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Liège airport

RUNWAY PERFORMANCE REPORT 2019

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EXECUTIVE SUMMARY

Despite a global economic slowdown, Liège airport has achieved a new record with 902,480 tonnes (+3.6%) of transported goods compared with 870,644 tonnes in 2018. Passenger activity remained stable with 170,737 passengers passing through the airport.

This is reflected in the increasing IFR traffic recorded at the airport over the past four years. The number of VFR movements have also increased considerably in 2019, with a growth of 25%. Further details are given about the 2019 movements in the first chapter of this report: the busiest day this year was the 13th of September, with 219 movements, while the average of 2019 was of 119 movements per day. Distribution of traffic throughout the hours of day, seasons of the year and per runway can also be found in this chapter. Traffic levels throughout the year have followed similar patterns over the past four years, with clearly marked peaks corresponding to the cargo activity on each night of the week.

Some disruptions in air navigation services in the en-route centre of skeyes occurred in 2019. As of the 12th April, skeyes implemented the Liège business continuity procedure, allowing flights to arrive and depart without depending on East en-route sector. The initial capacity of six (6) aircraft per hour was raised to 12 in September. Furthermore, the implementation of single person sector operations at ACC avoided service disruption, diminishing the impact on the traffic at Liège airport.

Air Traffic Management (ATM) performance is driven by four Key Performance Areas (KPAs): safety, capacity, environment and cost-efficiency. This report focuses on skeyes' operations at Liège airport (ICAO code EBLG). Its aim is to provide our main stakeholders with traffic figures for 2019 and relevant data on the performance of our operations at EBLG, namely on three of the four KPAs: safety, capacity and environment.

Safety

Two types of occurrences are analysed in this report, both giving a view on airport safety performance: missed approaches and runway incursions (RI). Overall the rate of missed approaches decreased in 2019. For runway 04R, the certification of the ILS to CAT III has led to a decrease in missed approaches caused by low visibility conditions.

After a particularly low rate of runway incursions in 2018, the number has risen slightly for 2019, from one to three, two of which were without ATM contribution. The A-SMGCS, foreseen to become operational end of 2020, will allow better awareness of ground movements and thereby help to limit the number of runway incursions, with and without ATM contribution.

Environment

One of the factors influencing noise around the airport are the landing procedures. Continuous descent operations (CDO), also called green landings, increased at EBLG in 2019 for CDOs flown from FL100 to 3000ft, and decreased slightly for CDOs flown from FL60 to 3000ft. The fluctuation of the CDO rate over the years is however hard to explain, as they are influenced by a multitude of factors. Similarly to what was successfully set up in 2018 in Brussels, skeyes is promoting the implementation of an agreement on 'collaborative environmental management' (CEM) to increase cooperation with airlines and the airport on undertaking joint initiatives that further reduce the environmental impact of airport operations. Wind records are also published in this chapter, showing a return to dominant south-westerly winds (with the exception of the month of April), after an exceptional amount of easterly winds in 2018.

Capacity and Punctuality

Capacity and delay go hand in hand when it comes to runway performance. As in previous years, the throughput capacity of the airport is analysed, comparing actual traffic with the declared IFR capacity. Because of the reduction of separation from 5 to 3NM in the EBLG TMA, the declared capacity of arrivals only has increased in 2018 for both runways at Liège airport. However, even during the busiest month of the year, there was still IFR capacity available and the declared capacity of each runway at peak hour was never reached (on an average staying 13 movements below).

Arrival delay is analysed, as a performance target has been set for EBLG, defined as the average ATFM delay (in minutes) per flight, attributable to skeyes. The arrival delay due to causes considered to be with the Air Navigation Service Provider (ANSP)'s contribution (CRSTMP) in 2019 had an average of 0.03 minutes / flight, thereby well below the defined target of 0.06 minutes / flight.

New to this edition of the RWY performance report are the details of the delays from the airport's point of view. Indeed, from skeyes' point of view, Air Traffic Flow Management (ATFM) regulations placed at Liège airport in 2019, created a total of 1,556 minutes of delay. From the airport and airlines perspective however, delays are observed much more frequently than this, as every departure or arrival can be affected by ATFM regulations placed in other parts of the Belgian airspace, or by other countries that the flight has to cross. In 2019, departing flights from EBLG experienced a total of 45,519 minutes of ATFM delay, of which 39.5% was attributable to skeyes. The ATFM delay for arrival flights was of 29,037 minutes, only 37.2% of which was due to ATFM measures placed by skeyes.

SYNOPSIS

Malgré un ralentissement de l'économie mondiale, Liège Airport a atteint un nouveau record avec 902.480 tonnes (+ 3,6%) de marchandises transportées contre 870.644 tonnes en 2018. L'activité passagers est restée stable avec 170.737 passagers transitant par l'aéroport.

Cela se reflète dans la croissance du trafic IFR enregistrée à l'aéroport au cours des quatre dernières années. Le nombre de mouvements VFR ont aussi fortement augmenté en 2019, avec une croissance de 25%. Vous trouverez de plus amples détails sur les mouvements en 2019 dans le premier chapitre de ce rapport. Le 13 septembre 2019 fut la journée la plus chargée, avec 219 mouvements, alors que la moyenne de 2019 était de 119 mouvements par jour. La répartition du trafic sur les heures de la journée, les saisons de l'année et par piste se trouve également dans ce chapitre.
Les niveaux de trafic tout au long de l'année ont suivi des tendances similaires au cours des quatre dernières années, avec des pics très marqués correspondant à l'activité cargo chaque nuit de la semaine.

Quelques interruptions des services de navigation aérienne ont eu lieu en 2019. A partir du 12 avril, skeyes a implémenté la procédure de continuité des activités à Liège, ce qui a permis aux vols d'atterrir et de décoller sans dépendre du secteur en route Est. La capacité initiale de six avions par heure a été portée à 12 en septembre. De plus, la mise en œuvre de single person sector operations à l'ACC a permis d'éviter des discontinuités de service, diminuant ainsi l'impact sur le trafic à Liège.

Les performances de la gestion du trafic aérien (ATM) reposent sur quatre domaines de performance clés (KPA) : la sécurité, la capacité, l'environnement et l'efficacité économique. Le présent rapport se focalise sur les opérations de skeyes à l'aéroport de Liège (code OACI : EBLG). Son objectif est de fournir à nos principaux stakeholders les chiffres du trafic pour 2019 et des données pertinentes sur la performance de nos opérations à EBLG, à savoir pour trois des quatre KPA : la sécurité, la capacité et l'environnement.

Sécurité

Deux types d'évènements sont analysés dans ce rapport, tous deux donnant un aperçu des performances de la sécurité aux aéroports : les approches interrompues et les incursions de piste (Runway Incursions, RI). Globalement, le taux d'approches interrompues a diminué en 2019. Pour la piste 04R, la certification de l'ILS en CAT III a entraîné une diminution des approches interrompues en raison de la visibilité.

Après un pourcentage d'incursions de piste particulièrement faible en 2018, le nombre a légèrement augmenté en 2019, passant de un à trois, dont deux qui n'étaient pas imputables à l'ATM. L'A-SMGCS, prévu d'entrer en opération en 2020, permettra une meilleure appréciation des mouvements au sol et contribuera ainsi à la réduction du nombre de RI, imputable ou non à l'ATM.

Environnement

Un facteur qui influence les nuisances sonores à l'aéroport concerne les procédures d'atterrissage. Les Continuous descent operations (CDO), également appelées atterrissages verts, ont augmenté à EBLG en 2019 pour les CDO effectuées du FL100 à 3000 pieds, et ont légèrement diminué pour les CDO effectuées du FL60 à 3000 pieds.
La fluctuation du pourcentage de CDO au fil des années est cependant difficile à expliquer, car elle dépend d'une multitude de facteurs. Après une expérience positive à Bruxelles depuis 2018, skeyes œuvre pour la mise en place à Liège d'un accord 'collaborative environmental management' (CEM) afin d'améliorer la collaboration avec l'aéroport et les compagnies aériennes pour prendre des mesures Commune visant à réduire encore l'impact environnemental des opérations aéroportuaires.
Les enregistrements de vents sont aussi publiés dans ce dernier chapitre, et montrent un retour de vents dominants du sud-ouest (à l'exception du mois d'avril), après une année 2018 où les vents d'est étaient plus présents.

Capacité et Ponctualité

Sur le plan de la performance des pistes, la capacité et les retards sont indissociables. Comme les années précédentes, on analyse la capacité de transport de l'aéroport en comparant le trafic réel à la capacité IFR déclarée. Avec la réduction de séparation de 5 à 3NM dans la TMA de EBLG, la capacité IFR déclarée a augmenté en 2018 pour les deux pistes. Même pendant le mois le plus chargé de l'année, il restait de la marge en capacité IFR et la capacité déclarée de chaque piste à l'heure de pointe n'a jamais été atteinte (en moyenne, 13 mouvements en dessous).

Les retards à l'arrivée sont analysés, car un objectif de performance a été fixé pour EBLG, défini comme le retard ATFM moyen (en minutes) par vol, imputable à skeyes. Les retards à l'arrivée dus à des causes imputables à l'ANSP (CRSTMP) en 2019 s'élevaient en moyenne à 0,03 minute/vol, ce qui est bien en deçà de l'objectif défini de 0,06 minutes/vol.

Ce qui est neuf dans cette édition du rapport sur la performance des pistes, ce sont les détails des retards du point de vue de l'aéroport. En effet, aux yeux de skeyes, les régulations ATFM (Air Traffic Flow Management) imposées à l'aéroport de Liège en 2019, ont généré un total de 1.556 minutes de retard. Cependant, du point de vue de l'aéroport et des compagnies aériennes, les retards sont constatés beaucoup plus fréquemment que cela, car chaque départ ou arrivée peut être impacté par les régulations ATFM imposées dans d'autres parties de l'espace aérien belge ou par d'autres pays que l'avion doit traverser. En 2019, les vols au départ d'EBLG ont accusé un total de 45.519 minutes de retard ATFM, dont 39,5% étaient imputables à skeyes. Le retard ATFM pour les vols à l'arrivée était de 29.037 minutes, dont seulement 37,2% étaient dus à des mesures ATFM imposées par skeyes.

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ACRONYMS

ACFT : Aircraft
AMS : Airport Movement System
ANSP : Air Navigation Service Provider
ARR : Arrival
ATC : Air Traffic Control
ATCO : Air Traffic Control Officer
ATFM : Air Traffic Flow Management
ATM : Air Traffic Management
BCAA : Belgian Civil Aviation Authority
CDO : Continuous Descent Operation
CRSTMP : C-Capacity, R-Routing, S-Staffing, T- Equipment, M- Airspace Management, P- Special Event
CTOT : Calculated Take-Off Time
CTR : Control Zone of an Airport
DEP : Departure
DGS&O : Directorate General Systems and Operations
EBAW : Antwerp airport ICAO Code
EBBR : Brussels airport ICAO Code
EBCI : Charleroi airport ICAO Code
EBKT : Kortrijk airport ICAO Code
EBLG : Liège airport ICAO Code
EBOS : Ostend airport ICAO Code
EU : European Union
FABEC : Functional Airspace Block Europe Central
FL : Flight Level
FOD : Foreign Objects Debris
ICAO : International Civil Aviation Organization
IFR : Instrument Flight Rules
ILS : Instrument Landing System
KPA : Key Performance Area
KPI : Key Performance Indicator
LVO : Low Visibility Operations
M/A : Missed Approach
MCT : Maximum Throughput Capacity
MVT: Mixed Volume Traffic
NM: Nautical Mile
NM: Network Manager (EUROCONTROL)
RAT : Risk Analysis Tool
RI : Runway Incursions
ROTA: Runway Occupancy Time for Arrival
RWY : Runway
SRO : Simultaneous Runway Occupancy
VFR : Visual Flight Rules

1. TRAFFIC

In this chapter, the traffic at Liège airport is presented, as recorded by the Airport Movement System (AMS) developed by skeyes.
The AMS records the movements at an aerodrome and within its Control Zone (CTR), which 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 (VFR and IFR, helicopters and airplanes, commercial or general aviation). As this report considers runway performance, movements such as crossings of CTRs are not considered. As such[1]*:*

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

[1] As per BCAA's aerodrome movement definition

Increasing traffic

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

- 2016: 39,369 (33,794 IFR; 5,575 VFR)
- 2017: 38,677 (33,509 IFR; 5,168 VFR)
- 2018: 41,771 (36,104 IFR; 5,667 VFR)
- 2019: 43,451 (36,370 IFR; 7,081 VRF).

The amount of movements continue to increase compared to the three previous years, especially due to VFR traffic, with a growth of 25% if compared to 2018.

The highest traffic in 2019 was observed in September, the third busiest month since 2016 with 3,946 movements. See Figure 1-1 and Table 1-1 for the details per month.

