An aerial photograph of an airport tarmac. A large white commercial airplane is the central focus, parked at a gate. Several other smaller aircraft are visible in the background. The tarmac is dark asphalt with white markings. A blue ground support vehicle is visible on the right side. The background shows a large hangar with a corrugated metal roof.

Summer 2023: Final assessment of the likely impact of declaring the Wishlist runway capacity

Peter Straka
26 August 2022



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- 01.** Context
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 - Departure taxi out time
 - Departure runway holding delay
 - Arrival ground delay
 - Arrival taxi in time
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01.

Context



Context

The Commission for Aviation Regulation (CAR) is responsible for determining the parameters for slot allocation at Dublin Airport.

To ensure that optimal parameters are set, the Commission has instructed Egis to undertake airfield fast time simulations in preparation for the Summer 2023 (S23) season at Dublin airport.

This document provides results from two simulated scenarios:

- S23 flight schedule coordinated to the proposed S23 limits with the northern runway operational and
- S23 flight schedule coordinated to the existing S22 limits with the northern runway operational.

Model description

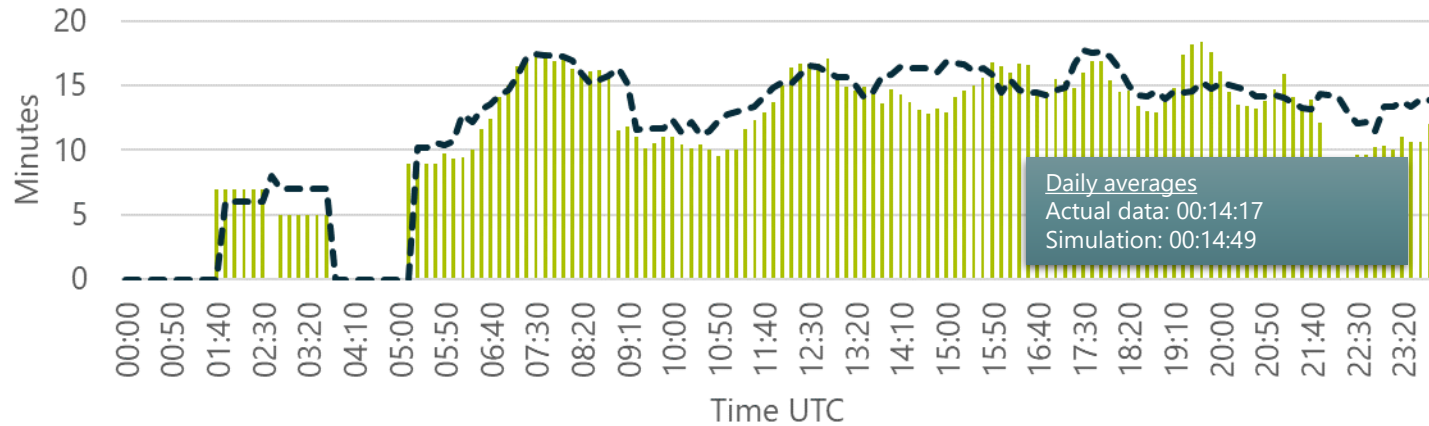
- **Based on the model developed to support the coordination committee decisions in 2017 and used since.**
- **Historically validated against a number of design days from previous seasonal assessments.**
- **Calibrated against a single day of S22 operations (18 April 2022).**
- **Run from actual block times to take into account all delays.**
- **A comparison set of airside performance metrics is provided on following slides.**

Busy day simulated for the purpose of model calibration

- **18 April 2022**
 - RWY 28 in operations for 100% of the time;
 - Dual ops not available on this day.
- **642 flights in total, incl. GA and cargo**
 - 325 arrivals and 317 departures;
 - helicopter operations not simulated.

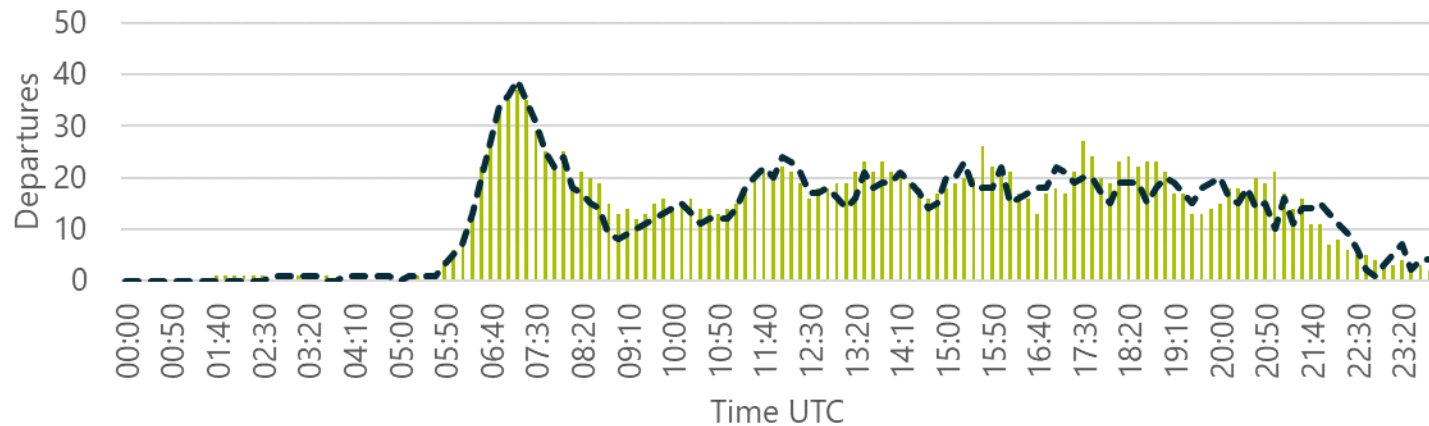
Calibration of departure performance

Departure taxi out duration



Actual data Simulation

Off-block count



Actual data Simulation

Metric definition:

Time duration between the off-block time and aircraft lifting off.

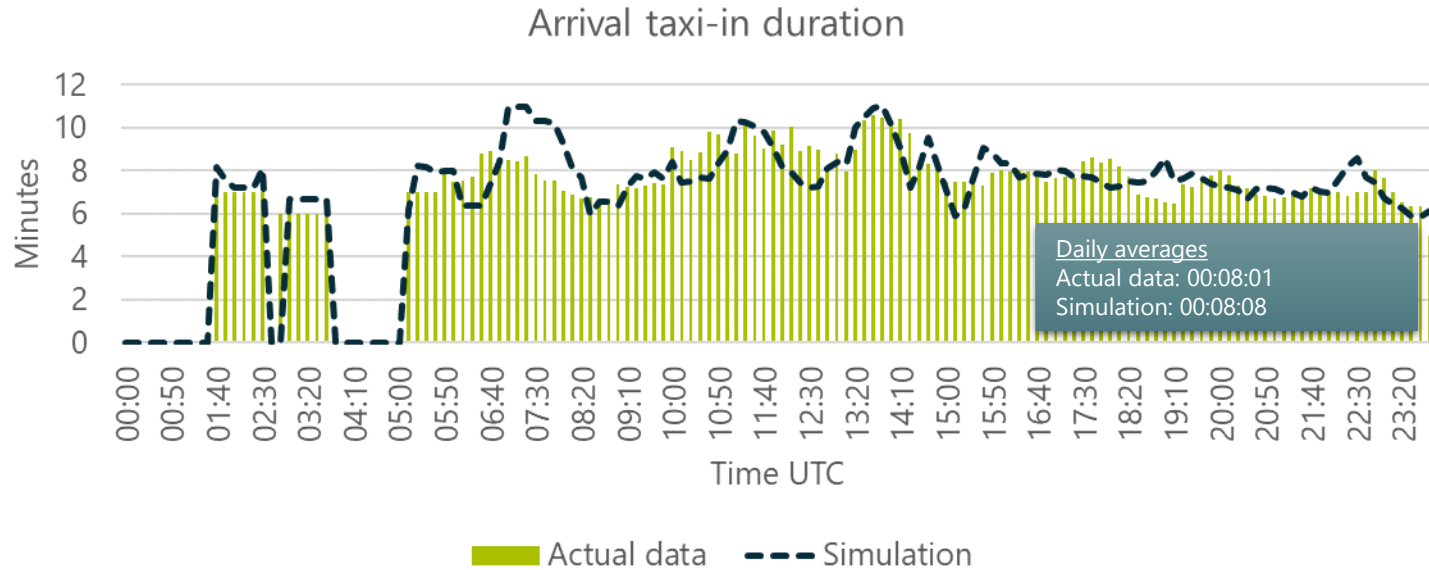
*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).

Metric definition:

The number of aircraft that have been pushed back in the last rolling period. The count is incremented when the aircraft leaves its departure parking position (either being pushed back at gate or taxiing / pulled away from a parking position).

