HELIOS

The aviation consultancy of Egis

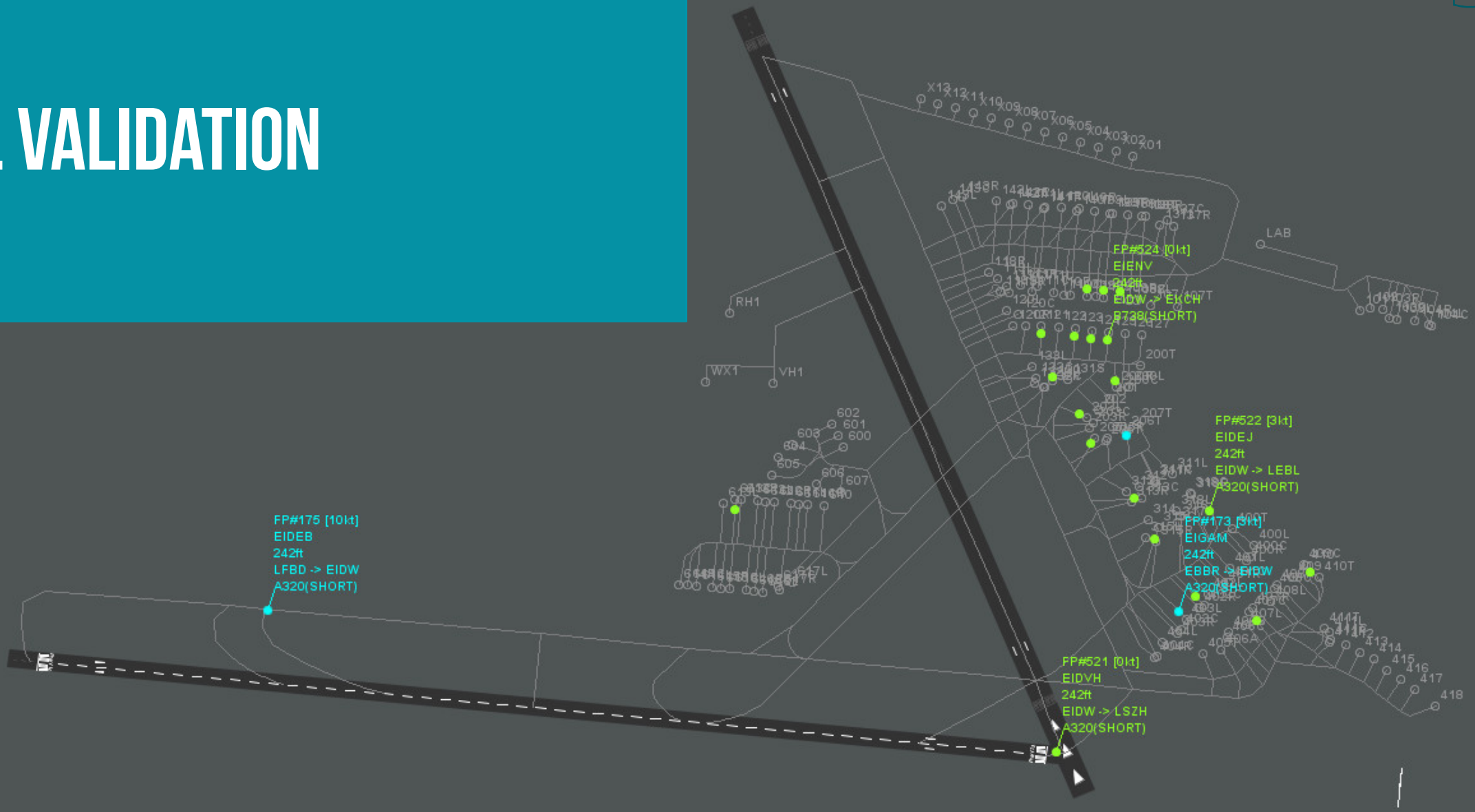
SUMMER 2019: ASSESSMENT OF THE LIKELY IMPACT OF DECLARING THE WISHLIST RUNWAY CAPACITY