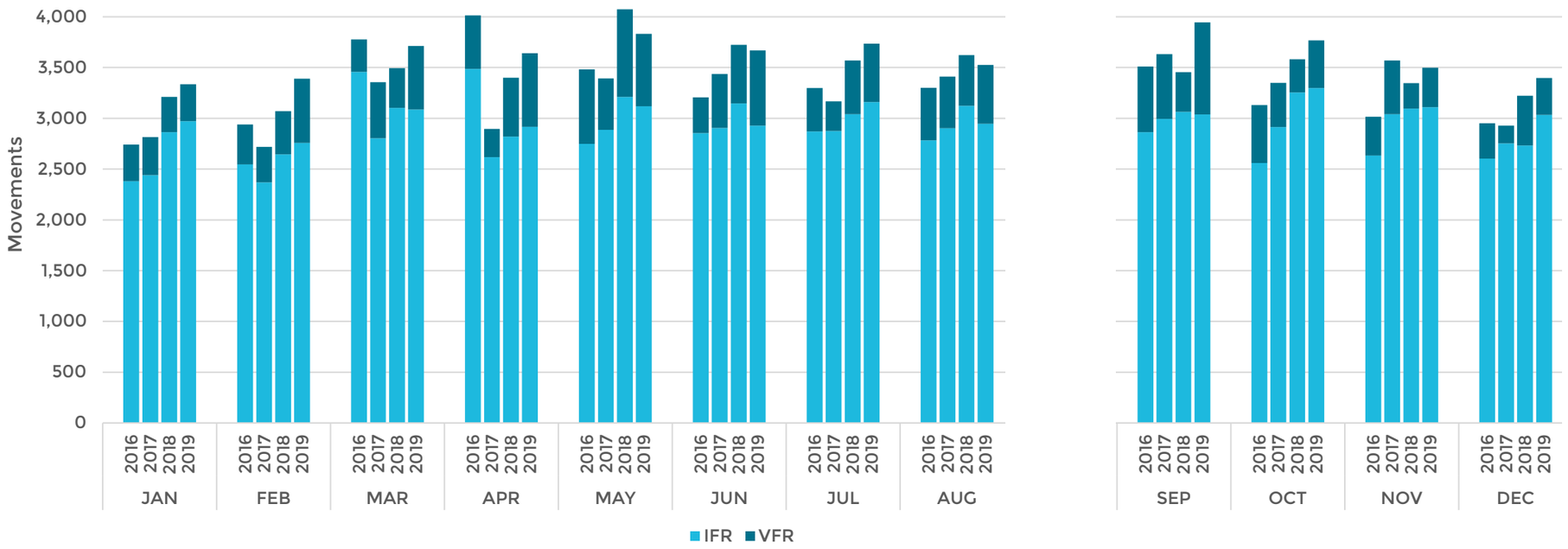


Figure 1-1: Total monthly movements per year

Table 1-1: Total monthly movements per year

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
IFR	**2016**	2,382	2,546	3,457	3,488	2,748	2,855	2,872	2,783	2,865	2,561	2,633	2,604	33,794
	2017	2,441	2,369	2,804	2,619	2,887	2,905	2,876	2,904	2,996	2,914	3,041	2,753	33,509
	2018	2,864	2,646	3,103	2,821	3,212	3,147	3,042	3,124	3,063	3,254	3,096	2,732	36,104
	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
VFR	**2016**	359	394	321	526	735	351	426	519	646	569	382	347	5,575
	2017	374	350	553	277	507	532	291	507	637	435	530	175	5,168
	2018	348	424	392	578	862	578	527	499	391	327	251	490	5,667
	2019	362	633	625	725	714	740	575	579	908	470	388	362	7,081
Total	**2016**	2,741	2,940	3,778	4,014	3,483	3,206	3,298	3,302	3,511	3,130	3,015	2,951	39,369
	2017	2,815	2,719	3,357	2,896	3,394	3,437	3,167	3,411	3,633	3,349	3,571	2,928	38,677
	2018	3,212	3,070	3,495	3,399	4,074	3,725	3,569	3,623	3,454	3,581	3,347	3,222	41,771
	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

Liège airport plays a major role in the needs of the European cargo market. Following the air traffic market segment rules (STATFOR/EUROCONTROL) it is possible to extract cargo flights based on the operator code, aircraft types, aircraft operators. Matching the traffic at Liège Airport with these criteria as a result clearly indicate that the majority of the IFR operations at Liège Airport in 2019 were cargo flights, with an 88% share. The other 12%, categorized “other”, consist in passenger, business, military and state flights. Traffic has increased slightly from 2018 to 2019 but the proportion of the cargo flights remains stable at 88%.

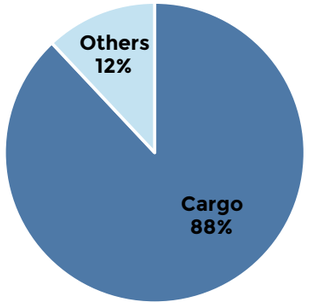


Figure 1-2: Share of cargo traffic in EBLG in 2019

Another way of describing traffic is to look at the number of arrivals and departures at an airport. Table 1-2 below shows the details for each year.

As the overall traffic in Liège airport increased in 2019, so did the arrival and departure rates.

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

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
ARR	**2016**	1,371	1,445	1,867	1,987	1,691	1,596	1,650	1,624	1,729	1,551	1,490	1,476	19,477
	2017	1,381	1,355	1,665	1,445	1,679	1,707	1,569	1,674	1,809	1,659	1,768	1,478	19,189
	2018	1,583	1,506	1,745	1,666	1,983	1,826	1,740	1,753	1,688	1,759	1,651	1,613	20,513
	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
DEP	**2016**	1,370	1,495	1,911	2,027	1,792	1,610	1,648	1,678	1,782	1,579	1,525	1,475	19,892
	2017	1,434	1,364	1,692	1,451	1,715	1,730	1,598	1,737	1,824	1,690	1,803	1,450	19,488
	2018	1,629	1,564	1,750	1,733	2,091	1,899	1,829	1,870	1,766	1,822	1,696	1,609	21,258
	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

Busy days

The ten busiest days of 2019 for Liège airport are depicted in Figure 1-3 below.

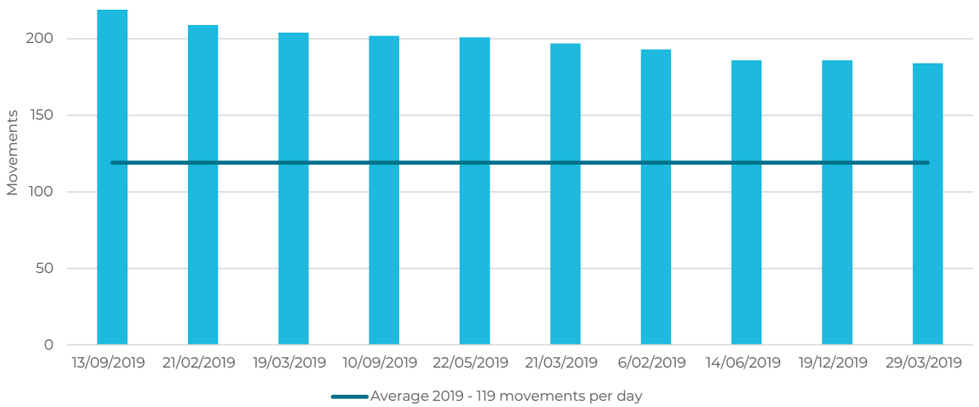


Figure 1-3: Ten days with highest amount of traffic in 2019

The most active days in 2019 were spread out during the year. The 13th of September saw the highest amount of traffic with 219 movements, while the average number in Liège airport in 2019 was 119 movements per day.

Figure 1-4 emphasizes the previous statement that traffic is increasing, as four out of the ten days with highest traffic of the past four years happened in 2019.

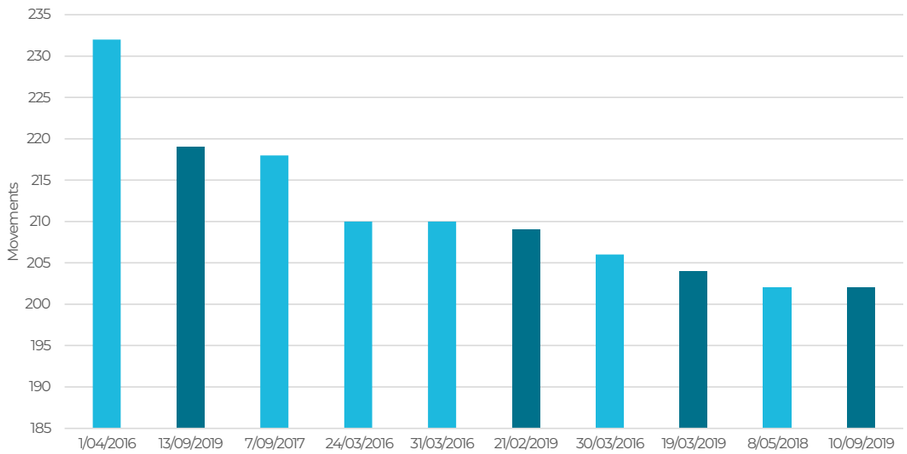


Figure 1-4: Ten days with highest amount of traffic since 2016

Quiet days

As shown in Figure 1-5 below, the most of low traffic days in 2019 were registered in January and February, the day with least traffic was the 13th of February with 14 movements, all arrivals. On that day, air traffic in Belgian airspace was restricted, due to a day of industrial action in the whole country. Air traffic services were halted for two hours.

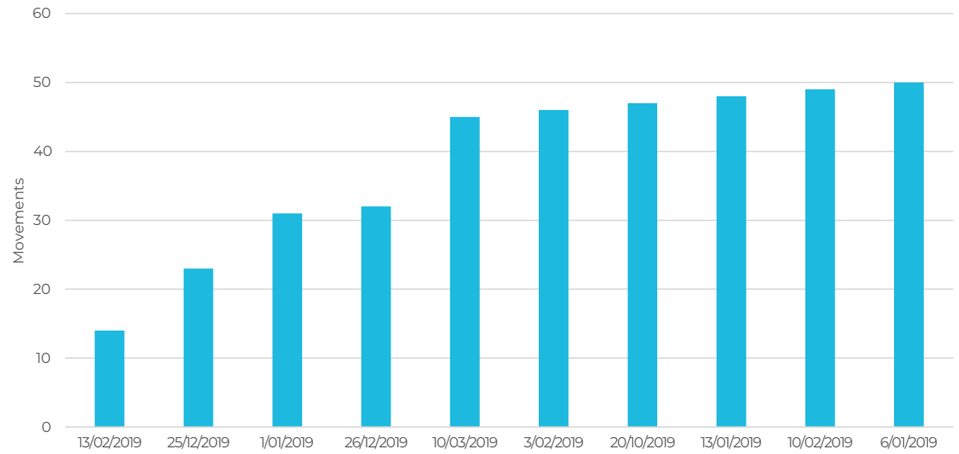


Figure 1-5: Ten days with lowest amount of traffic in 2019

Traffic patterns

Figure 1-6 shows the average IFR and VFR traffic throughout the hours of the day, in local time, over the period 2016 to 2019. While there are few VFR flights throughout the day, two peaks can be identified for IFR traffic. The first peak, at midnight, pictures the arrival wave of cargo flights and the second, at 04:00, shows the departures of those flights.

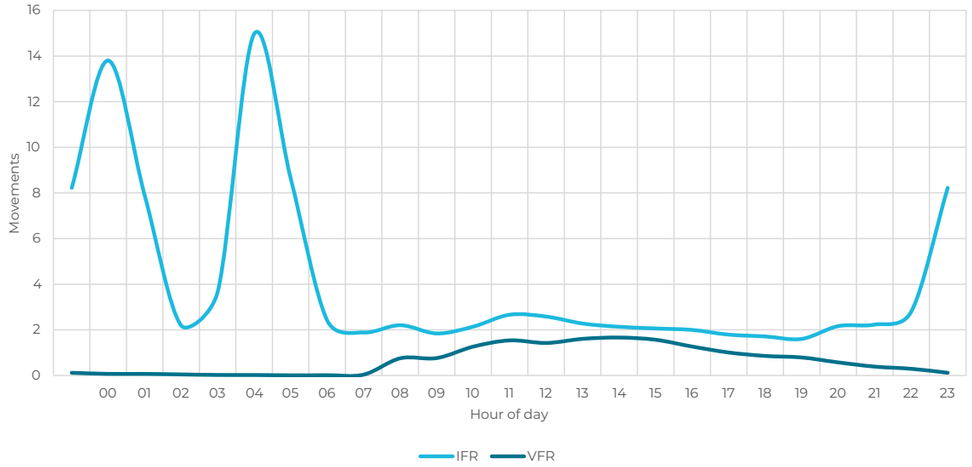


Figure 1-6: Average hourly IFR and VFR movements for the period 2016-2019 (local time)

The traffic pattern at Liège airport can also be decomposed depending on the days of the week, as shown in Figure 1-7. From Tuesday to Friday, the traffic is similar. These days are therefore grouped on the graph and the two peaks mentioned above can be identified. On Saturdays, the midnight peak still appears, but very few departures happen. Sunday is the day with the least traffic, with an average of less than five (5) movements per hour throughout the day. On Monday mornings, the aircraft that did not depart on Sunday take off continuously between 00:00 and 04:00. Around 23:00, traffic numbers rise again to reach the departure peaks of Tuesday nights.

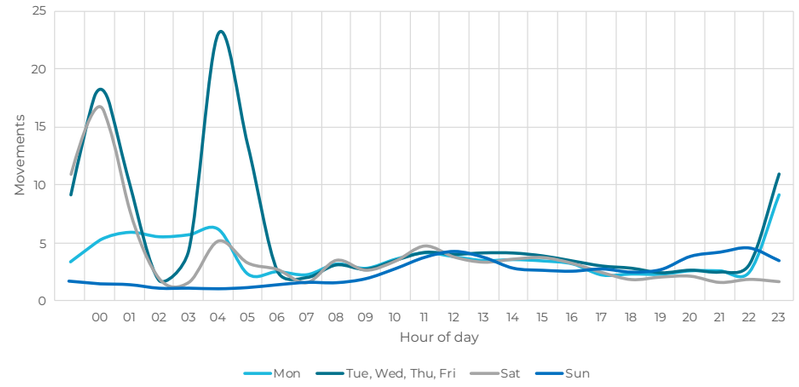


Figure 1-7: Average hourly movements per weekday for the period 2016-2019 (local time)

Runway use

The use of one runway configuration over another depends on several factors that have to be taken into account, which are presented in Chapter 4. Figure 1-8 shows the runway use in Liège since 2016. In 2019, runway 22R was less in use than in the previous years, which is balanced with a greater use of runway 22L.