* This graph is presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

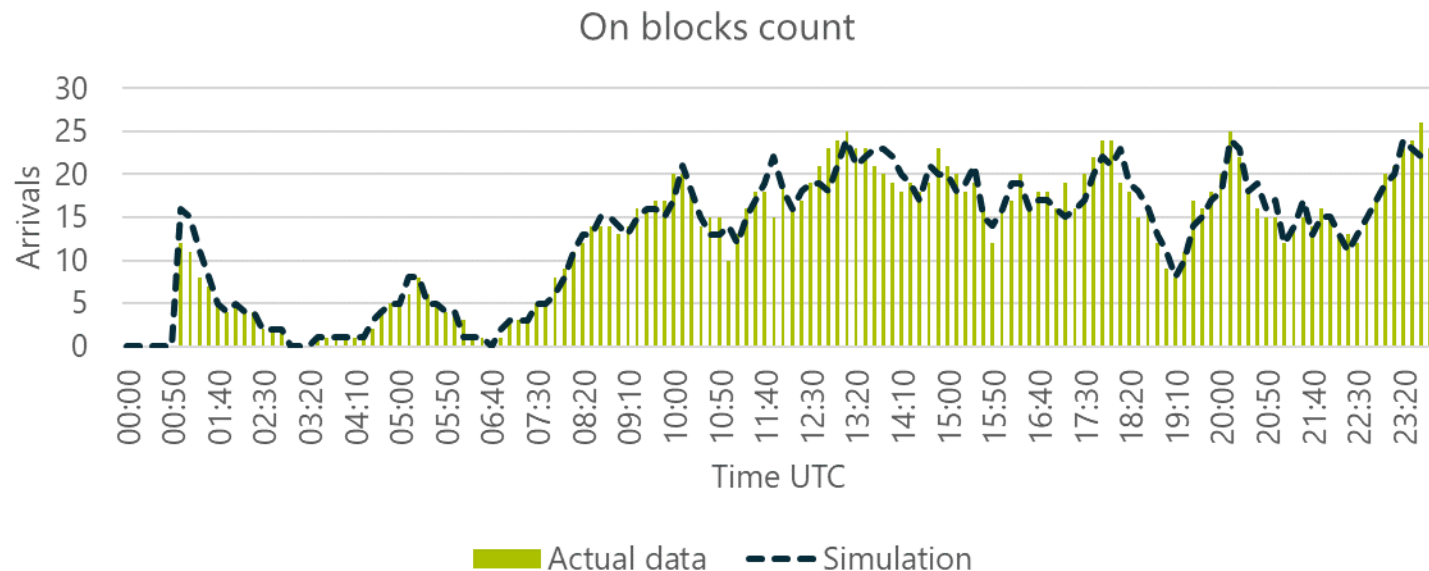
Calibration of arrival performance



Metric definition:

Time duration between touch-down and aircraft parking on-blocks.

*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).

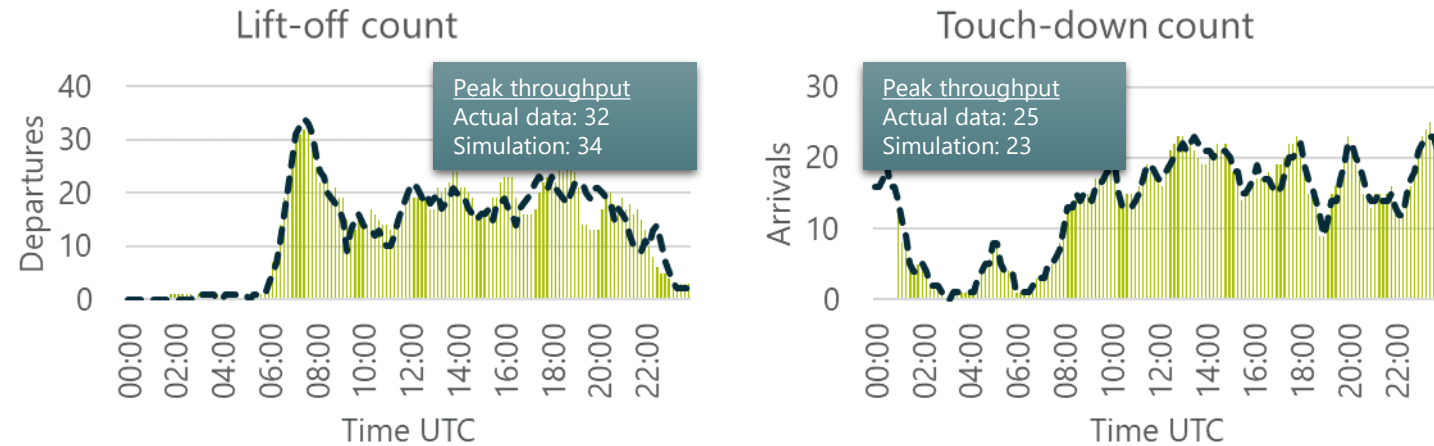


Metric definition:

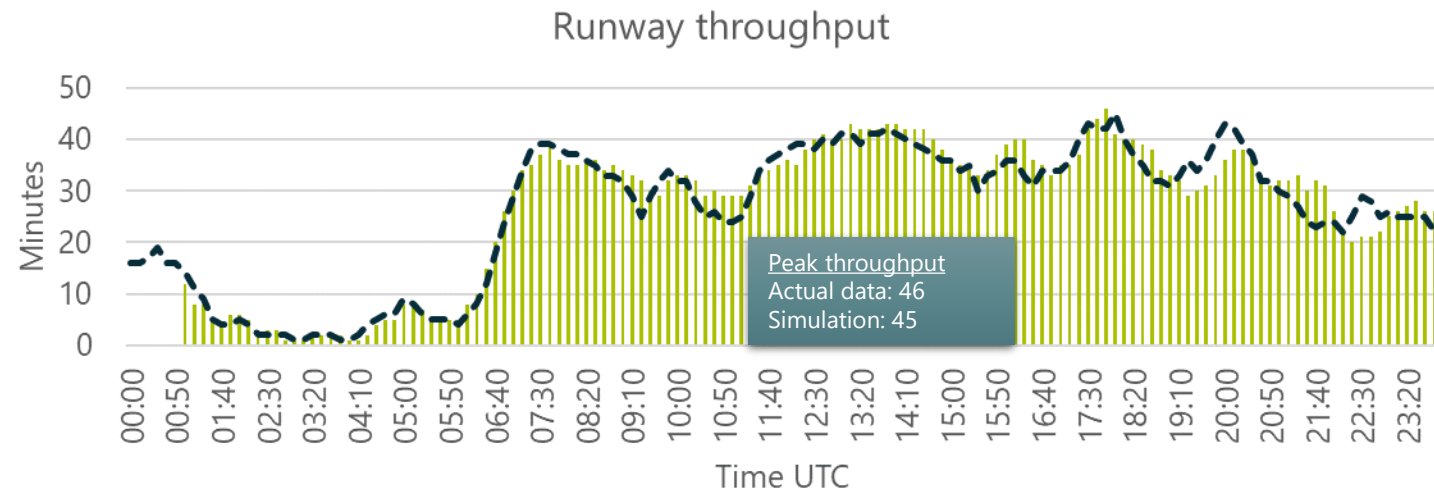
The number of aircraft that have reached their arrival parking position in the last 60-minute rolling period. The count is incremented when the aircraft reaches its in-blocks position.

* This graph is presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

Calibration of runway performance



Actual data Simulation Actual data Simulation



Actual data Simulation

Metric definition:

Lift-off count: The number of aircraft that have lifted off in the 60-minute rolling period. The count is incremented when the aircraft passes over the opposite end of the runway.

Touch-down count: The number of aircraft that have touched down in the 60-minute rolling period.

Runway throughput: Sum of all aircraft touching down and lifting-off in the 60-minute rolling period.