PETER STRAKA

an egis company

CONTENTS

MODEL VALIDATION



MODEL DESCRIPTION

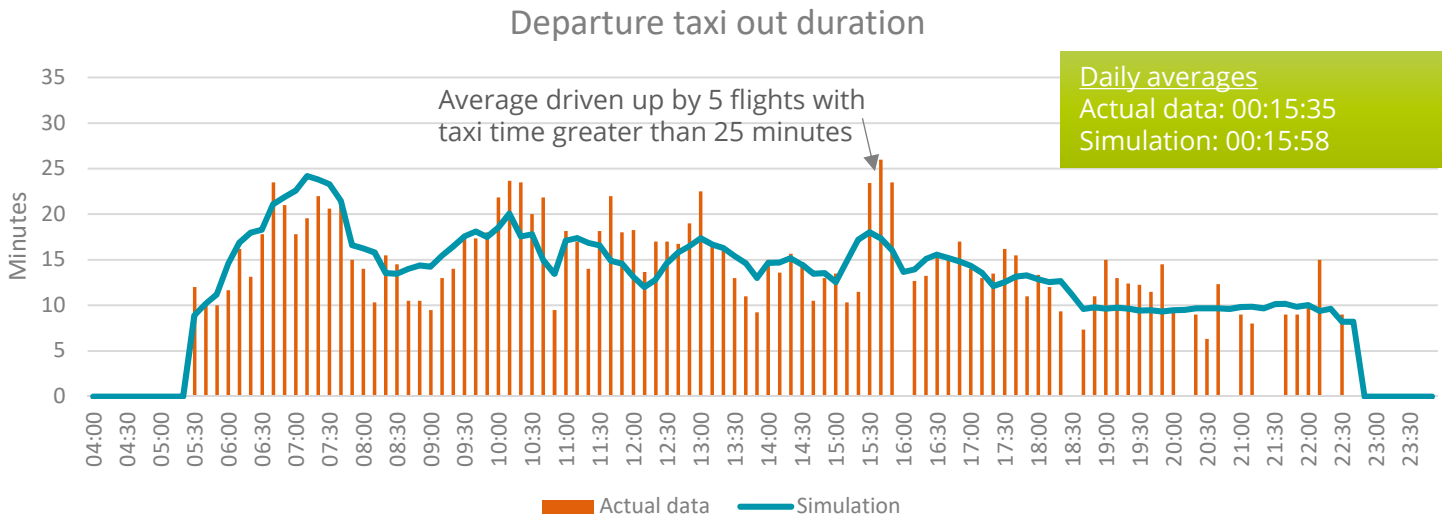
- Based on the model developed in support of coordination of the previous seasons.
- Historically validated against selected S16, S17 and W17 design days.
- Calibrated again, against two days of S18 operations:
  - 02 June 2018, and
  - 05 July 2018.
- Validation run from actual block times to take into account all types of delays.
- Comparison against a set of airside metrics provided.

VALIDATION EXERCISE 1: AGAINST 02 JUN 2018

SELECTED DAY SIMULATED FOR VALIDATION PURPOSES (02 JUN 2018)