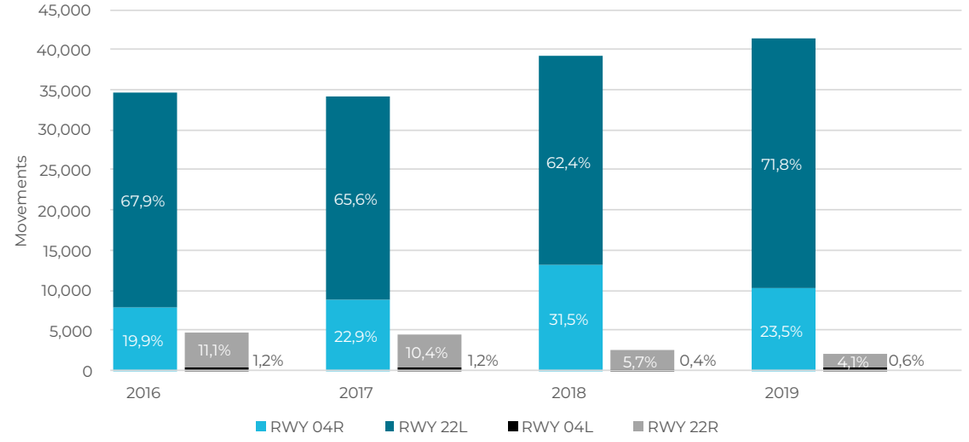
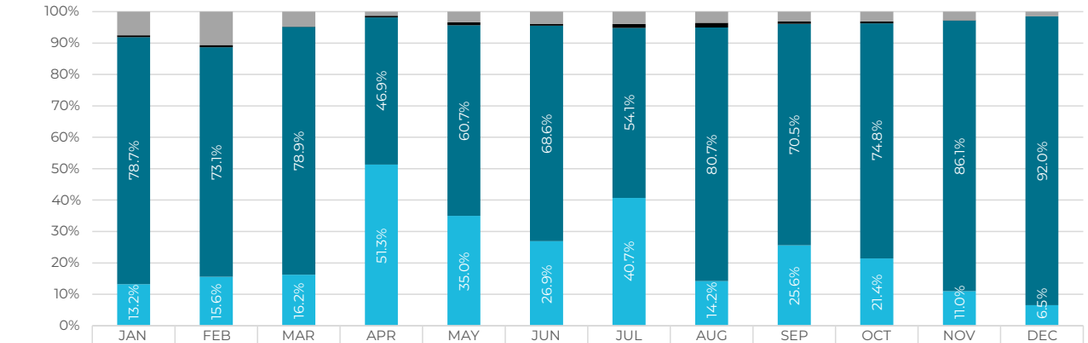


Figure 1-8: Runway use per year

Figure 1-9 below shows the runway use per month of 2019. Runway 22L is overall the most used runway. In April 2019, strong north-easterly winds were recorded, in Liège as in all of the Belgian airports, which explains the increased usage of runway 04R (see Figure 1-9).



	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
RWY 22R	252	361	177	47	130	142	148	126	125	116	96	52
RWY 04L	18	23	2	20	37	21	46	51	27	25	6	0
RWY 22L	2,624	2,479	2,930	1,706	2,326	2,518	2,021	2,847	2,783	2,819	3,012	3,124
RWY 04R	441	528	603	1,868	1,340	988	1,520	502	1,011	808	384	221

Figure 1-9: Runway use per month in 2019

2. SAFETY

This section discusses two topics: runway incursions and missed approaches. The runway incursions is a runway safety indicator which shows lagging and is mandatory to be reported. The missed approaches are not mandatory to report and are reported on a voluntary basis. As such the quality and accuracy of the available information is commensurate with the level of reporting.

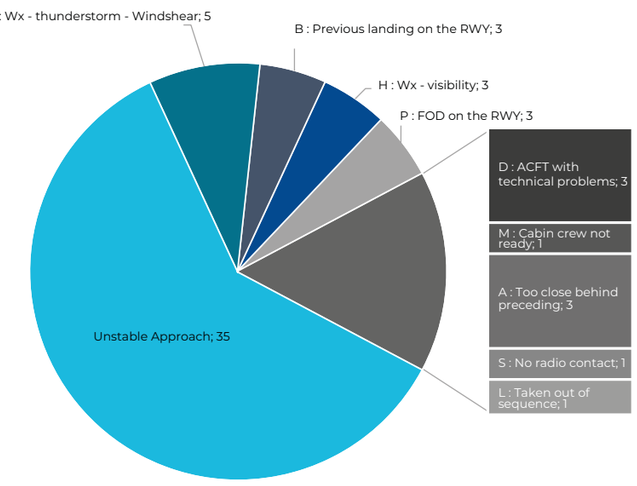
Missed approaches do not represent safety incidents. They are an operational solution allowing to maintain safety margins when the approach cannot be continued for a safe landing. At the same time, particularly during peak hours at busy airports, they also increase the traffic complexity and the residual safety risk.
One could argue that missed approaches are a hybrid leading indicator, and that by analysing the reasons leading to this type of procedure, we can examine if there are any systemic deficiencies in a technical equipment, in a procedure or in manner in which Air Traffic Control Officers (ATCOs) and/or pilots apply these procedures.

Missed Approaches

Missed approaches are performed according to published procedures, under the instructions of the air traffic controller or they are initiated by the pilot when the approach cannot be continued for a safe landing. Besides the discomfort for passengers and crew, the missed approaches increase the air traffic management complexity. The number of missed approaches and particularly their cause can therefore indicate which measures are to be taken to improve the safety of air navigation service provision. All missed approaches are recorded by cause of event, and the 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 four years for each runway in Liège airport (runways 04L, 04R, 22L, 22R). In 2019 there were 58 missed approaches. Figure 2-1 shows the number of missed approaches per cause. It is clear that weather conditions and unstable approaches are the main reasons accounting for 74.1% of the missed approaches at Liège airport.

Figure 2-1: Missed approaches 2019 per cause



The rate of missed approaches is compared over the period from 2016 until 2019 in Figure 2-2. The number of arrivals is provided by the AMS under the BCAA's aerodrome movement definition. Overall the rate of missed approaches decreased in 2019, see Figure 2-2, for runways 04R, 22L and 22R there is also a decrease in the rate. Runway 04L is rarely used (148 of 21,466 arrivals in Liège) such that even one missed approach will increase the rate significantly. In runway 22L there has been a decrease for the first time in the analysed years. For runways 04R and 22R the decrease seen in 2018 continued.

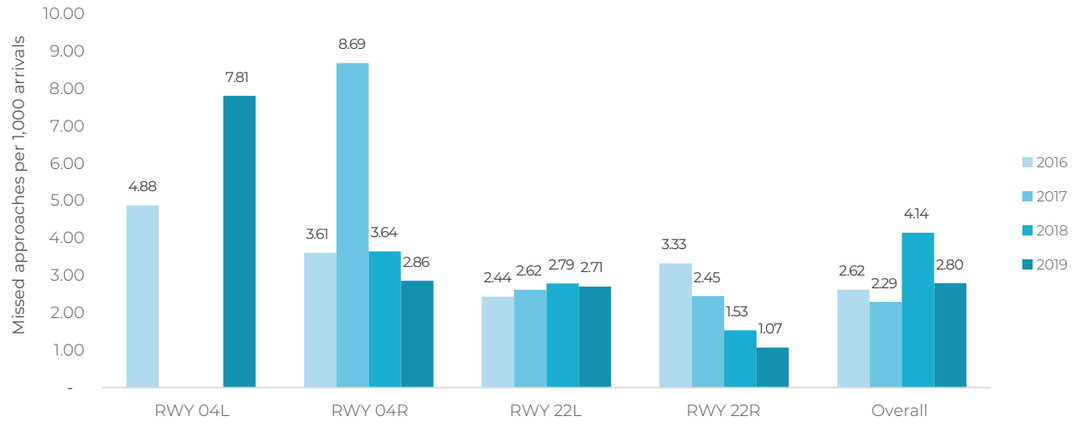


Figure 2-2: Rate of missed approaches per 1,000 arrivals, per year

Out of all the arrivals in Liège airport, the major part are night arrivals which means an arrival between 22:00 and 06:00 local time. Comparison between night and day arrivals is given in Figure 2-3. However, in order to make a meaningful comparison between the yearly number of missed approaches per runway, we need to look at the rate (see Figure 2-4).

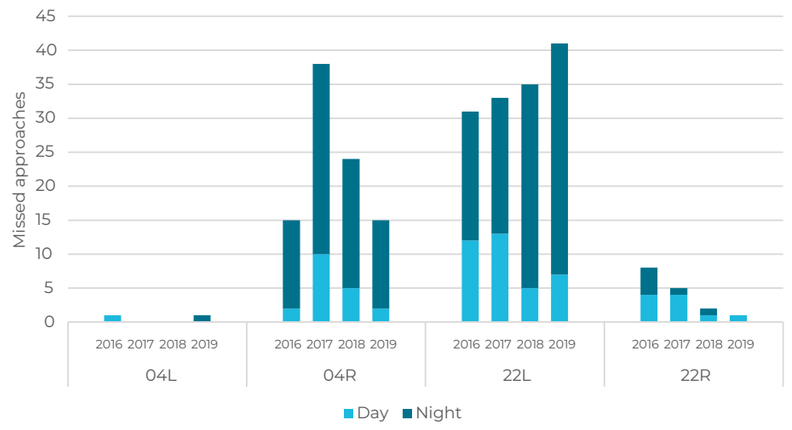


Figure 2-3: Missed approaches divided in day and night arrivals, per year

The rate of the missed approaches are almost in line with the absolute figures shown in Figure 2-3 for runways 04R and 22L. Runway 04L was only used once in 2019 and this arrival had a missed approach giving the large rate. A similar situation occurred for runway 22R in 2018, where only one missed approach was reported during the night but due to the number of arrivals (42 arrivals) this number is amplified.

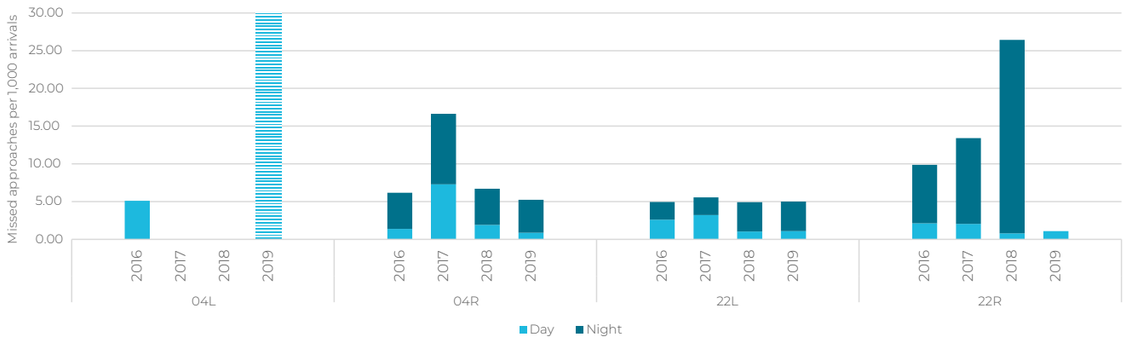


Figure 2-4: Rate of missed approaches with day and night separation, per year

Runway 04L

Due to the low amount of arrivals (less than 1% of the arrivals over four years), this runway had two (2) missed approaches between 2016 and 2019, one in 2016 caused by an unstable approach and one in 2019 caused by weather conditions (I: Wx – Thunderstorm – Windshear).

Runway 22R

In 2019, there was one (1) missed approach reported for this runway 22R, which was due to a foreign object debris (FOD) on the runway. This runway is not used very often for arrivals hence the low number of missed approaches.

Runway 22L

Table 2-1 shows the total missed approaches on runway 22L per year, the top five reasons in 2019 and the missed approaches caused by these five reasons. The frequency that these five reasons caused missed approaches in the previous 3 years is also shown, e.g. these reasons cover 77% of all reasons for missed approaches in 2018 and 79% in 2017.

A continuous increase of missed approaches is seen for this runway. The main reason in 2019 is Unstable approach. The large amount of missed approaches due to a previous landing on the runway in 2018 (due to aircraft missing the C2/C0 exit and having to backtrack in order to vacate) decreased in 2019.

	2016	2017	2018	2019
Total missed approaches	**31**	**33**	**35**	**41**
Unstable Approach	11	13	10	25
I : Wx - thunderstorm - Windshear	4	1	3	3
D : ACFT with technical problems	1	5	3	2
B : Previous landing on the RWY	1	3	11	2
H : Wx - visibility	6	4		2
part top 5 causes of 2019	74%	79%	77%	83%

Table 2-1: Causes of missed approaches on runway 22L, per year, top five causes in 2019

Runway 04R

The amount of missed approaches on runway 04R decreased for the second year in a row to 15 missed approaches in 2019. As in 2018, the missed approaches due to an unstable approach is the main cause. Table 2-2 shows the top five causes of missed approaches in 2019. The table also shows the number of missed approaches with these reasons in the years 2016 until 2018 and the percentage of the total missed approaches attributable to these causes.

The ILS CAT I on runway 04R was replaced in 2017 with one that is certified CAT III. The replacement caused a decrease of the number of missed approaches caused by low visibility conditions in 2018. This is also the case in 2019 as the number of missed approaches due to reduced visibility was low: from 11 missed approaches due to low visibility in 2017, there has only been one in 2018 and one in 2019.