* All graphs are presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

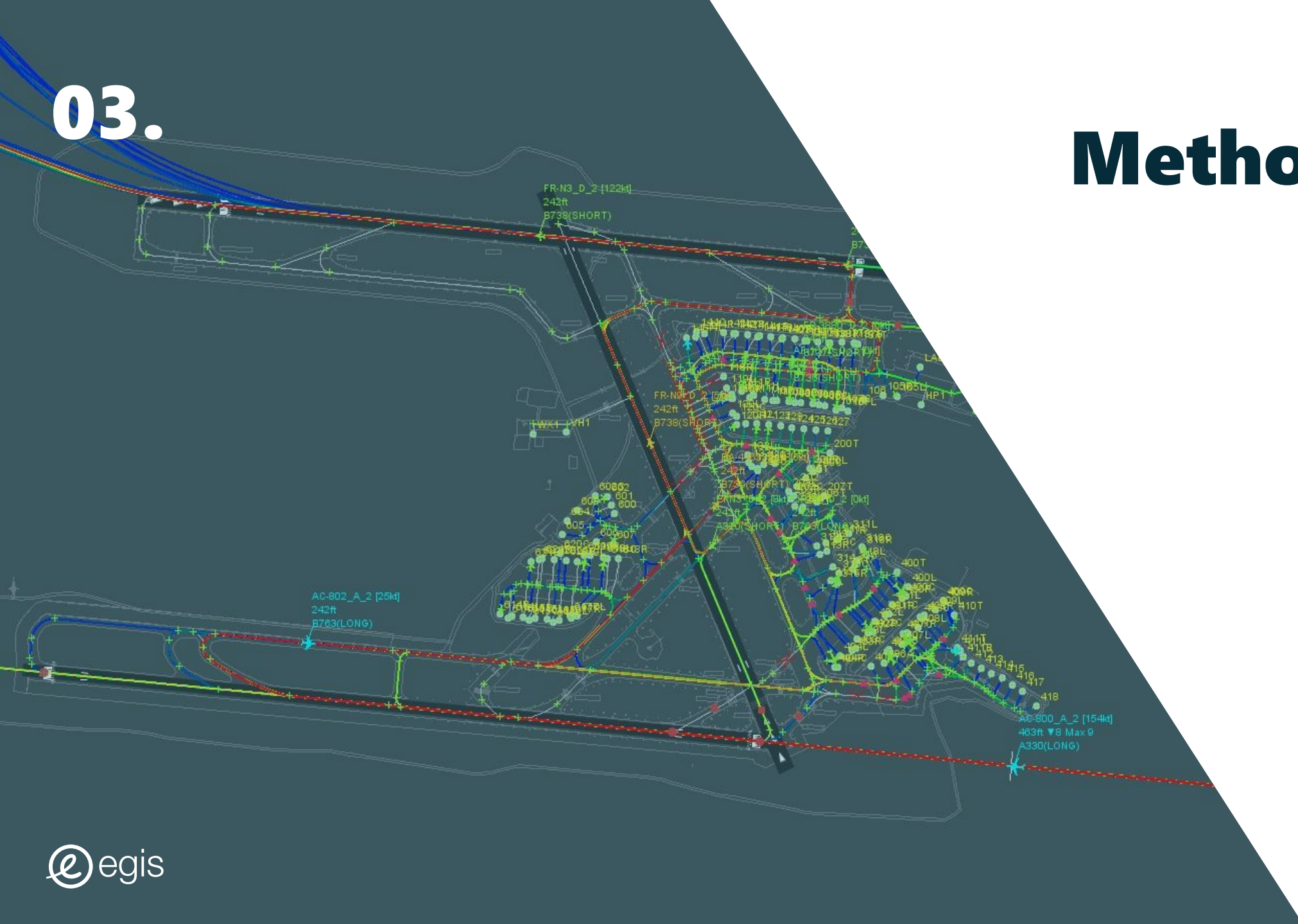
Result of model validation exercise

As the metrics calculated through the FTS model closely match the real-world data, both in terms of magnitude and profile shape, the model can be considered a satisfactory representation for the purpose of evaluating the impact of the proposed changes on flight schedules.

The model is considered to be valid if it is a sufficiently accurate representation of the corresponding real-world problem from the perspective of the intended uses of the model. "Valid" for a simulation does not mean the same as "indistinguishable from the real-world system", even though in this case there is a close match.

03.

Methodology



Task description

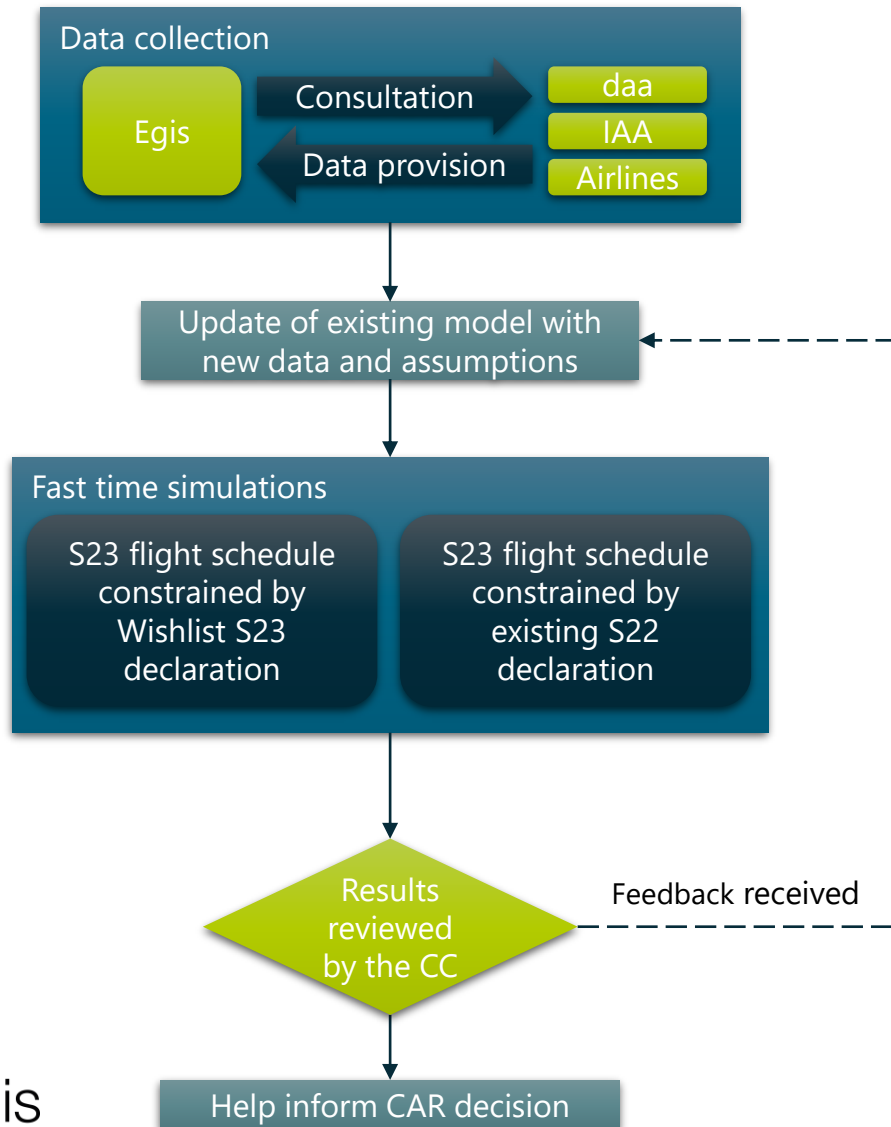
The purpose of this comparison is to assess the likely effect of either:

- **declaring an increased runway capacity, as per the Dublin Airport Wishlist proposal, or**
- **maintaining the Summer 2022 capacity declaration limits.**

In both cases it is presumed that the Summer 2023 schedule of increased demand materialises as expected.

The same number of movements are modelled in all cases, the difference being the limits to which they are coordinated. This difference is therefore a best current information estimate of the effect of a decision to increase the runway limits on a busy Summer 2023 day.

Approach and key changes in the model



Changes to airfield model:

- Prerequisites for construction of Apron 5H:
 - Light Aircraft Parking B closed, GA parking moved to northern part of the West Apron;
- Prerequisites for the critical taxiway project :
 - F-OUTER and P1 closed;
- Prerequisites for dual code E ops on Z/B1:
 - B1 closed for the duration of construction works.
- Dual runway operations:
 - Semi-mixed mode (arrive 28L, depart 28L & 28R) during the day (06:00 – 21:59 UTC) and
 - Single runway operations for both arrivals and departures from 28L for the night period (22:00 – 05:59 UTC).
 - Departures from runway 28R operating on diverging SIDs modelled with 60 seconds D-D separation;
- No changes to operating procedures
 - Departure-departure separation kept at minimum of 84 seconds for runway 28L departures;
 - Arrival-arrival separation kept at minimum of 3.5 NM;
 - A-D-A separation kept at minimum of 5.5 NM.

Summer 2023 (S23) flight schedule

The flight schedule used for modelling of both scenarios:

- Based on 29th July 2022 flight schedule (an already a busy day before the new services were added);
- Contains a total of 831 flights (419 arrivals and 412 departures);
- Contains 58 new arrivals and 48 new departures;
- Does not contain general aviation, helicopter, military, state or medical flights.

S23 Wishlist proposed by Dublin Airport

Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	
Arrivals																										
Existing S22 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	27	23	27	23	26	25	23	23	23	25	30	28	23	586	
Proposed S23 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	29	24	27	23	26	27	23	23	23	25	30	28	23	591	
Difference (against S22 declaration)	0	0	0	0	0	0	0	0	0	0	0	2	1	0	0	0	2	0	0	0	0	0	0	0	5	
Departures																										
Existing S22 departures capacity	25	25	25	25	25	36	31	25	25	24	27	28	27	24	27	25	29	27	26	22	22	25	25	25	625	
Proposed S23 departures capacity	25	25	25	25	25	36	35	25	25	24	27	28	27	26	27	25	29	27	26	22	22	25	25	25	631	
Difference (against S22 declaration)	0	0	0	0	0	0	4	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	
Totals																										
Existing S22 totals capacity	32	32	32	32	32	40	42	41	45	44	45	48	46	46	45	47	48	45	40	39	38	36	32	32	959	
Proposed S23 totals capacity	32	32	32	32	32	40	44	41	45	48	48	51	49	50	45	47	52	47	43	39	38	42	32	32	993	
Difference (against S22 declaration)	0	0	0	0	0	0	2	0	0	4	3	3	3	4	0	0	4	2	3	0	0	6	0	0	34	

Besides adhering to hourly runway limits, flights in all modelled scenarios adhere also to 10-minute limits on number of movements – these have been assumed in line with daa proposal as follows:

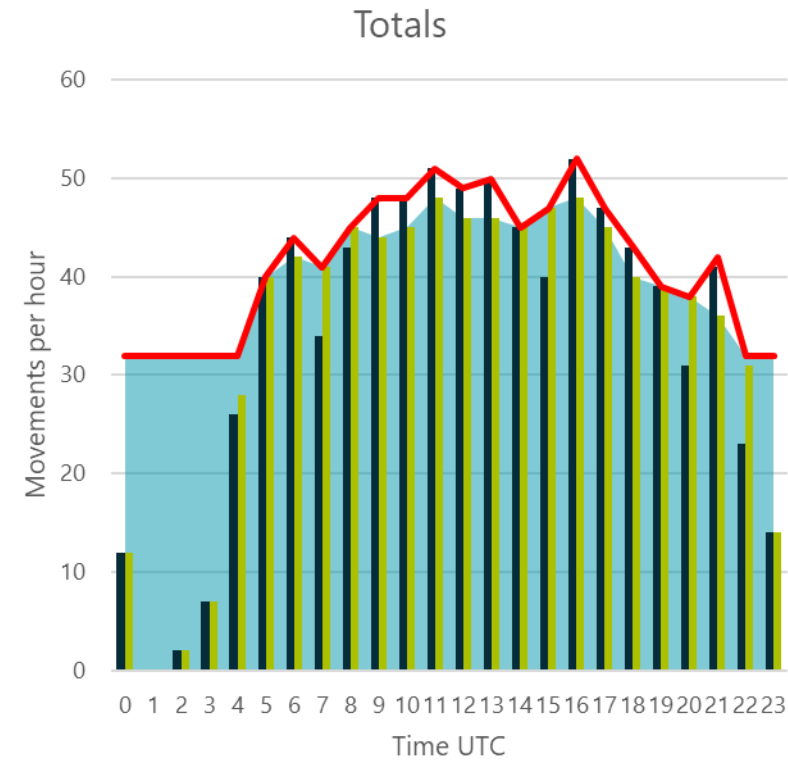
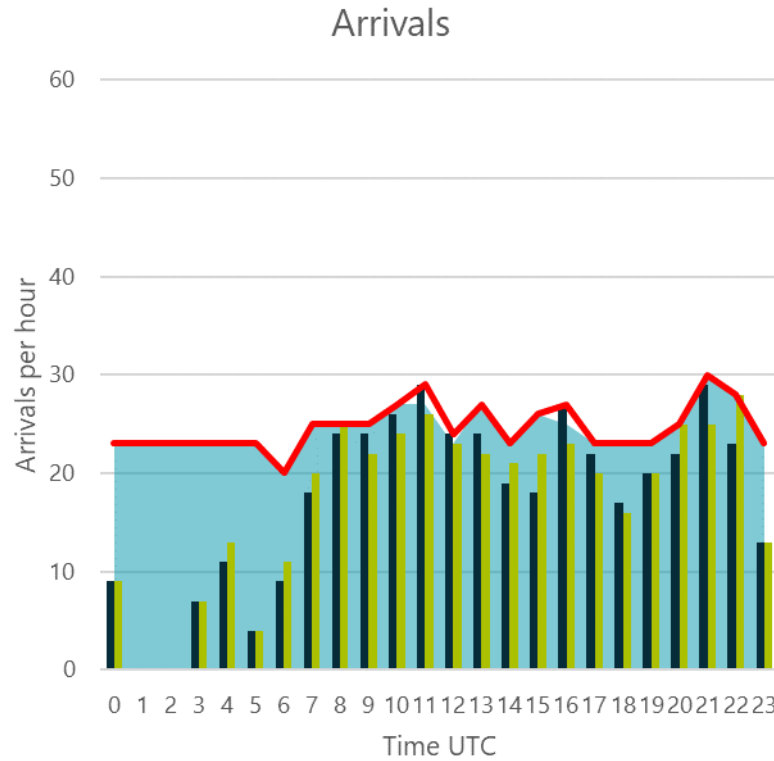
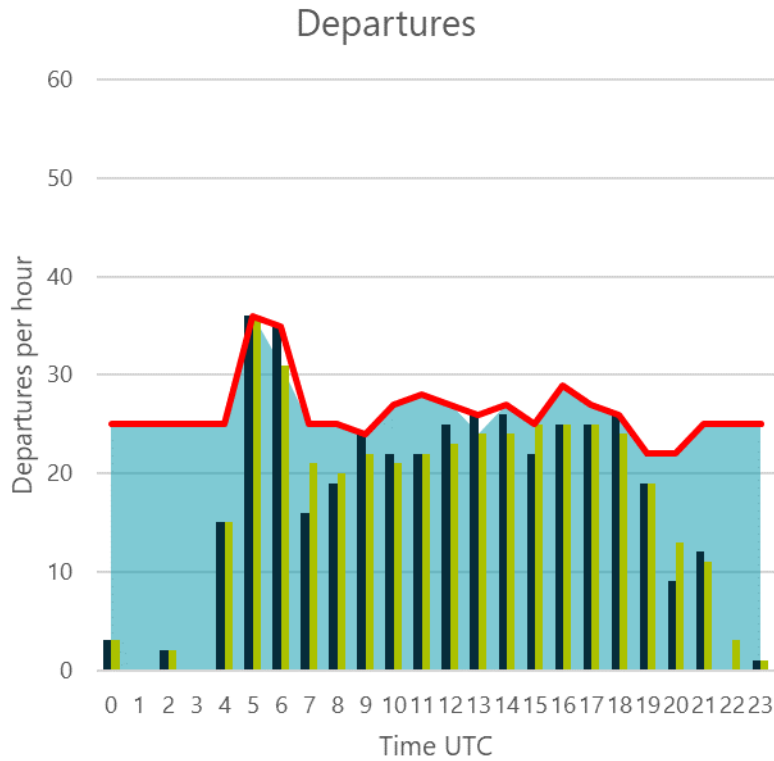
Maximum number of movements per 10 minute period	Dual Operations	Single Operations
Maximum Total	13*	9
Maximum Arrivals	6	6
Maximum Departures	7*	6

*In Hours of Dual Runway Operations only
 **Exception – Maximum Departure Limit is 7 mvts at 0500, 0510, 0520, 0230, 0540, 0550 UTC

S23 constrained by proposed S23 limits

Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	
Arrivals																										
Proposed S23 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	29	24	27	23	26	27	23	23	23	25	30	28	23	591	
Arrivals in simulated S23 schedule	9	0	0	7	11	4	9	18	24	24	26	29	24	24	19	18	27	22	17	20	22	29	23	13	419	
<i>Historic</i>	9	0	0	7	9	4	8	15	20	23	20	22	19	21	18	17	21	18	16	18	17	23	23	13	361	
<i>Additional arrivals proposed for S23</i>	0	0	0	0	2	0	1	3	4	1	6	7	5	3	1	1	6	4	1	2	5	6	0	0	58	
Spare capacity (against S23 wishlist)	14	23	23	16	12	19	11	7	1	1	1	0	0	3	4	8	0	1	6	3	3	1	5	10	172	
Departures																										
Proposed S23 departures capacity	25	25	25	25	25	36	35	25	25	24	27	28	27	26	27	25	29	27	26	22	22	25	25	25	631	
Departures in simulated S23 schedule	3	0	2	0	15	36	35	16	19	24	22	22	25	26	26	22	25	25	26	19	9	13	0	2	412	
<i>Historic</i>	3	0	2	0	15	36	28	16	15	22	18	19	21	20	23	22	21	20	23	17	9	12	0	2	364	
<i>Additional departures proposed for S23</i>	0	0	0	0	0	0	7	0	4	2	4	3	4	6	3	0	4	5	3	2	0	1	0	0	48	
Spare capacity (against S23 wishlist)	22	25	23	25	10	0	0	9	6	0	5	6	2	0	1	3	4	2	0	3	13	12	25	23	219	
Totals																										
Proposed S23 totals capacity	32	32	32	32	32	40	44	41	45	48	48	51	49	50	45	47	52	47	43	39	38	42	32	32	993	
Totals in simulated S23 schedule	12	0	2	7	26	40	44	34	43	48	48	51	49	50	45	40	52	47	43	39	31	42	23	15	831	
<i>Historic</i>	12	0	2	7	24	40	36	31	35	45	38	41	40	41	41	39	42	38	39	35	26	35	23	15	725	
<i>Additional movements proposed for S23</i>	0	0	0	0	2	0	8	3	8	3	10	10	9	9	4	1	10	9	4	4	5	7	0	0	106	
Spare capacity (against S23 wishlist)	20	32	30	25	6	0	0	7	2	0	0	0	0	0	0	7	0	0	0	0	7	0	9	17	162	

Constraining the S23 schedule by the S22 limits results in spreading the flights into shoulder hours



- Declared departures capacity (S22)
- Departures in simulated S23 flight schedule (S23 limits)
- Departures in simulated S23 flight schedule (S22 limits)
- Wishlist departures capacity (S23)

- Declared arrivals capacity (S22)
- Arrivals in simulated S23 flight schedule (S23 limits)
- Arrivals in simulated S23 flight schedule (S22 limits)
- Wishlist arrivals capacity (S23)

- Declared totals capacity (S22)
- Totals in simulated S23 flight schedule (S23 limits)
- Totals in simulated S23 flight schedule (S22 limits)
- Wishlist totals capacity (S23)



Some of the additional services envisaged in S23 schedule had to be re-timed to make the flight schedule compatible with the existing S22 declaration. This simulates a case where existing S22 declaration will be rolled forward to Summer 23 season but all of the new services would still operate – although not necessarily at the originally scheduled times.