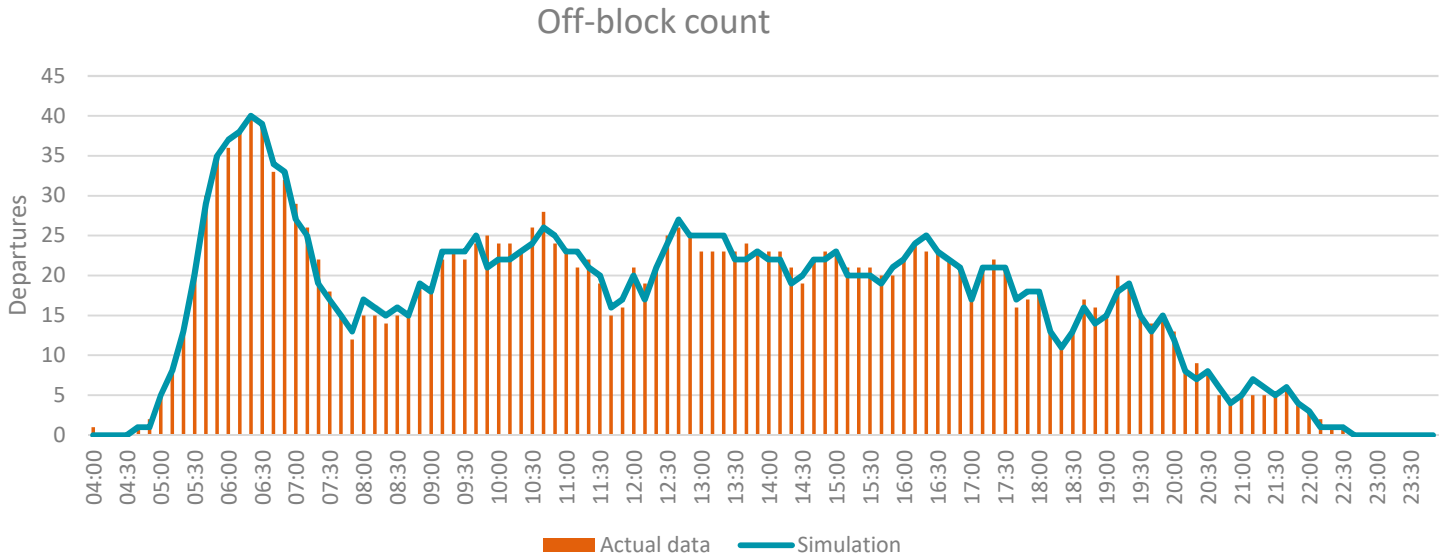
- RWY 28 in operations for 98% of the time
  - 6 morning arrivals on RWY 10 simulated on RWY 28,
  - 7 late night arrivals on RWY 16 simulated on RWY 28,
  - All departures from RWY 28.
- 682 flights total, incl. GA and cargo
  - 341 arrivals and 341 departures,
  - 4 helicopter operations not simulated.

CALIBRATION OF DEPARTURE PERFORMANCE (02 JUN 2018)



Metric definition:
Time duration between the off-block time and aircraft lifting off

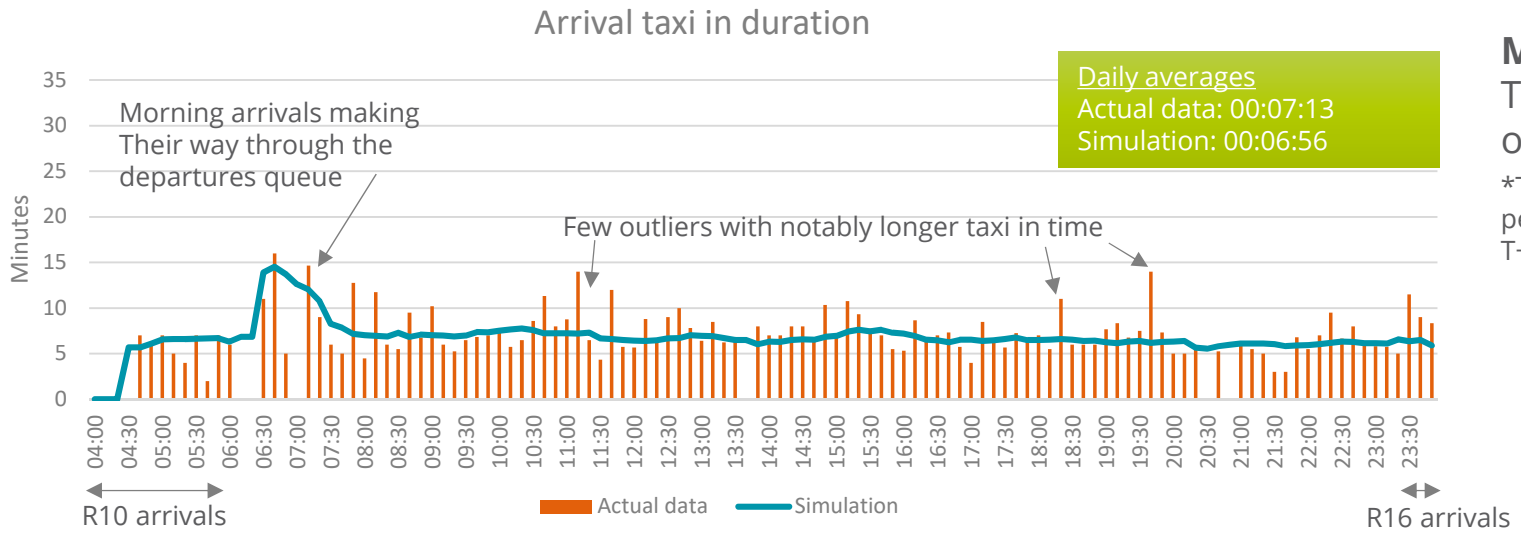
*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).