	2016	2017	2018	2019
Total missed approaches	**15**	**38**	**24**	**15**
Unstable Approach	4	7	10	10
A : Too close behind preceding	2	2	2	1
I : Wx - thunderstorm - Windshear			1	1
B : Previous landing on the RWY	5	3	3	1
H : Wx - visibility	1	11	1	1
part top five causes of 2019	80%	61%	71%	93%

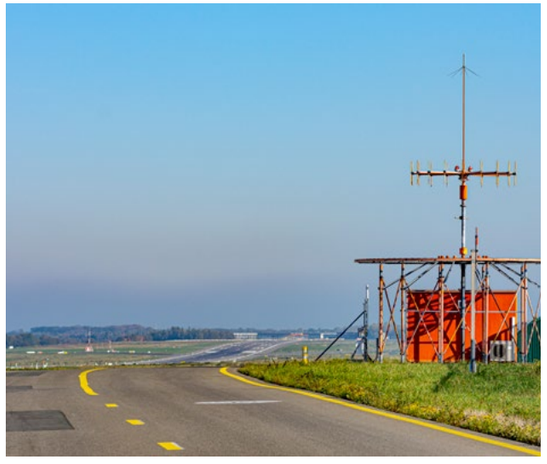
Table 2-2: Causes of missed approaches on runway 04R, per year, top five causes in 2019

Runway incursions

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

It should be noted that this ‘incorrect presence’ may be a consequence of a failure of a pilot or vehicle driver to comply with a valid ATC clearance or their compliance with an inappropriate ATC clearance.

Runway incursions are mandatory to be reported as per EU 2015/1018. Moreover, in accordance with EU 2019/317, all RIs need to be reported using the severity classification based on the Risk Analysis Tool (RAT).



According to this scheme, RIs are classified based on their severity in the following categories:

- A – Serious Incident, a collision was narrowly avoided
- B – Major Incident, separation decreases and there is a significant potential for collision, which may result in a time critical corrective or evasive response.
- C – Significant Incident, an incident characterized by ample time and/or distance to avoid a collision.
- D – Not Determined, an incident that meets the definition of runway incursion such as incorrect presence of a single vehicle/person/aircraft on the protected area of a surface designated for the landing and take-off of aircraft but with no immediate safety consequences.
- E – No Safety Effect
- N – No ATM contribution (i.e. no system, procedure or person involved in the provision of ATC services initiated or contributed to the incident).[2]

This indicator includes:

- The overall number of runway incursions;
- The overall number of runway incursions where skeyes had an ATM Ground contribution, classified according to the incident’s severity from A to E as described above;
- The overall number of movements in the corresponding period. The number of movements for this KPI is provided by the AMS under the BCAA’s aerodrome movement definition.

Increase in the rates of runway incursions

A monthly overview of the runway incursions in 2019 can be seen in Figure 2-5. The graph shows two runway incursions in March with no ATM contribution and one runway incursion in October which is categorised as E meaning no immediate safety consequence: an aircraft performed a touch-and-go without clearance. The runway incursions without ATM contribution were concerning the position of vehicles along the runway and a line-up on runway 04R without clearance.

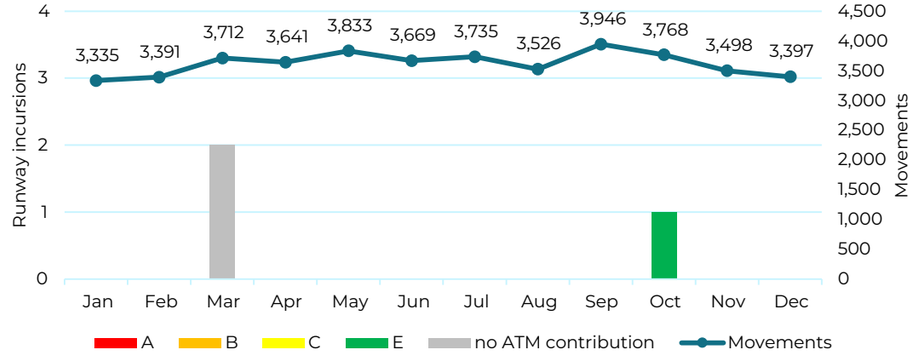


Figure 2-5: Runway incursions in 2019 per month, per category

Figure 2-6 gives a yearly overview of the runway incursions from 2016 until 2019. An increase is seen in runway incursions compared to 2018 from one (1) to three (3).

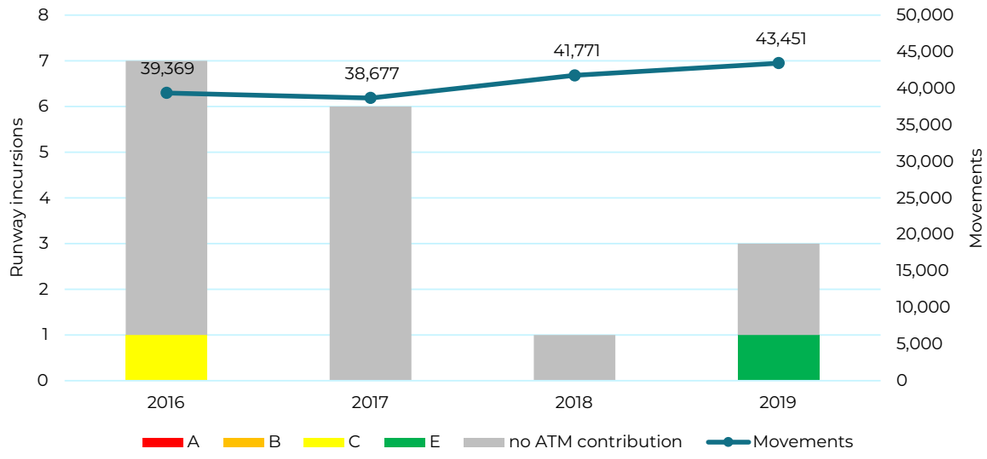
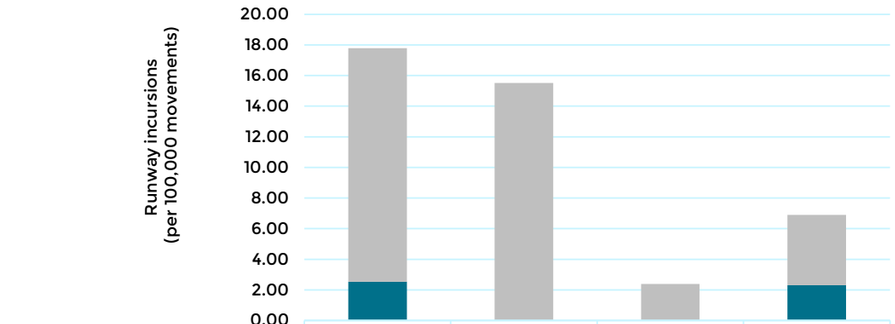


Figure 2-6: Runway incursions 2016-2019, per year, per category

A better way to compare is through the rate of runway incursions. Figure 2-7 shows the rate per 100,000 movements for Liège airport for the period from 2016 until 2019. The same trend is seen as in the graph showing the absolute figures (Figure 2-6).



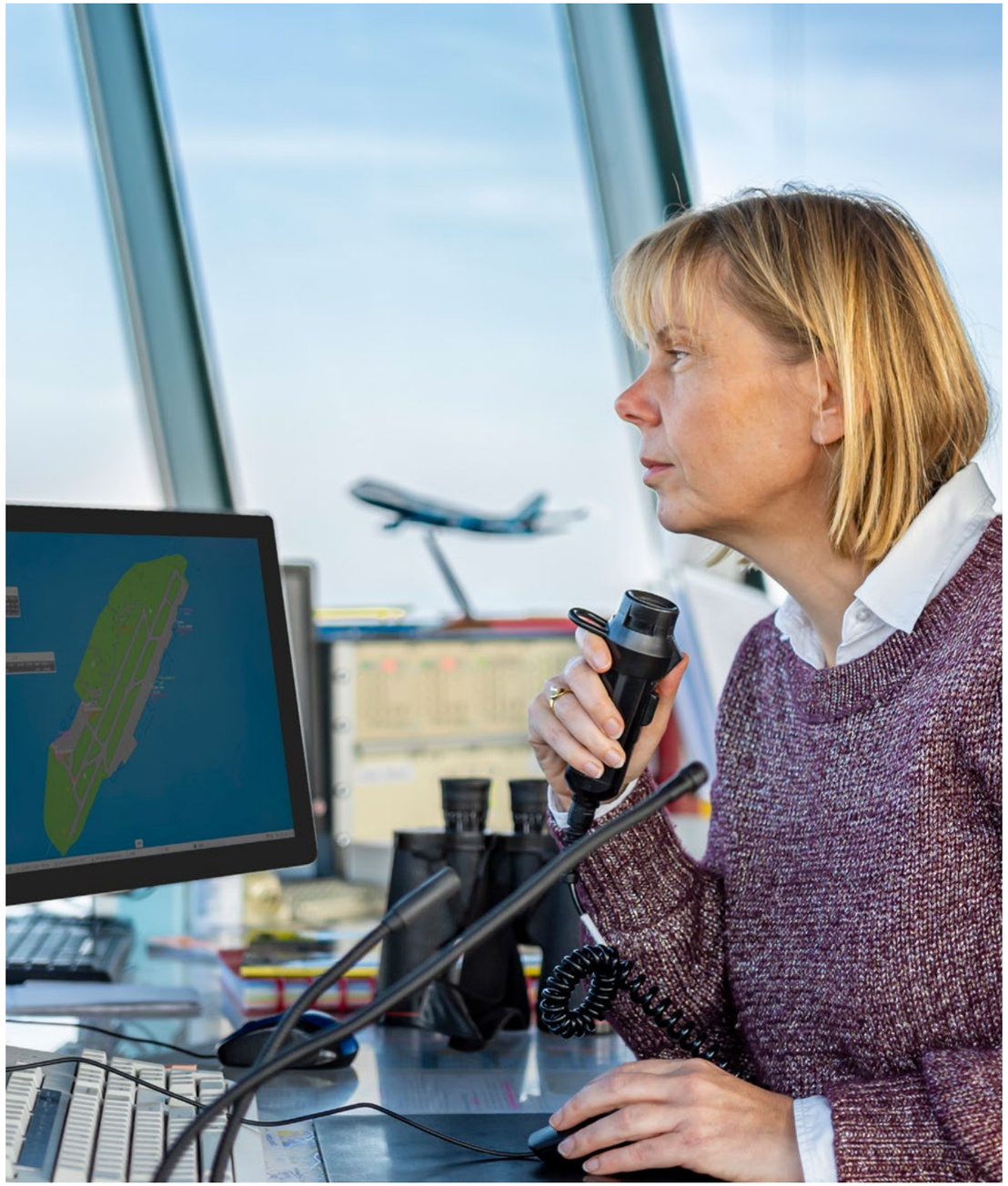
	2016	2017	2018	2019
no ATM contribution per 100,000	15.24	15.51	2.39	4.60
ATM contribution per 100,000	2.54	0.00	0.00	2.30

Figure 2-7: Rate of runway incursions per 100,000 movements, per year

Improvements and recommendations

skeyes is working on the implementation of the A-SMGCS system together with the airport. The A-SMGCS (Advanced-Surface Movement Guidance and Control System) is a radar monitoring tool which, in poor visibility on the airfield, provides air traffic controllers the means to control and guide aircraft and ground vehicles. In conditions of reduced visibility, this technology will make it possible to optimize the capacities while guaranteeing an optimal level of safety. This is expected to have a positive impact also on the probability to have runway incursions, as it represents a safety net, increasing the controllers' situational awareness regarding every target on the movement surface. The A-SMGCS has been installed and is awaiting Site Acceptance and operational validation by the provider. It is expected to become operational at the end of 2020[2].

The upgrade of the ILS on runway 04 from CAT I to CAT III in 2017 has already shown clear benefits by reducing the rate of missed approaches on that runway: from 11 missed approaches due to low visibility in 2017, there has only been one in 2018 and one in 2019.

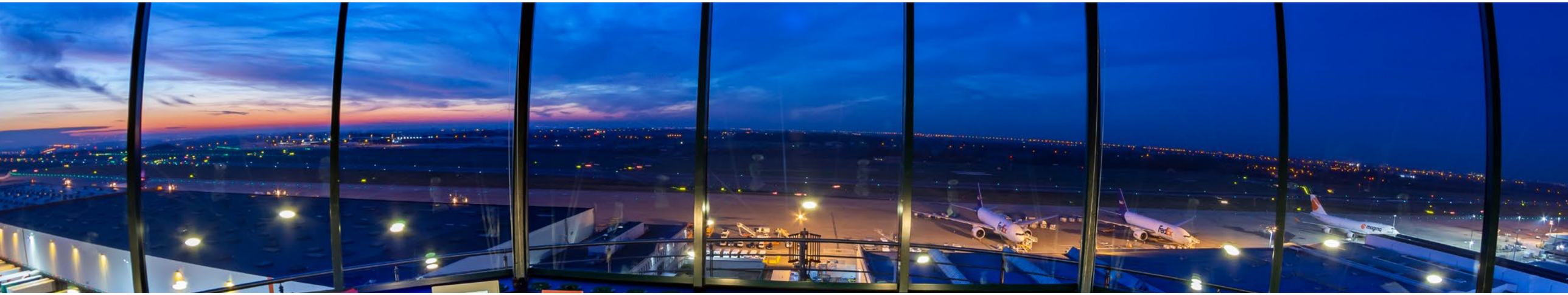


[2] Due to the difficulties in travelling caused by the Covid19 pandemic, the tests planned in March 2020 have been delayed until further notice.

3. CAPACITY & PUNCTUALITY

This chapter is divided into two sections. In the first part, the airport capacity is addressed. The declared capacities for runways 04 and 22 are given and analysed, taking as reference the number of movements during peak hours in the busiest month.

In the second section, the punctuality (arrival delay) at EBLG is studied. An overview of the targets and assumptions are given, and arrival delays are analysed. The delay is also analysed from the airport's point of view, i.e. considering the impact caused by regulations not only at EBLG, but also in the Belgian en-route airspace and by other Air Navigation Service Providers (ANSPs).



Airport Capacity

A performance indicator for airports is the throughput capacity and its utilisation.
The throughput capacity of an airport is influenced by several factors, e.g. airport layout, weather, fleet mix, ATC procedures, etc.