S23 constrained by existing S22 limits

Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	
Arrivals																										
Existing S22 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	27	23	27	23	26	25	23	23	23	25	30	28	23	586	
Arrivals in simulated S23 schedule	9	0	0	7	12	4	11	21	25	22	23	27	23	22	19	23	24	20	17	20	25	24	28	13	419	
<i>Historic</i>	9	0	0	7	10	4	8	15	20	22	20	22	19	21	18	17	21	18	16	18	17	23	23	13	361	
<i>Additional arrivals proposed for S23</i>	0	0	0	0	2	0	3	6	5	0	3	5	4	1	1	6	3	2	1	2	8	1	5	0	58	
Spare capacity (against S23 wishlist)	14	23	23	16	11	19	9	4	0	3	4	0	0	5	4	3	1	3	6	3	0	6	0	10	167	
Departures																										
Existing S22 departures capacity	25	25	25	25	25	36	31	25	25	24	27	28	27	24	27	25	29	27	26	22	22	25	25	25	625	
Departures in simulated S23 schedule	3	0	2	0	19	36	31	20	20	22	22	21	23	24	26	24	24	25	23	19	13	12	1	2	412	
<i>Historic</i>	3	0	2	0	15	36	28	16	15	22	18	19	21	20	23	22	21	20	23	17	9	12	0	2	364	
<i>Additional departures proposed for S23</i>	0	0	0	0	4	0	3	4	5	0	4	2	2	4	3	2	3	5	0	2	4	0	1	0	48	
Spare capacity (against S23 wishlist)	22	25	23	25	6	0	0	5	5	2	5	7	4	0	1	1	5	2	3	3	9	13	24	23	213	
Totals																										
Existing S22 totals capacity	32	32	32	32	32	40	42	41	45	44	45	48	46	46	45	47	48	45	40	39	38	36	32	32	959	
Totals in simulated S23 schedule	12	0	2	7	31	40	42	41	45	44	45	48	46	46	45	47	48	45	40	39	38	36	29	15	831	
<i>Historic</i>	12	0	2	7	25	40	36	31	35	44	38	41	40	41	41	39	42	38	39	35	26	35	23	15	725	
<i>Additional movements proposed for S23</i>	0	0	0	0	6	0	6	10	10	0	7	7	6	5	4	8	6	7	1	4	12	1	6	0	106	
Spare capacity (against S23 wishlist)	20	32	30	25	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	3	17	128	

04.



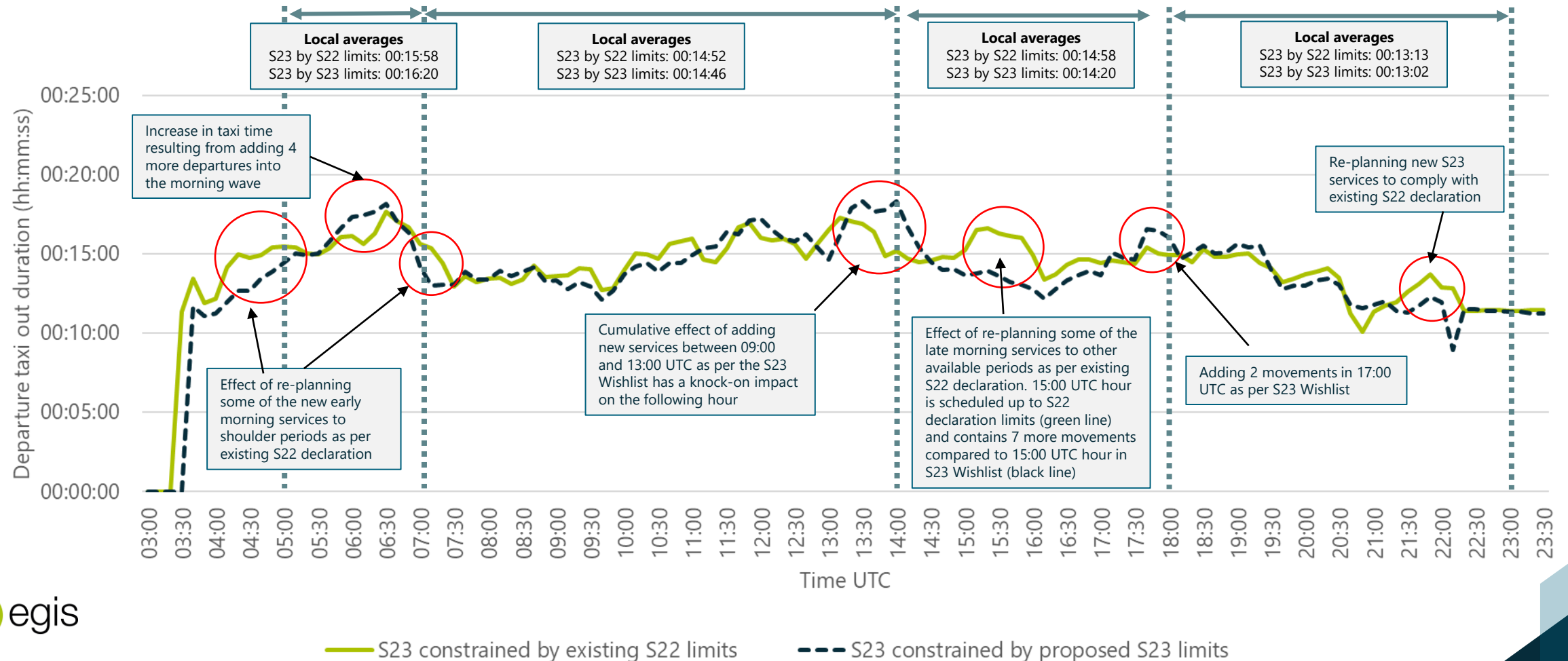
↓
Results

**(westerly
operations)**

Departure taxi out time

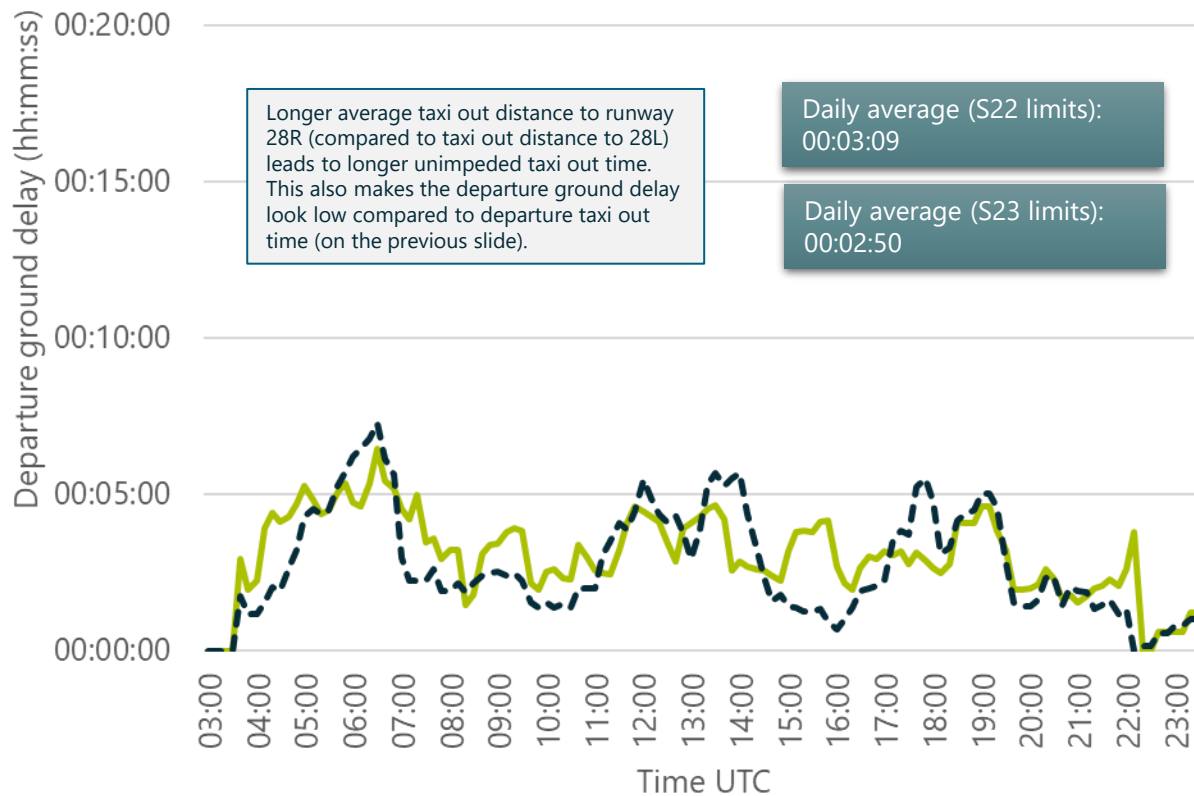
	S22 limits	S23 limits	Difference
Daily average	00:14:29	00:14:13	00:00:16
Peak	00:17:41	00:18:19	00:00:38

Definition: This metric is defined to be the time period between off-block and the time the aircraft reaches its stop bar for runway entry. This value is updated every second during the simulation when the aircraft is taxiing for departure even if the aircraft is stopped on ground.



