belgian part of Brussels Flight Information Region (FIR). This plan aims to provide a strategy for the introduction of full PBN environments at the aerodromes of Antwerp, Brussels, Charleroi, Kortrijk, Liege, and Ostend. Once introduced, the optimization of these PBN environments will be initiated. This comprises the redesign of airspace as well as the routes which can then be redesigned independently from the ground-based infrastructure and placed at the most strategically beneficial location.

In 2023, Liege Airport became successfully a full PBN environment. After a project of several years led by skeyes' project team, supported by the operational units, a PBN-compliant environment was introduced on the 7th of September 2023. With the decommissioning of the Doppler Very High Frequency Omnidirectional Radio Range / Distance Measuring Equipment (DVOR/DME) "LGE" on the 30th of November 2023, Liege Airport then became the first full PBN environment in Belgium. Ever since, the navigation is primarily based on Global Navigation Satellite System (GNSS) where aircraft fly from point to point unrestrained from the navigation infrastructure on the ground as with conventional navigation (flying from beacon to beacon). During the project, operational and environmental benefits were observed:

- Increased flight accuracy and predictability allowing the flight crews to better optimize their descent and reduce fuel burn.
- Enhanced vertical flight efficiency (CDO) with a focus on level-off & noise pollution limitation.
- Reduced radar track dispersion, minimizing the overflight of specific areas around the airport, in particular of areas located outside the regular noise contours.

Annex: Missed Approaches

Table A.1: *Causes for missed approaches per runway per year.*

	Reasons	2019	2020	2021	2022	2023
RWY 04R	FOD (foreign object debris) on the runway	-	-	-	-	1
	aircraft with technical problems	1	4	2	2	-
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	-	-	1	1	1
	no radio contact	-	-	-	-	-
	other	-	-	3	1	1
	pilot's error	-	-	1	-	-
	previous landing on the runway	1	-	1	1	-
	runway incursion	-	-	-	-	-
	tail wind	-	-	-	-	-
	taken out of sequence	-	-	-	-	-
	technical problems of ground equipment	-	-	1	-	1
	too close behind preceding	1	1	2	-	-
	training flight	-	-	-	-	-
	unstable approach	10	5	9	5	2
	weather - thunderstorm - windshear	1	4	7	1	-
	weather - visibility	1	1	3	2	3
RWY 22L	FOD (foreign object debris) on the runway	2	1	2	-	-
	aircraft with technical problems	2	6	2	4	1
	cabin crew not ready	1	-	-	-	-
	departing traffic on the runway	-	2	2	2	1
	no radio contact	1	-	-	-	-
	other	-	2	2	3	6
	pilot's error	-	-	-	-	3
	previous landing on the runway	2	2	3	2	2
	runway incursion	-	-	1	1	-
	tail wind	-	1	1	-	-
	taken out of sequence	1	1	-	1	2
	technical problems of ground equipment	-	-	-	-	1
	too close behind preceding	2	3	1	1	2
	training flight	-	-	-	1	1
	unstable approach	25	16	24	17	11
	weather - thunderstorm - windshear	3	10	2	9	2
	weather - visibility	2	-	1	4	5

Table A.2: *Causes for missed approaches per runway per year.*

	Reasons	2019	2020	2021	2022	2023
RWY 04L	FOD (foreign object debris) on the runway	-	-	-	-	-
	aircraft with technical problems	-	-	-	-	-
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	-	-	-	-	-
	no radio contact	-	-	-	-	-
	other	-	-	-	-	-
	pilot's error	-	-	-	-	-
	previous landing on the runway	-	-	-	-	-
	runway incursion	-	-	-	-	-
	tail wind	-	-	-	-	-
	taken out of sequence	-	-	-	-	-
	technical problems of ground equipment	-	-	-	-	-
	too close behind preceding	-	-	-	-	-
	training flight	-	-	-	-	-
	unstable approach	-	1	-	-	-
	weather - thunderstorm - windshear	1	-	-	-	-
	weather - visibility	-	-	-	-	-
RWY 22R	FOD (foreign object debris) on the runway	1	-	-	-	-
	aircraft with technical problems	-	-	-	-	-
	cabin crew not ready	-	-	-	-	-
	departing traffic on the runway	-	-	-	-	-
	no radio contact	-	-	-	-	-
	other	-	-	-	-	-
	pilot's error	-	-	-	-	-
	previous landing on the runway	-	-	-	-	-
	runway incursion	-	-	-	-	-
	tail wind	-	-	-	-	-
	taken out of sequence	-	-	-	-	-
	technical problems of ground equipment	-	-	-	-	-
	too close behind preceding	-	-	-	-	-
	training flight	-	-	-	-	-
	unstable approach	-	-	-	-	-
	weather - thunderstorm - windshear	-	-	-	-	-
	weather - visibility	-	-	-	-	-

ANNEX Fact sheet

Yearly Evolution

Movements	2019	2020	2021	2022	2023	2023 vs 2022	2023 vs 2019
IFR	36,370	37,791	43,611	34,980	30,734	-12%	-15%
VFR	7,081	5,120	5,303	6,012	5,090	-15%	-28%
Total	43,451	42,911	48,914	40,992	35,824	-13%	-18%

Quarterly comparison

- *Decrease of traffic throughout the year resulting from the restructuring of FedEx, and other factors like the geopolitical instability and sanctions due to the Russian invasion of Ukraine (24/02/2022).*

Movements	2019	2020	2021	2022	2023	2023 vs 2022	2023 vs 2019
Q1	10,438	9,787	10,881	12,564	7,956	-37%	-24%
Q2	11,143	9,551	12,511	9,658	9,466	-2%	-15%
Q3	11,207	11,974	13,036	10,236	9,390	-8%	-16%
Q3	10,663	11,599	12,486	12,486	9,012	+6%	-15%

Missed Approaches

46 missed approaches in 2023

TOP 3 causes in 2023:

1. Unstable approach (13)
2. Weather - visibility (8)
3. Other (7)

Safety Occurrences

- 8 runway incursions, none with ATM contribution
- 8 other occurrences of runway safety events – less than in the previous year (15 in 2022)

Capacity

- Capacity exceeded on 6 days for 24-24 and on 2 days for 06-06 only due to majority VFR traffic.
- IFR capacity was never exceeded.

Runway configuration		Max. Movements/hour	Declared Capacity	% of hours above Capacity
Departures	Arrivals			
04L,04R	04L,04R	30	35	0,00%
22L,22R	22L,22R	29	34	0,00%

Punctuality

Arrival delay:

- Arrival Delay: 0.07 min/flight
- CRSTMP delay: 0 min/flight

ATFM impact:

- Departures 39,000 minutes ATFM delay, 2% (689 min) due to skeyes' regulations.
- Arrivals: 20,119 minutes ATFM delay, 7% (1,310 min) due to skeyes' regulations.

CDO

Rate of CDO Fuel (54%) and CDO Noise (62%) stable compared to 2022

New indicator introduced: the 'Average level-off time below certain altitude'

- RWY 22L demonstrated slightly better CDO performance compared to RWY 04R.
- The month-to-month variations were primarily driven by changes in level-off time at low altitudes (≤ 3,000 ft), where the majority of level-off time occurred.

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Runway Performance Report **2023**

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