To better understand the following section, some definitions are given first:

Capacity

Aerodrome capacity is the estimated number of total operations that a given aerodrome configuration can handle in a given period of time and under a given set of assumptions, which are fleet mix, separation minima rules, weather conditions and technological aids.

Maximum Throughput (or Saturation) Capacity

Maximum Throughput Capacity (MCT) is the fundamental measure of the runway system's capacity. MCT defines the average number of movements (arrivals and/or departures) that can be performed on the runway system in one hour.
The following assumptions are made:

- there is a continuous supply of arrivals and/or departures.
- Air Traffic Control rule - no Simultaneous Runway Occupancy (SRO).
- Air Traffic Control rule - safe Wake Vortex Separation Distances between two flights.
- Static fleet mix (i.e. types of aircraft do not change).
- Approach and departure procedures do not change.

As a consequence, MCT is a theoretic measure of runway capacity and is represented as an average capacity for the runway system.

Declared Capacity

Declared capacity is the capacity per hour used to determine the number of slots available for schedule coordination purposes.

For the declared capacity of 2019, the figures of 2018 were taken, as the assumptions and conditions did not change.

For Liège airport, the declared capacities for each runway threshold have been calculated as being 90% of the theoretical MCT. For the calculations of the MCT, on top of the above-mentioned assumptions, the following was considered:

- The fleet mix of the busiest month in 2018 is taken as reference. 30% were in the heavy weight category .
- A nominal radar separation of 3NM is taken into account.
- A loss factor of 15% is considered for inter arrival times.
- The average runway occupancy time for arrival (ROTA) is based on measurements.
- The average approach speed is 136 knots (based on an analysis of the aircrafts characteristics operating into EBLG).
- The average headwind differs per runway.
- The inter departure time is a function of the between T/O-clearance delivery and the aircraft reaching a given altitude.

Table 3-1 shows the declared capacities depending on the runway configurations at Liège airport. Only IFR traffic has been considered in the calculations, the declared capacity will therefore be referred to “declared IFR capacity”.

Table 3-1: Declared IFR capacity

Runway configuration	Runway		Declared Capacity		
	DEP	ARR	DEP	ARR	MVT
RW22	22	22	28	28	34
RW04	04	04	28	28	35

Details for the month of September, busiest month of the year, are presented below. In fact, Figure 3-1 shows the number of arrivals and departures, along with the runway configuration and the resulting declared IFR capacity for the peak hour of each day of the month. A peak hour is determined on a 15 minutes floating basis.

The overview of the year can be found monthly in Annex 1.

September

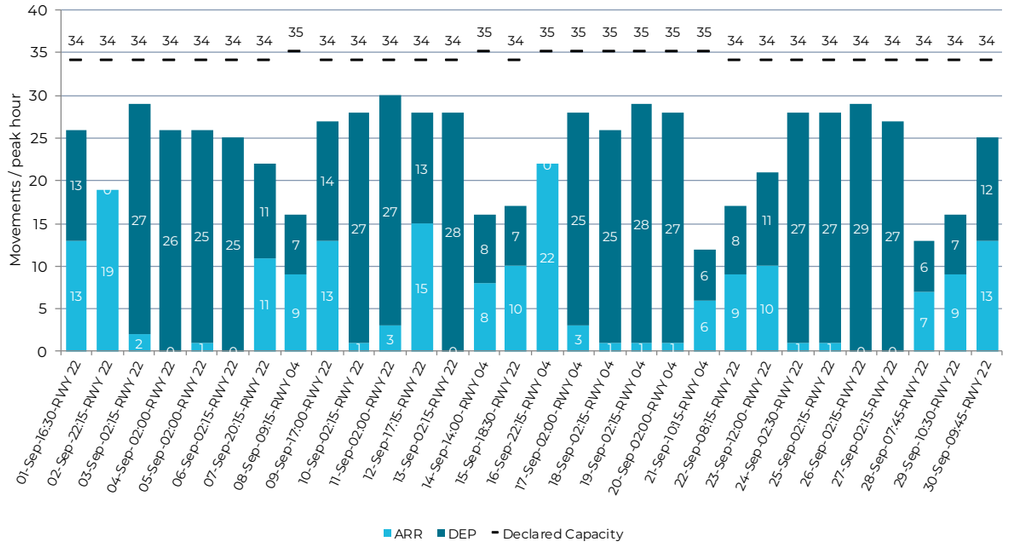


Figure 3-1: Arrivals, departures and declared capacities during peak hours in September 2019

The most traffic per peak hour happened on the 28th of March, with 33 movements. Because of the reduction of separation from 5 to 3NM in the EBLG TMA, the declared capacity of arrivals has increased in 2018 for both runways at Liège. However, the declared IFR capacity has never been reached in 2019, meaning there is still slack IFR capacity. On average, the traffic at peak hours was 12.9 movements below the declared IFR capacity.

Punctuality

Punctuality can be seen as a service quality indicator from a passenger perspective. This section observes one of the factors that influences the punctuality: ATFM (Air Traffic Flow Management) delay. ATFM delay is defined as the time difference between estimated take-off time (ETOT) and calculated take-off time (CTOT) of the NM (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)
- O - Other
- P - Special Event
- R – ATC Routeing
- S – ATC Staffing
- T - Equipment (ATC)
- V – Environmental Issues
- W - Weather
- NA - Not Specified.

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 is about the regulated traffic at Liège airport where the first part considers the key performance indicator: arrival delay, the delay of a flight due to a regulation placed by the airport of arrival. In addition, this section gives an overview of the influence of ATFM measures on departing traffic followed by an overview of the influence of ATFM measures on arriving traffic.

Airport arrival ATFM delay per flight

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 an airport. The target is defined as the average arrival delay per flight, as defined in the FABEC Performance Plan, §3.1. (C). (ii), which is in accordance with the European Performance Regulation (EU) No 390/2013, Annex 1, Part 2, §3.1 (b).

Targets are on a national level and on an airport level. The national target is the aggregation of the airport targets and is the target is 0.10 minutes/flight for 2016 until 2019. On an airport level, targets are set for Brussels airport and Liège airport. The target for Liège airport on CRSTMP arrival delay is 0.06 minutes/flight for the years 2016 until 2019.

For this performance indicator, a comparison is made over the last four year. Table 3-2 gives the amount of arrival delays in Liège airport and the total number of arrivals per year. Note that the number of arrivals in this part and the arrival delay for each flight is calculated by NM and has been provided by the Performance Review Unit (PRU / EUROCONTROL)[3] . In 2019, a total of 1,556 minutes of arrival delay at EBLG were registered. Weather, as in 2018, is the main reason for the regulations that caused delay for arriving aircraft.

Table 3-2: Number of arrivals and arrival delay at Liège airport for 2016-2019, per year, per cause

Year	# Arrivals	Arrival delay (minutes)			
		CRSTMP	Weather	Other categories	Total
2016	16,376	3,081	2,300	0	5,381
2017	16,234	281	2,232	0	2,513
2018	17,265	0	1,570	152	1,722
2019	17,444	439	1,117	0	1,556

As mentioned before, the key performance indicator (KPI) is the average arrival delay (per arrival) at the airport. Figure 3-2 gives the data for Liège airport for the years 2016 until 2019.

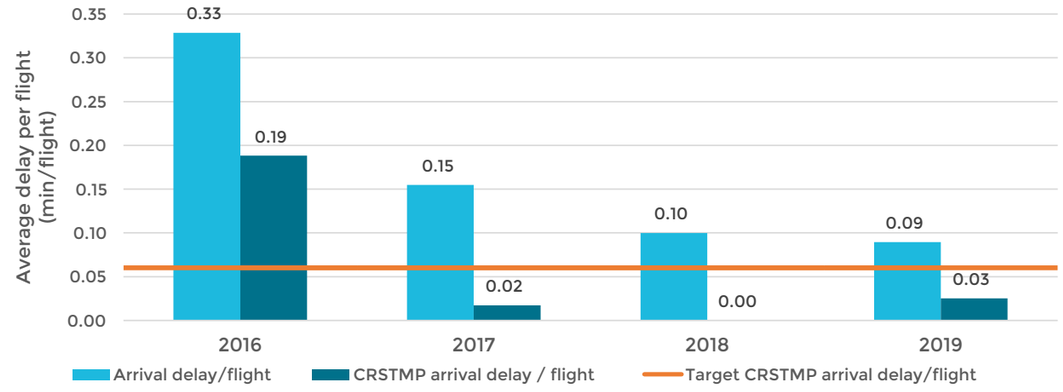


Figure 3-2: Arrival delay KPI at Liège airport for 2016-2019, per year

The figure shows that only in 2016 the target was not met for the CRSTMP arrival delay. In 2019, there was arrival delay with ANSP contribution but this was below the target set for the airport.

Also, the national target (for Belgium, this is the aggregated arrival delay per flight of Brussels airport and Liège airport) was met in 2019. The average arrival delay on a national level was 0.06 minutes per flight.

[3] Hence the difference with figures in chapter 1, where movements are counted using the AMS and the BCAA criteria. NM only account for flights with a registered flight plan.

Measures taken by skeyes to reduce weather delay

In the last two years, most of the delay happened due to weather, as shown in Table 3-2 above. Low visibility, including mist and fog, was almost the only reason for weather regulations in the last four years. The planned installation of an A-SMGCS system will allow further optimisation of procedures during low visibility conditions as it will provide an aid to ATCOs to handle safely a greater amount of movements in those conditions. This will have a positive impact on capacity and thereby reduce delay. The A-SMGCS is planned to become operational at the end of 2020.

All ATFM delay affecting departures

Flights departing from an airport can be delayed by ATFM measures in any of the sectors they cross on their route. In 2019, 2,457 departing flights from Liège airport were regulated resulting in a total of 45,519 minutes of delay. 39.5% (17,999 minutes) of that delay is attributable to skeyes while 60.5% (27,520 minutes) is attributable to other ANSPs. Figure 3-3 shows the ATFM delay attributable to skeyes and other ANSPs.

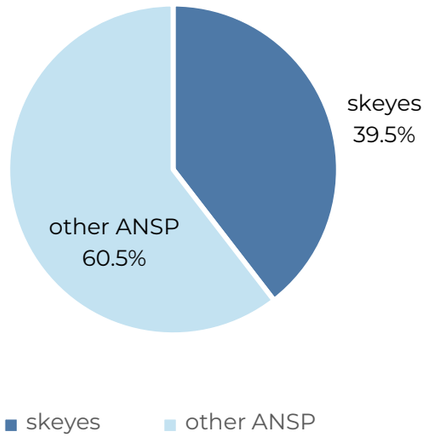


Figure 3-3: ATFM delay for departing flights attributable to skeyes and other ANSPs

To give a view of the severity of the impact, the delayed flights can be categorised based on the length of the delay (Figure 3-4). There are four categories:

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

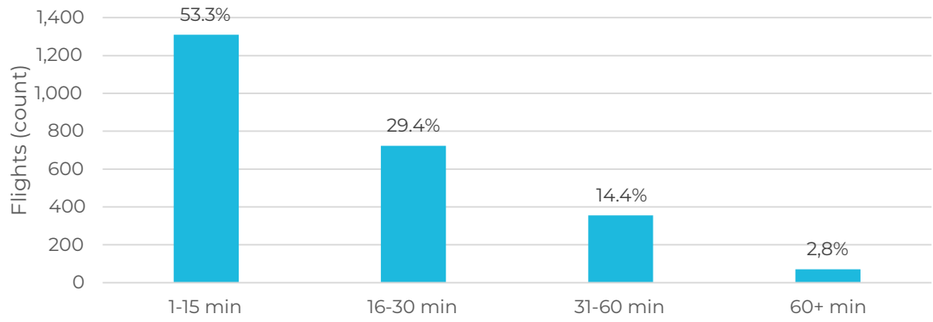
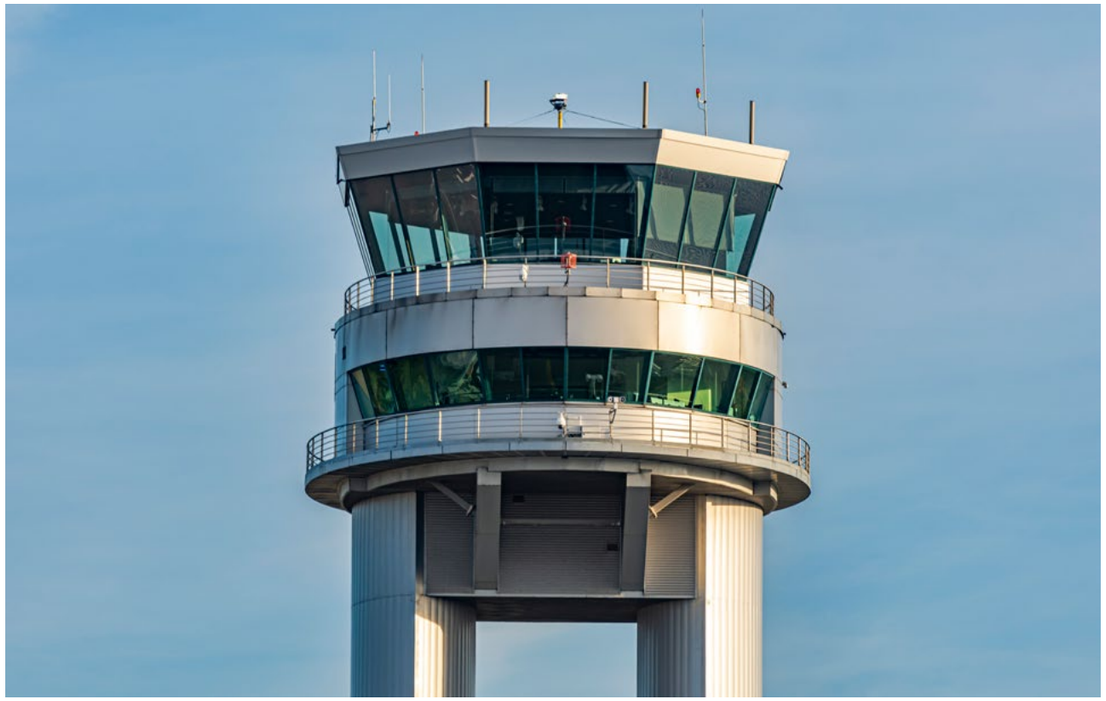


Figure 3-4: Delayed departing flights per category

The graph in Figure 3-4 shows that the majority of the delayed flights had a delay that did not exceed 15 minutes. 82.7% of the delayed flights had a delay of maximum 30 minutes.