Departure ground delay and runway holding delay

Departure ground delay: Total delay of departing aircraft accumulated between off-block and entering the runway. It is effectively the sum of runway holding delay and other delays.



— S23 constrained by existing S22 limits
 - - - S23 constrained by proposed S23 limits

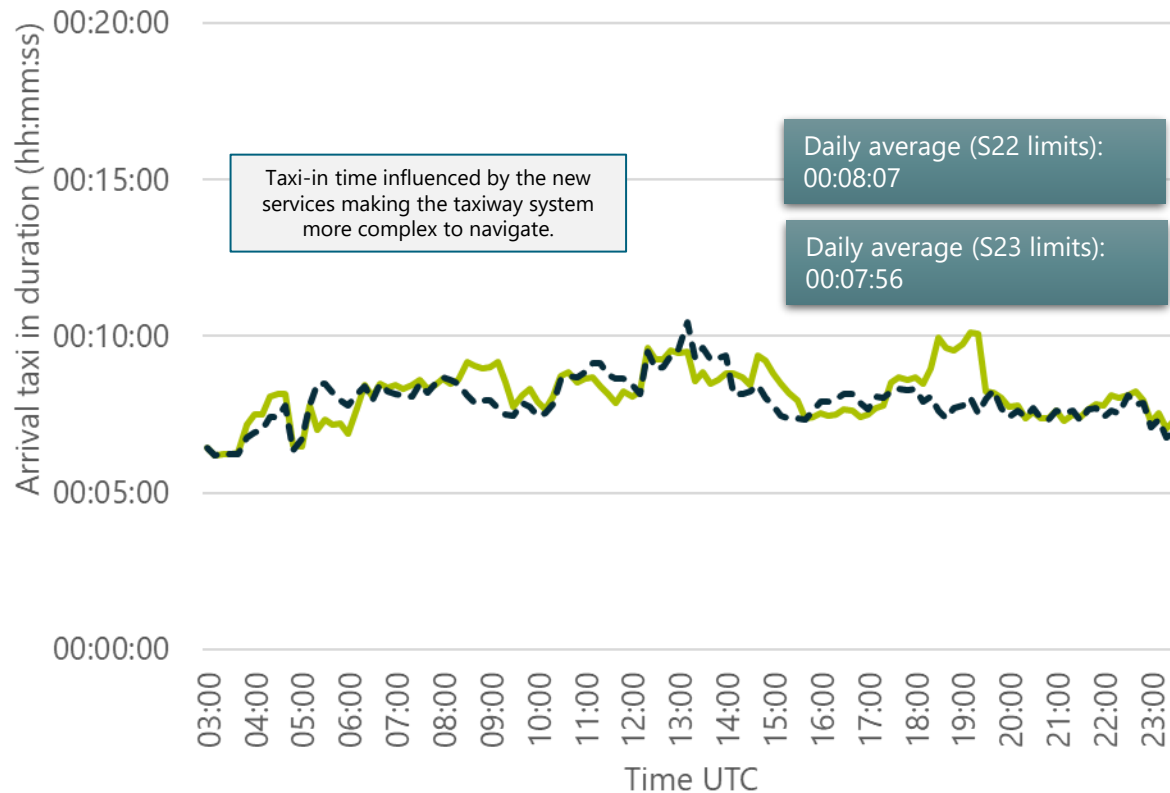
Runway holding delay: The delay experienced while the aircraft is queueing for runway entry. The delay can be caused by other aircraft (being slowed down or stopped) or when waiting at runway stop-bar (because the runway is not free for lining up). This metric is defined to be the time period between joining the back end of the queue and the time the aircraft reaches its stop bar for runway entry.



— S23 constrained by existing S22 limits
 - - - S23 constrained by proposed S23 limits

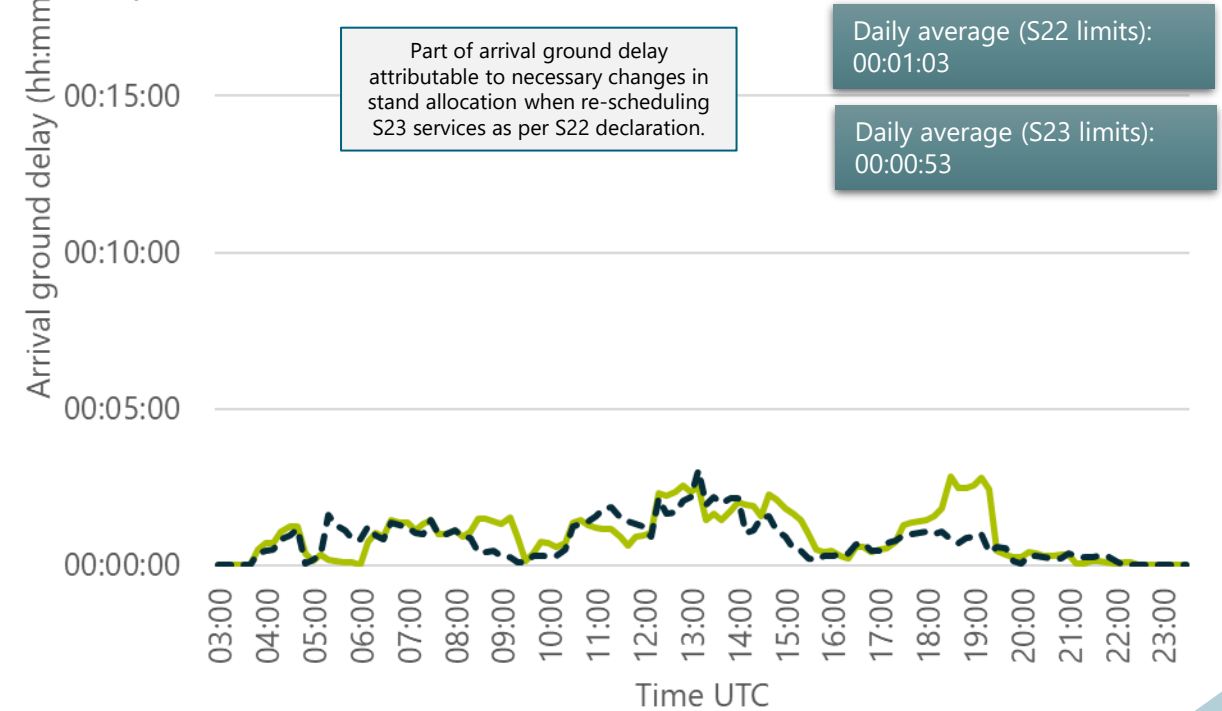
Arrival taxi in time and arrival ground delay

Arrival taxi-in time: The time duration the arriving aircraft has been taxiing on the ground of its arrival airport. This value is updated every second of simulation time when the arriving aircraft is taxiing even if the aircraft is stopped on ground.



- S23 constrained by existing S22 limits
- - - S23 constrained by proposed S23 limits

Arrival ground delay: The delay caused by traffic (slowing down or being stopped) while the aircraft is taxiing to its arrival stand. Every second of simulation time the aircraft is stopped on ground due to other traffic, the delay is increased accordingly. Additionally, if the aircraft is forced to slow-down due to other traffic, a proportional delay is calculated.



- S23 constrained by existing S22 limits
- - - S23 constrained by proposed S23 limits

05.

Findings



Increasing the RWY limits in line with the S23 Wishlist

Assuming the S23 schedule materializes as expected, increasing the runway limits in line with the S23 Wishlist:

- Is likely to cause localized deterioration of ground delays in and around those hours where capacity increases are proposed. However, the daily average taxi out time is not materially impacted by declaring the additional capacity.
 - The average taxi departure time in the first morning wave is likely to increase by 22 seconds per flight (compared to the flight schedule constrained by existing S22 limits), when measured across the flights operating in the morning period;
 - The proposed increase of 17 movements between 0900 UTC and 1359 UTC is likely to have a knock-on impact on traffic operating between 1300 UTC and 1430 UTC. However, this impact is unlikely to be more than three minutes on average per flight operating in this time period.
 - Capacity increases planned for 1600-1800 UTC are likely to have a marginal increase on departure taxi out times and are unlikely to have any significant impact on arrival performance;
- Is likely to lead to scheduled capacity limits being reached during the morning period (0500-0600 UTC), mid-day (0900-1400 UTC) and evening (1600-1900 UTC).
- However, the firebreaks will be preserved after the morning wave and at 1500 UTC.
- The results presented in this Final Assessment show better operational performance compared to the results in the Draft Assessment presented on 9 August. This is due to introduction of updated R10 limits that were not reflected in the Draft Assessment. Adherence of the schedule to the R10 limits ensures better “spacing” of movements within each hour, which prevents bunching of flights and leads to smoother operations.