All ATFM delay affecting arrivals

Flights arriving to an airport can be, just like departing flights, delayed by ATFM measures in ATC sectors on the flight plan (en-route delays) and arrival delays which are caused by ATFM measures at the airport of arrival. This part observes the delay of arriving traffic at Liège airport.

In 2019, 2,658 flights with destination Liège airport were regulated and experienced a total of 29,037 minutes of delay. 37.2% (10,794 minutes) of that delay is attributable to skeyes while 62.8% (18,243 minutes) is attributable to ATFM measures by other ANSP. This is illustrated in Figure 3-5.

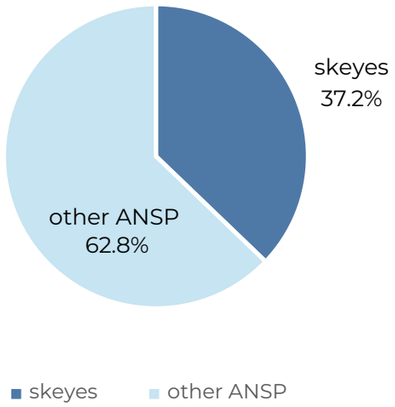


Figure 3-5: ATFM delay for arriving flights attributable to skeyes and other ANSPs

As for the departures, delayed arrival flights can be categorised based on the length of the delay, considering four categories:

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

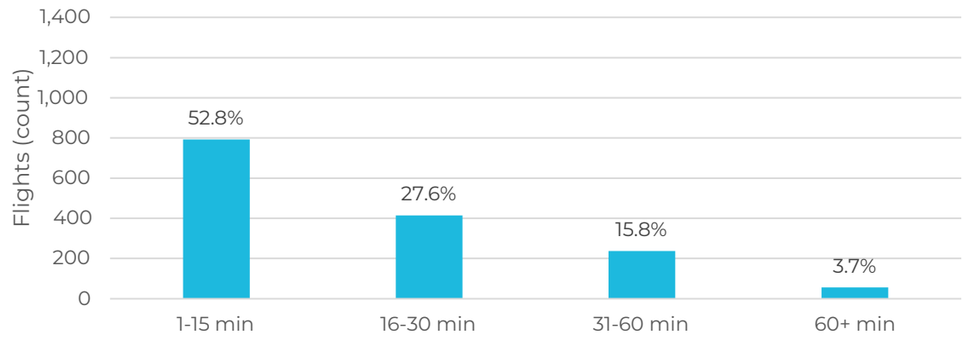


Figure 3-6: Delayed arriving flights per category

Based on the graph in Figure 3-6, the majority of the delayed flights have a delay that does not exceed 15 minutes,

80.4% had a delay of maximum 30 minutes and 96.3% had a delay that was not more than one hour.

Measures taken by skeyes to limit the impact of service disruption

In 2019, on several occasions a disruption of the provision of ATS at Brussels ACC resulted in zero-rates which impacted traffic at EBLG. A zero-rate means that the traffic in that sector is regulated as such that a rate of zero flights per hour is applied. The zero-rates mainly occurred in March and April and during the night, which causes an impact on Liège cargo traffic.

To ensure the continuity of skeyes services to the maximum extent possible in the case of outage of Brussels ACC, a service continuity procedure has been established. During this procedure, Liège APP provides ATS in an airspace delegated from Brussels ACC. Liège APP will function in isolated mode and will coordinate with and handover traffic directly with Langen ACC. The Liège business continuity procedure was implemented with the signing of the letter of agreement between skeyes and the German ANSP DFS on the 12th of April 2019. This procedure was activated on the 18th, 21st and 25th April and on the 21st of June for three (3) hours each night so that traffic at EBLG could arrive and depart (six (6) movements per hour) despite the zero rate in East sectors (12 hours in total). Further, a procedure allowing for service provision when teams are incomplete for unforeseeable reasons has been implemented at Brussels ACC. Under certain well established conditions, a sector can be manned by one ATCO instead of two for a limited time. The so called Single Person Sector operations have been in place since the 8th of October 2019 and have avoided service interruptions.

4. ENVIRONMENT

One of the factors influencing noise around the airport are the landing procedures. Continuous descent operations (CDO), also called green landings, are monitored in this chapter. An overview of predominant winds is also provided, as wind is a leading factor in the choice of runway use.

Continuous Descent Operations (CDO)

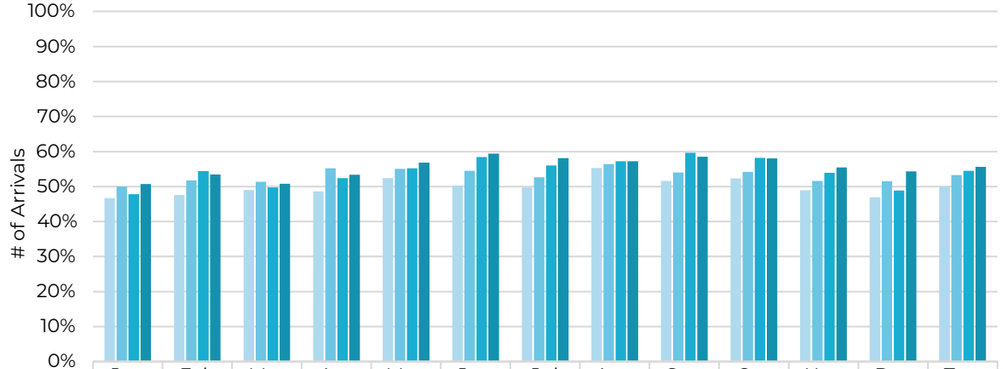
A CDO is an aircraft operating technique in which an arriving aircraft descends from an optimal position with minimum thrust and avoids level flight to the extent permitted by the safe operation of the aircraft and compliance with published procedures and ATC instructions. By doing so, the aircraft will use less fuel and produce less noise. Based on the recommendations made by EUROCONTROL, two CDO performance indicators were developed in 2016:

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

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 descend of less than 300 feet/minute.

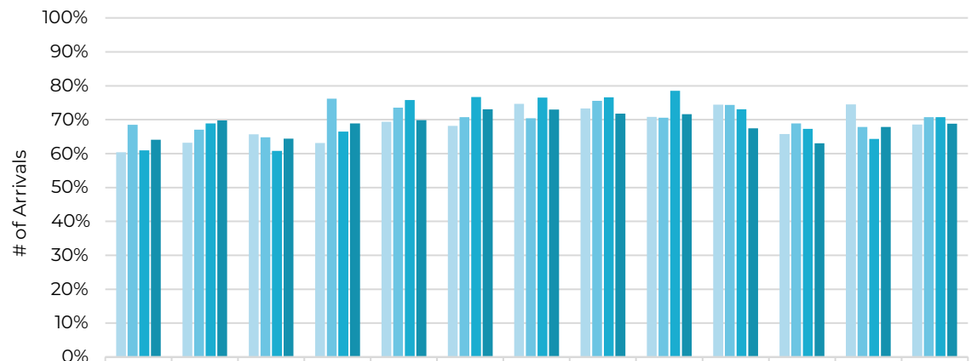
CDOs Fuel increasing

Figure 4-1 and Figure 4-2 show the monthly evolution (in percentage of flights) of CDO fuel and noise occurrences[4], respectively, in Liège airport.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot.
CDO Fuel 2016	47%	48%	49%	49%	52%	50%	50%	55%	52%	52%	49%	47%	50%
CDO Fuel 2017	50%	52%	51%	55%	55%	55%	53%	56%	54%	54%	52%	52%	53%
CDO Fuel 2018	48%	54%	50%	52%	55%	58%	56%	57%	60%	58%	54%	49%	54%
CDO Fuel 2019	51%	53%	51%	53%	57%	59%	58%	57%	59%	58%	55%	54%	56%

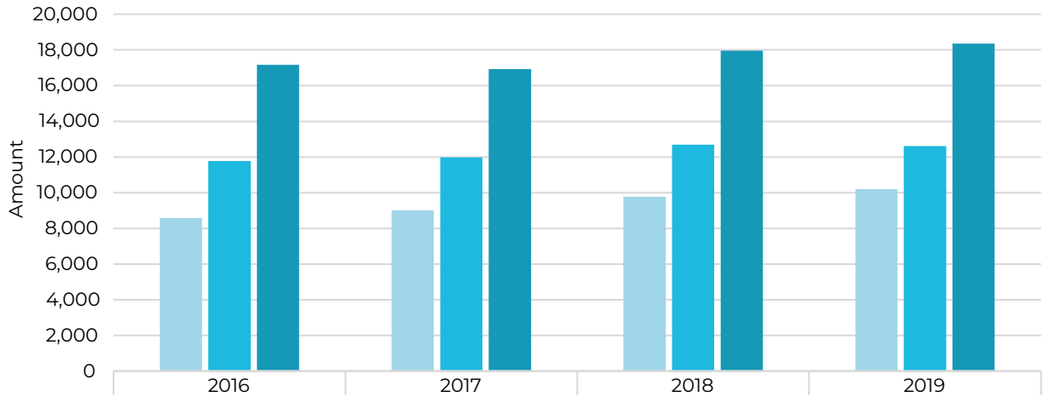
Figure 4-1: CDO Fuel usage



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Tot.
CDO Noise 2016	60%	63%	66%	63%	69%	68%	75%	73%	71%	74%	66%	75%	69%
CDO Noise 2017	69%	67%	65%	76%	74%	71%	70%	76%	71%	74%	69%	68%	71%
CDO Noise 2018	61%	69%	61%	67%	76%	77%	77%	77%	79%	73%	67%	64%	71%
CDO Noise 2019	64%	70%	64%	69%	70%	73%	73%	72%	72%	67%	63%	68%	69%

Figure 4-2: CDO Noise usage

The total of CDOs per year can be observed in Figure 4-3, together with the arrivals considered in the analysis. Note that helicopters and Touch and Go flights are not counted in the arrivals for the calculation of the CDO indicator[5]. Missed approaches are also excluded.



	2016	2017	2018	2019
CDO Fuel	8,584	9,015	9,779	10,204
CDO Noise	11,774	11,982	12,699	12,621
Arrivals	17,170	16,927	17,958	18,348

Figure 4-3: Total CDO Fuel and Noise per year

[4] Values from 2016 and 2017 were corrected from previous year report, following a typo error.

[5] Hence the difference with figures in chapter 1, where touch-and-gos and helicopter arrivals are counted using the AMS and the BCAA criteria. For CDO analysis those are excluded.

The ratio of CDOs flown in Liège show an increase tendency of CDO Fuel but a small decrease of CDO Noise. However, these values have not varied significantly over the past four few years (2016-2019). Also, these results indicate that the level off ratio between FL100 and FL60 increased, but between FL60 and 3000ft the ratio decreased.

Figure 4-4 shows the evolution of the CDOs per runway compared to previous years. It confirms the increasing tendency of CDO Fuel and decrease of CDO Noise per runway.

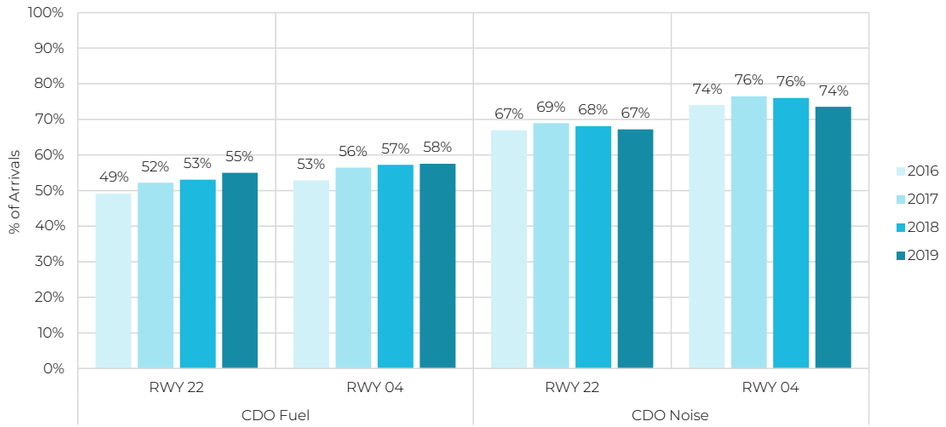


Figure 4-4: Total CDO Fuel and Noise per runway

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

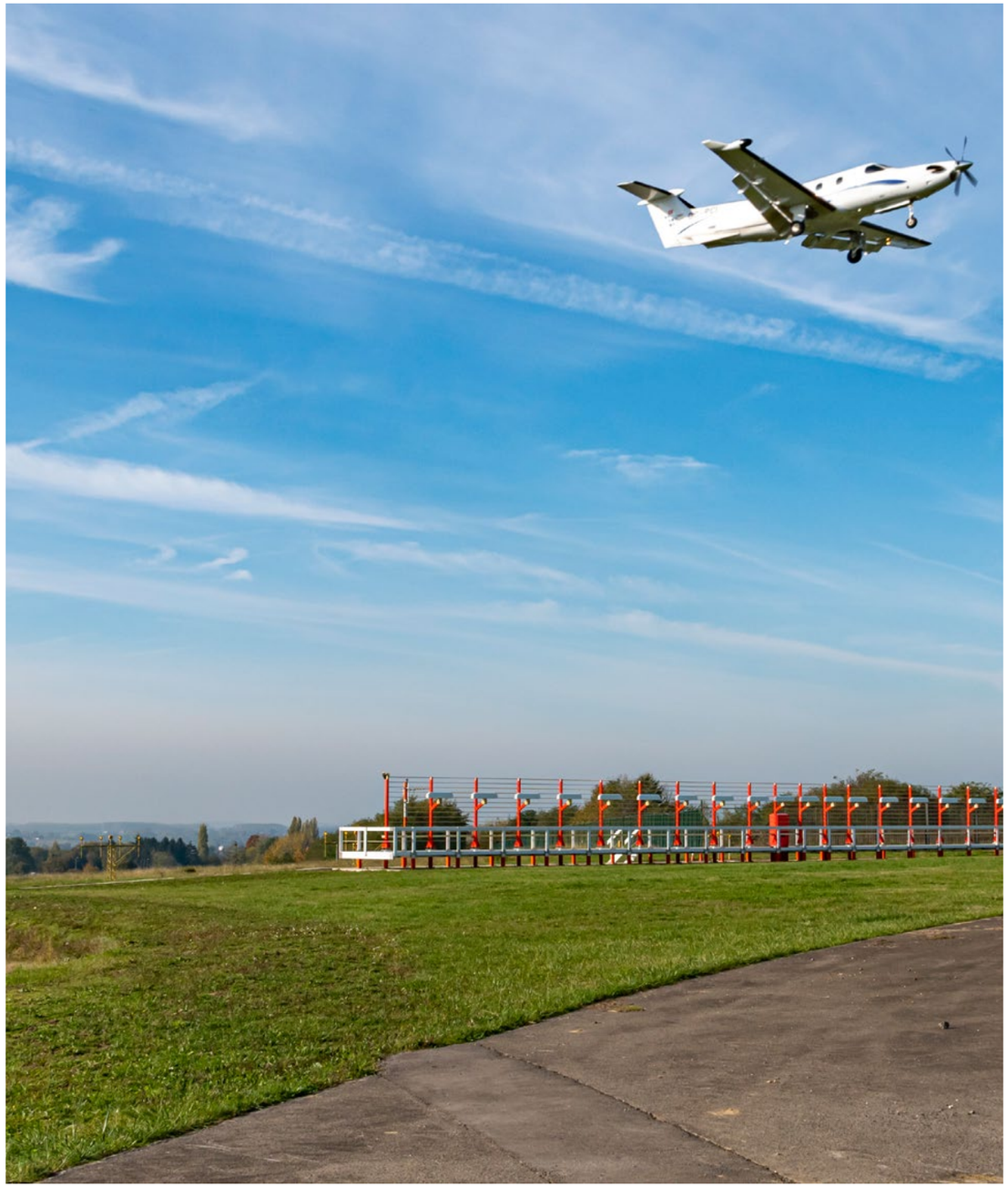
- Pilot CDO flying experience
- Pilot experience with specific airport
- ATC experience
- Runway usage (equipment)
- Aircraft type/equipment
- Mil airspace open/closed
- Traffic flows
- “Impact” of other traffic streams on arriving traffic.

As a result, it is difficult to explain an increase or decrease from one year to the next, especially when such small variations are observed.

Improvement measures and activities

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

- skeyes is in contact with airlines presenting CDO statistics and communicating the phraseology;
- skeyes is increasing awareness amongst ATCOs through courses, and by informing them of the current statistics and performance;
- Setting up a working group (ATCOs and pilots) to identify, analyse and implement operational improvements is planned for 2020.
- Similarly to what was successfully set up in 2018 in Brussels, skeyes is promoting the implementation of an agreement on ‘collaborative environmental management’ (CEM) to increase cooperation with airlines and the airport on undertaking joint initiatives that further reduce the environmental impact of airport operations.



South westerly winds increased in 2019

The wind pattern of 2019 shows clearly an increase in the frequency of winds coming from the south west and a reduction in north easterly winds. This explains the steady increase in movements on RWY 22L, in comparison with RWY 04R (see Figure 1-8).

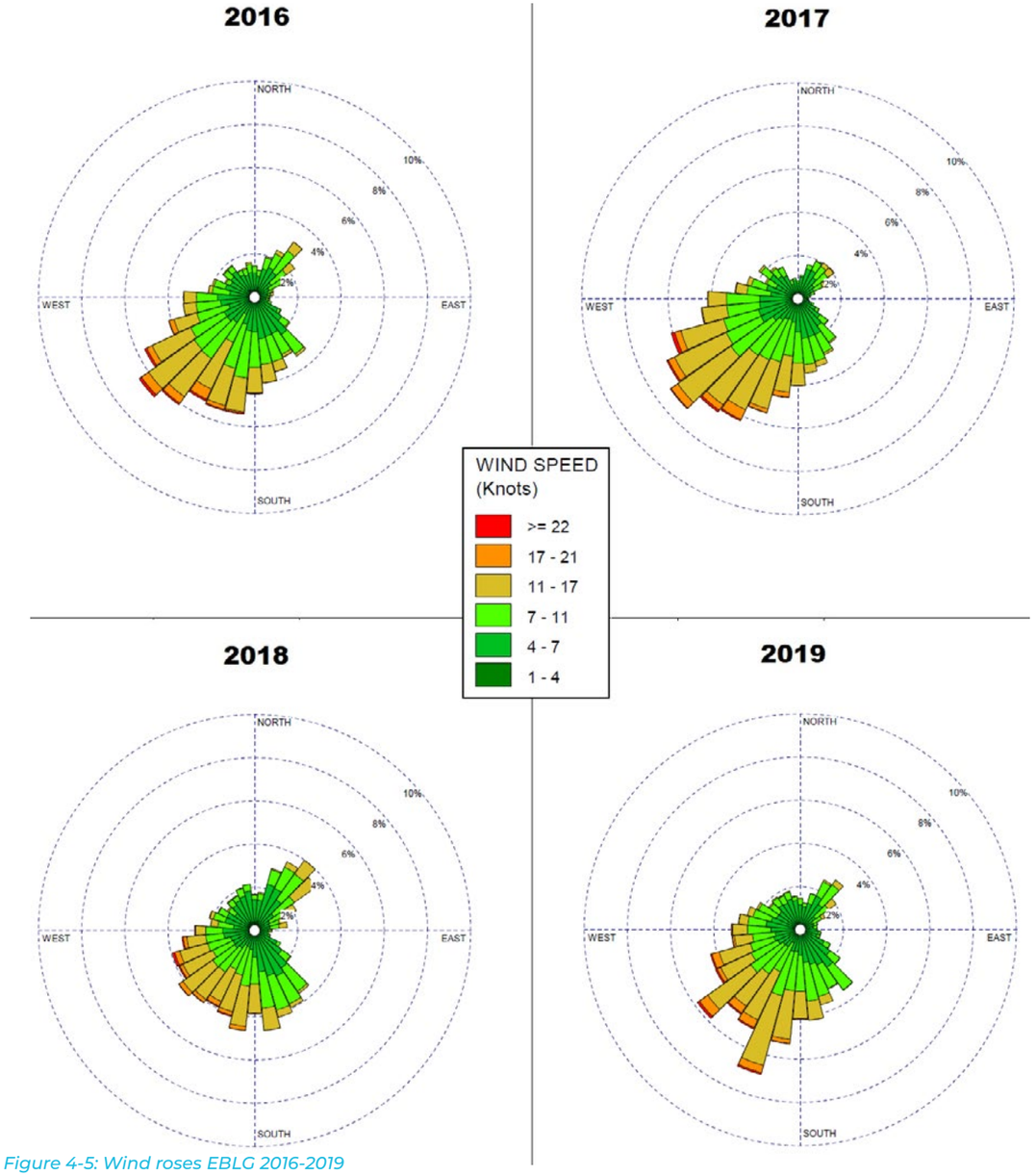


Figure 4-5: Wind roses EBLG 2016-2019

However, the exception was the month of April, when RWY 04R was the most used. That is explained due to the change in wind direction, which came exceptionally from north east in that month (see Figure 4-6).

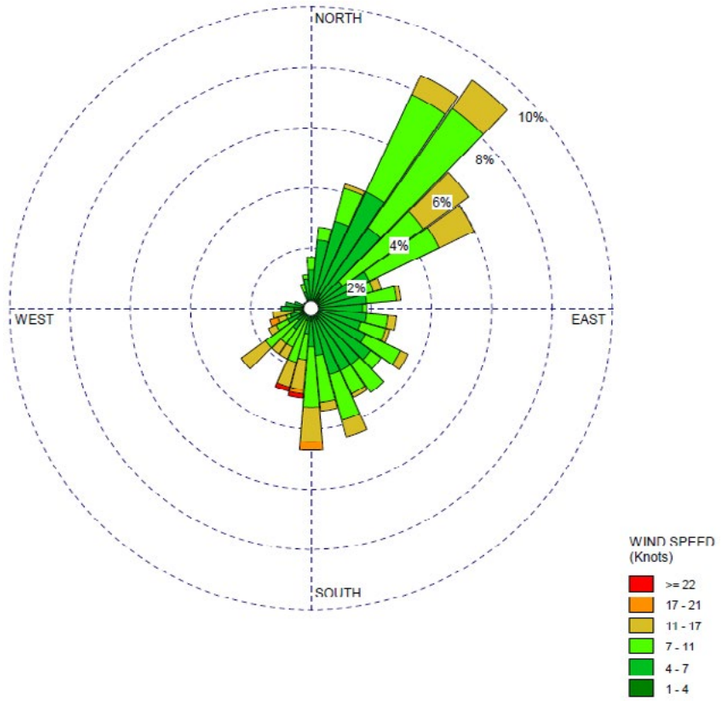


Figure 4-6: Wind rose EBLG April 2019

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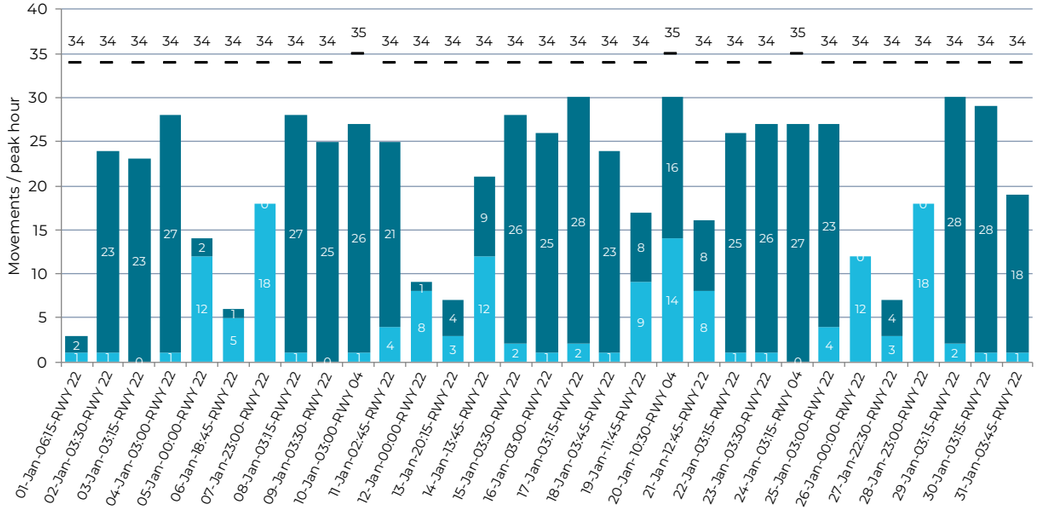
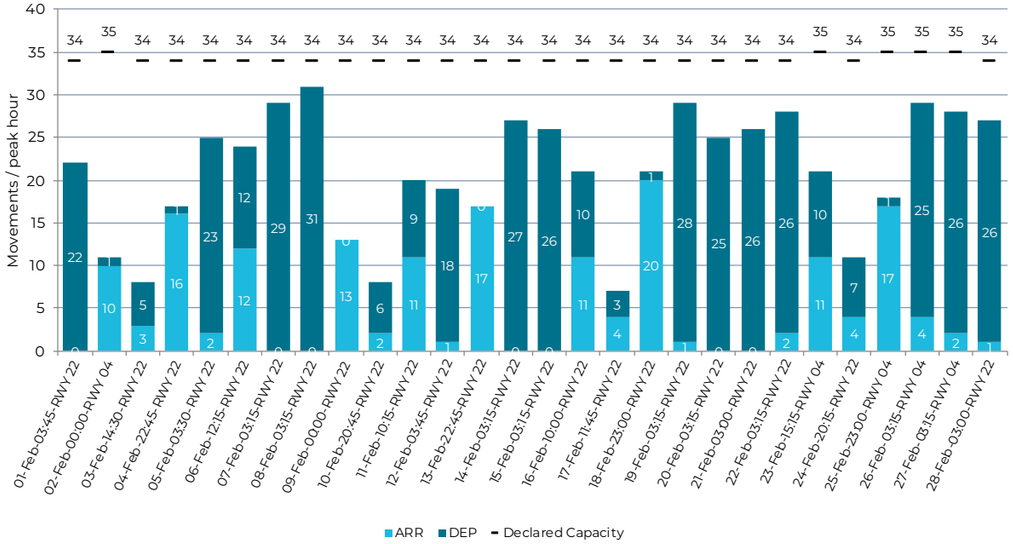
ANNEX