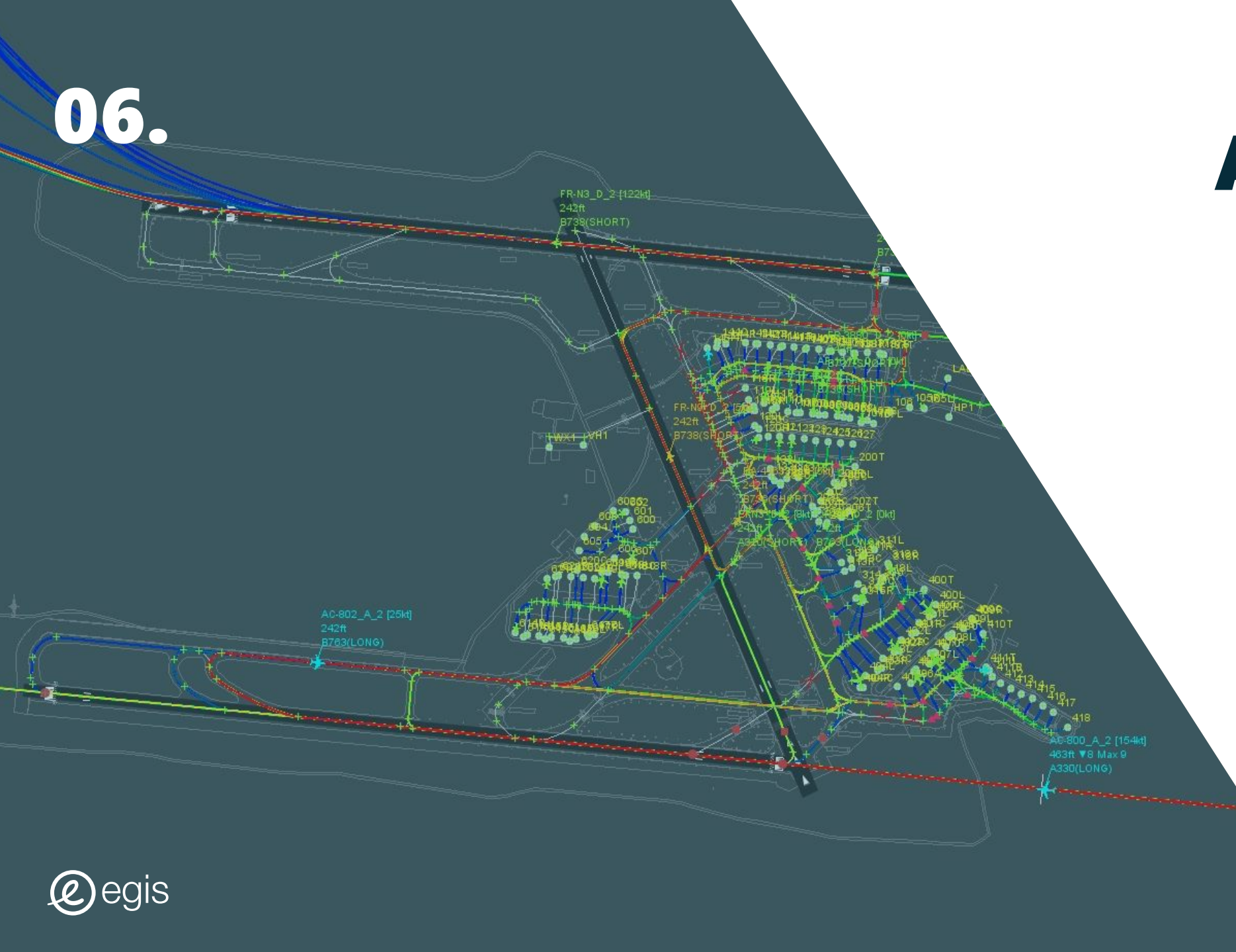
Maintaining the RWY limits in line with the S22 declaration

Assuming the S23 schedule materializes as expected, maintaining the runway limits in line with the S22 capacity declaration:

- Is likely to cause re-distribution of newly planned services to hours with any remaining available capacity.
 - The peak departure ground delay during the first morning wave is unlikely to change substantially. However, due to the distribution of new services to shoulder hours, the first wave is likely to last longer, causing an increase of departure ground delay before 0500 UTC and between 0700 and 0800 UTC (compared to the flight schedule constrained by proposed S23 limits);
 - As a result of utilization of any remaining slots between 0500 UTC and 2100 UTC, the departure ground delay is likely to increase in the afternoon (1500-1600 UTC) and evening (2100-2230 UTC) periods by one to two minutes per departing flight on average.
- The schedule will be left without any “firebreak” to compensate for unforeseen operational challenges.
- The results presented in this Final Assessment show better operational performance compared to the results in the Draft Assessment presented on 9 August. This is due to introduction of updated R10 limits that were not reflected in the Draft Assessment. Adherence of the schedule to the R10 limits ensures better “spacing” of movements within each hour, which prevents bunching of flights and leads to smoother operations.

06.

Additional scenarios



Additional scenarios

Following the Coordination Committee (CC) pre-meeting that took place on 9 August 2022 some CC members requested additional scenarios to be modelled:

- Both additional scenarios are a variation of the original S23 Wishlist.
- Additional scenario 1: no increases in the morning wave
 - In this scenario we keep the total number of flights constant and run S23 schedule by S23 Wishlist limits, excluding the proposed increases in 06:00 UTC. Instead, new departures planned for 06:00 UTC are re-planned to the closest available slot - in this case in 07:00 UTC.
- Additional scenario 2: additional capacity release
 - In this scenario, additional capacity is released in 06:00 UTC (+2 departures and +2 totals) and in 14:00 UTC (+2 totals) on top of S23 Wishlist declaration.

Additional scenario 1: no increases in the morning wave

Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	
Arrivals																										
Proposed S23 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	29	24	27	23	26	27	23	23	23	25	30	28	23	591	
Arrivals in simulated S23 schedule	9	0	0	7	11	4	9	18	24	24	26	29	24	24	19	18	27	22	17	20	22	29	23	13	419	
<i>Historic</i>	9	0	0	7	9	4	8	15	20	23	20	22	19	21	18	17	21	18	16	18	17	23	23	13	361	
<i>Additional arrivals proposed for S23</i>	0	0	0	0	2	0	1	3	4	1	6	7	5	3	1	1	6	4	1	2	5	6	0	0	58	
Spare capacity (against S23 wishlist)	14	23	23	16	12	19	11	7	1	1	1	0	0	3	4	8	0	1	6	3	3	1	5	10	172	
Departures																										
Departures limit at 0600 UTC kept at S22 levels - other hours scheduled as per S23 Wishlist declaration																										
Proposed S23 departures capacity	25	25	25	25	25	36	31	25	25	24	27	28	27	26	27	25	29	27	26	22	22	25	25	25	627	
Departures in simulated S23 schedule	3	0	2	0	15	36	31	20	19	24	22	22	25	26	26	22	25	25	26	19	9	13	0	2	412	
<i>Historic</i>	3	0	2	0	15	36	28	16	15	22	18	19	21	20	23	22	21	20	23	17	9	12	0	2	364	
<i>Additional departures proposed for S23</i>	0	0	0	0	0	0	3	4	4	2	4	3	4	6	3	0	4	5	3	2	0	1	0	0	48	
Spare capacity (against S23 wishlist)	22	25	23	25	10	0	0	5	6	0	5	6	2	0	1	3	4	2	0	3	13	12	25	23	215	
Totals																										
Proposed S23 totals capacity	32	32	32	32	32	40	42	41	45	48	48	51	49	50	45	47	52	47	43	39	38	42	32	32	991	
Totals in simulated S23 schedule	12	0	2	7	26	40	40	38	43	48	48	51	49	50	45	40	52	47	43	39	31	42	23	15	831	
<i>Historic</i>	12	0	2	7	24	40	36	31	35	45	38	41	40	41	41	39	42	38	39	35	26	35	23	15	725	
<i>Additional movements proposed for S23</i>	0	0	0	0	2	0	4	7	8	3	10	10	9	9	4	1	10	9	4	4	5	7	0	0	106	
Spare capacity (against S23 wishlist)	20	32	30	25	6	0	2	3	2	0	0	0	0	0	0	7	0	0	0	0	7	0	9	17	160	