Annex 1: Monthly overview of arrivals and departures at peak hours

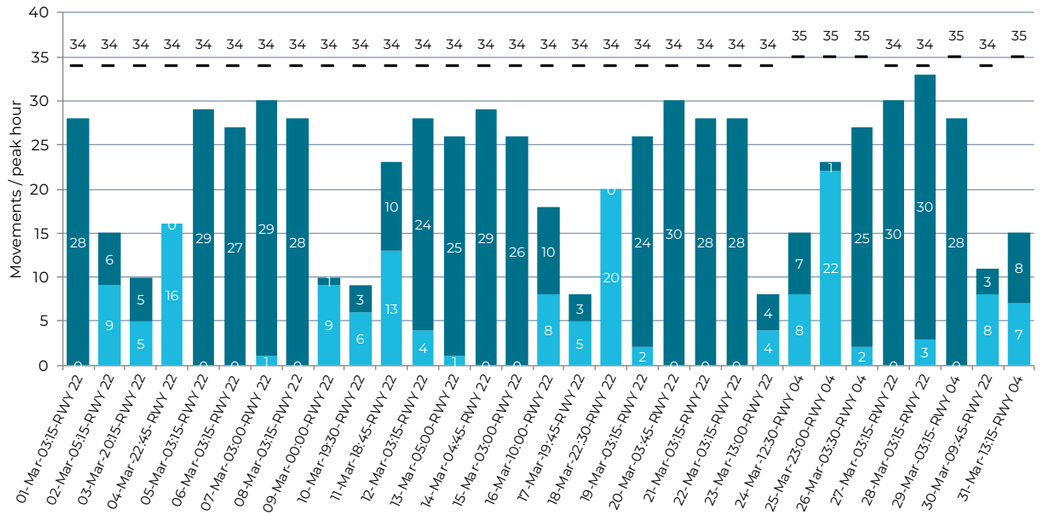
January



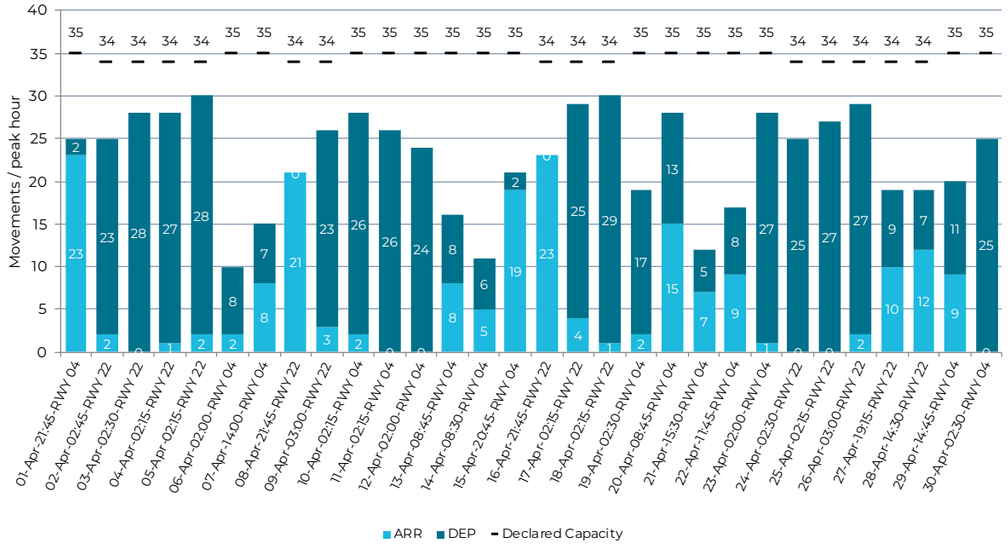
February



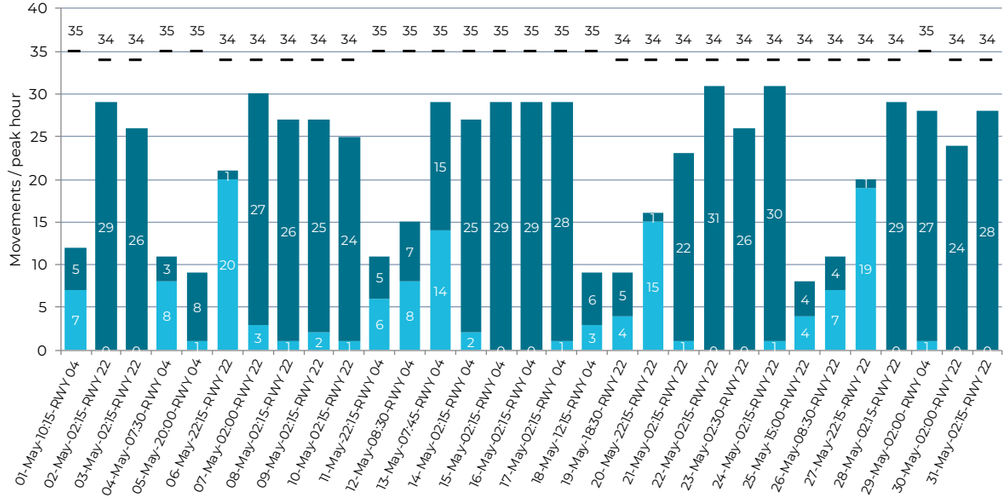
March



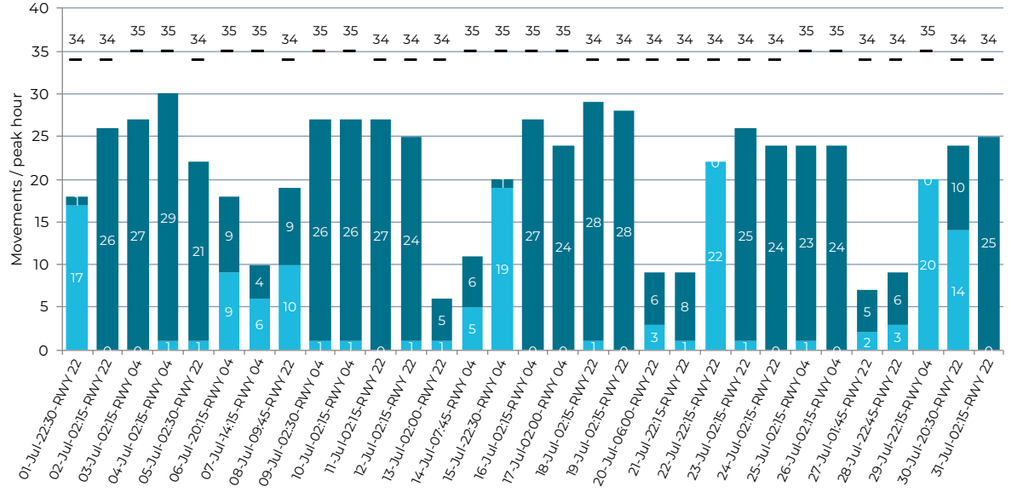
April



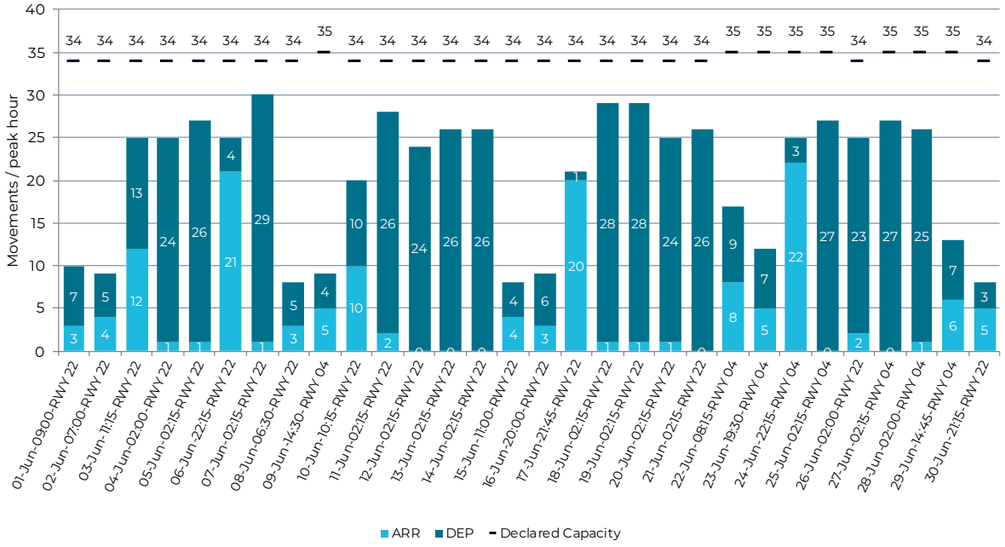
May



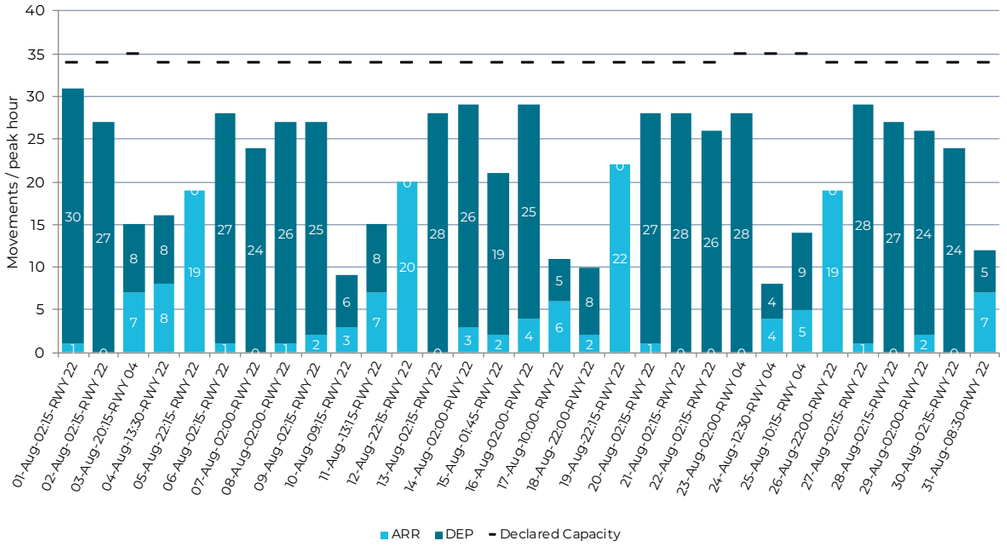
July



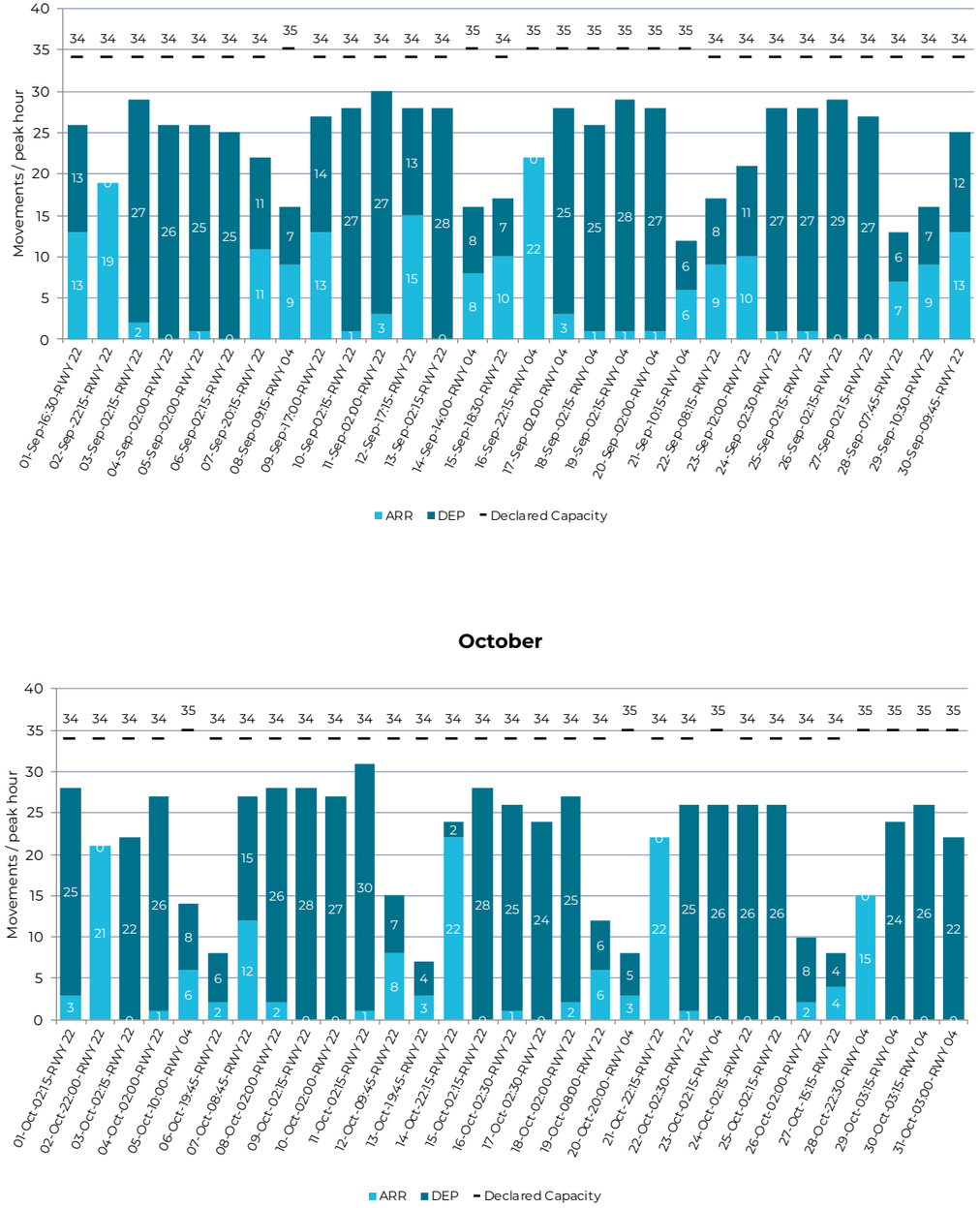
June



August



September



October

November

December

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