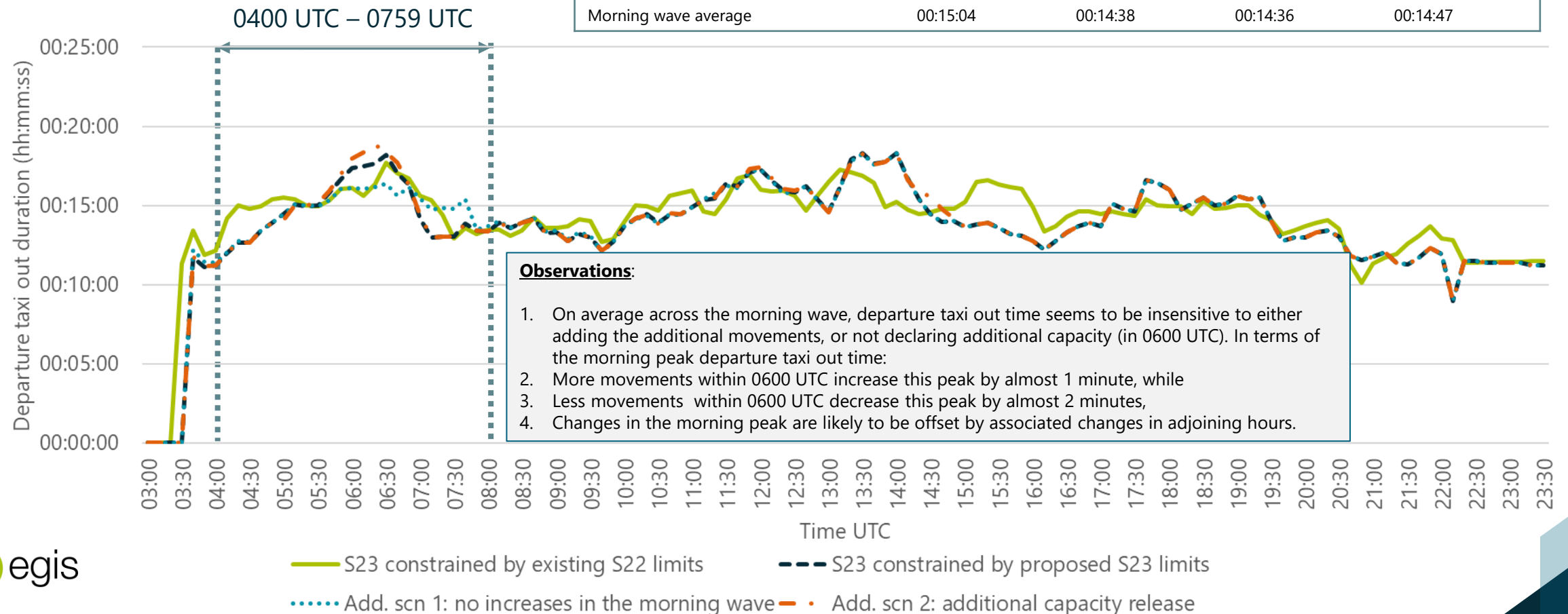
Additional scenario 2: additional capacity release

Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total	
Arrivals																										
Proposed S23 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	29	24	27	23	26	27	23	23	23	25	30	28	23	591	
Arrivals in simulated S23 schedule	9	0	0	7	11	4	9	18	24	24	26	29	24	24	20	18	27	22	17	20	22	29	23	13	420	
<i>Historic</i>	9	0	0	7	9	4	8	15	20	23	20	22	19	21	18	17	21	18	16	18	17	23	23	13	361	
<i>Additional arrivals proposed for S23</i>	0	0	0	0	2	0	1	3	4	1	6	7	5	3	2	1	6	4	1	2	5	6	0	0	59	
Spare capacity (against S23 wishlist)	14	23	23	16	12	19	11	7	1	1	1	0	0	3	3	8	0	1	6	3	3	1	5	10	171	
Departures Additional capacity is released in 06:00 UTC (+2 departures) on top of S23 Wishlist																										
Proposed S23 departures capacity	25	25	25	25	25	36	37	25	25	24	27	28	27	26	27	25	29	27	26	22	22	25	25	25	633	
Departures in simulated S23 schedule	3	0	2	0	15	36	37	16	19	24	22	22	25	26	27	22	25	25	26	19	9	13	0	2	415	
<i>Historic</i>	3	0	2	0	15	36	28	16	15	22	18	19	21	20	23	22	21	20	23	17	9	12	0	2	364	
<i>Additional departures proposed for S23</i>	0	0	0	0	0	0	9	0	4	2	4	3	4	6	4	0	4	5	3	2	0	1	0	0	51	
Spare capacity (against S23 wishlist)	22	25	23	25	10	0	0	9	6	0	5	6	2	0	0	3	4	2	0	3	13	12	25	23	218	
Totals Additional capacity is released in 06:00 UTC (+2 totals) and in 14:00 UTC (+2 totals) on top of S23 Wishlist																										
Proposed S23 totals capacity	32	32	32	32	32	40	46	41	45	48	48	51	49	50	47	47	52	47	43	39	38	42	32	32	997	
Totals in simulated S23 schedule	12	0	2	7	26	40	46	34	43	48	48	51	49	50	47	40	52	47	43	39	31	42	23	15	835	
<i>Historic</i>	12	0	2	7	24	40	36	31	35	45	38	41	40	41	41	39	42	38	39	35	26	35	23	15	725	
<i>Additional movements proposed for S23</i>	0	0	0	0	2	0	10	3	8	3	10	10	9	9	6	1	10	9	4	4	5	7	0	0	110	
Spare capacity (against S23 wishlist)	20	32	30	25	6	0	0	7	2	0	0	0	0	0	0	7	0	0	0	0	7	0	9	17	162	

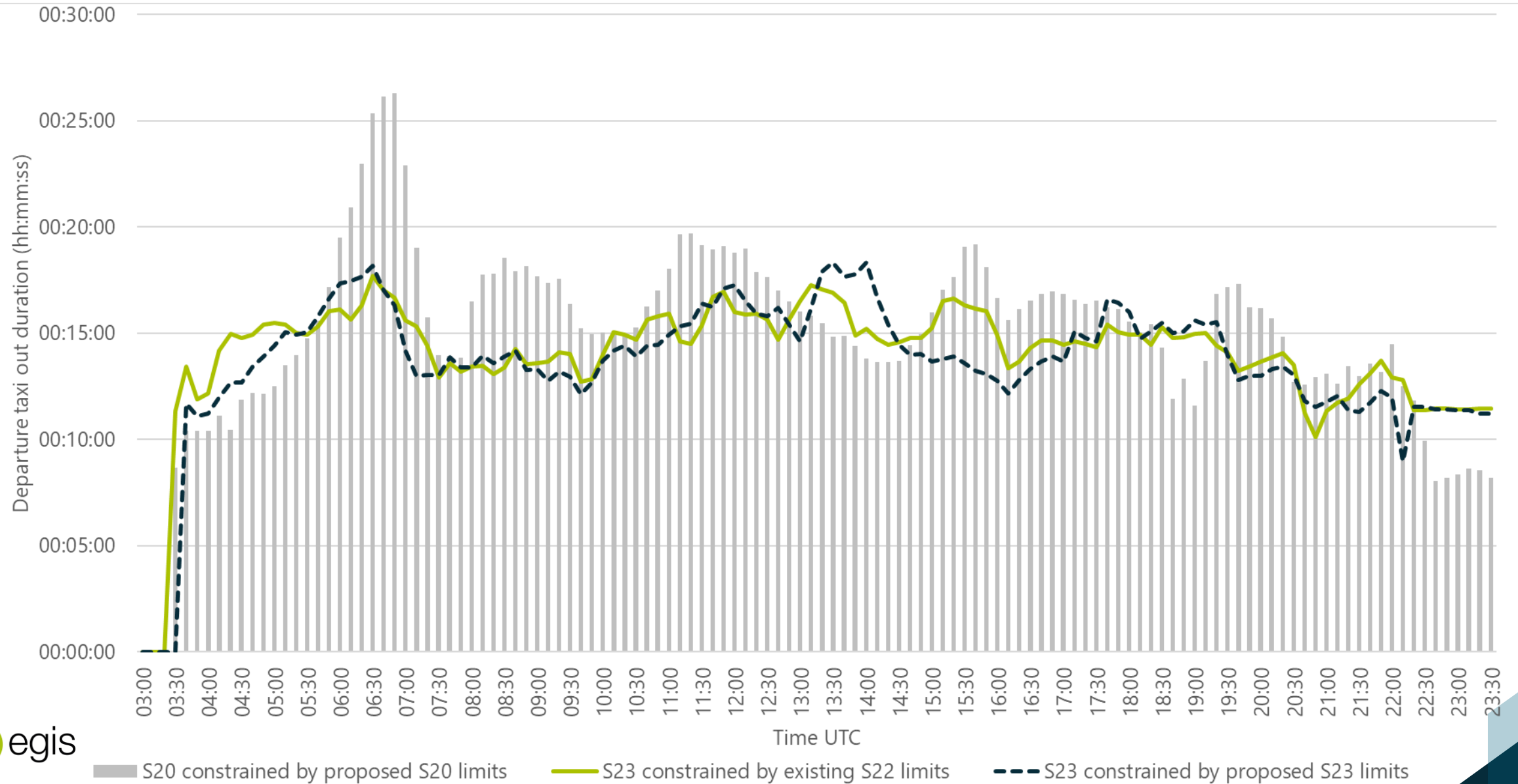
Departure taxi out time

Definition: This metric is defined to be the time period between off-block and the time the aircraft reaches its stop bar for runway entry. This value is updated every second during the simulation when the aircraft is taxiing for departure even if the aircraft is stopped on ground.

Morning wave (0400 UTC – 0759 UTC)	S22 limits	S23 limits	Add. Scn 1	Add. Scn 2
Morning wave peak	00:17:41	00:18:10	00:16:23	00:18:51
Morning wave average	00:15:04	00:14:38	00:14:36	00:14:47



Request to compare against S20 modelled back in 2019





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