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)

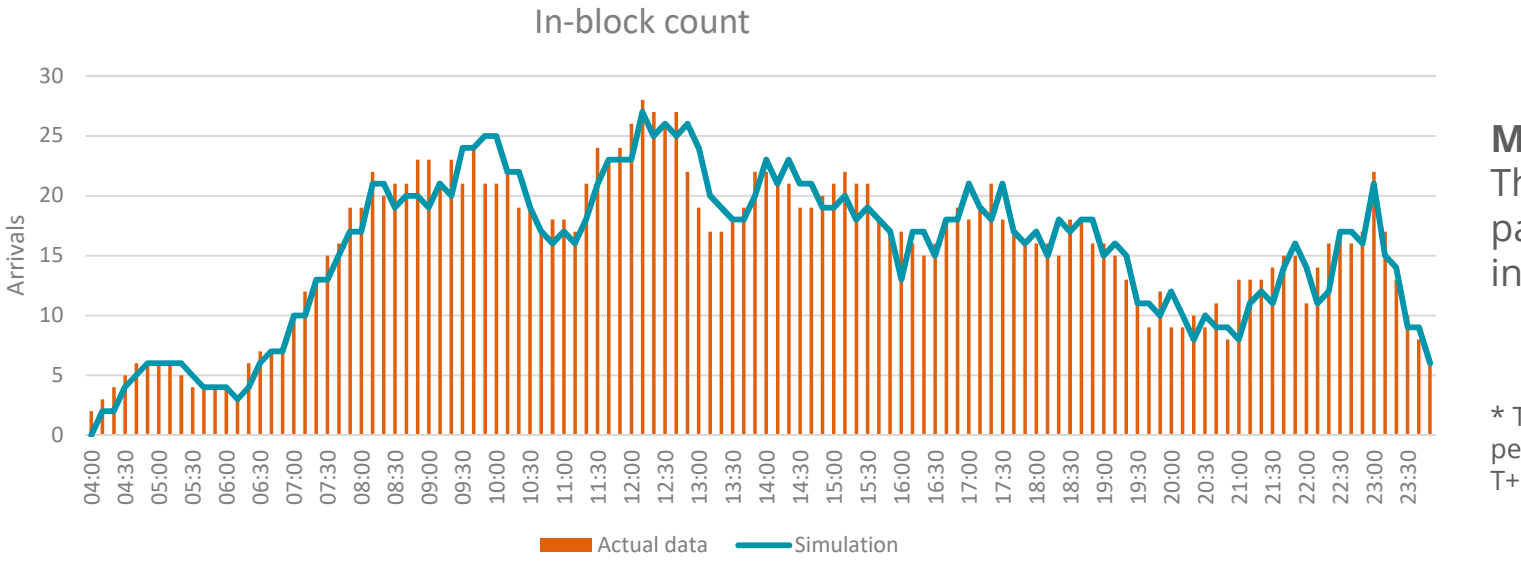
* This graph is presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

CALIBRATION OF ARRIVAL PERFORMANCE (02 JUN 2018)



Metric definition:
Time duration between touch-down and aircraft parking on-blocks

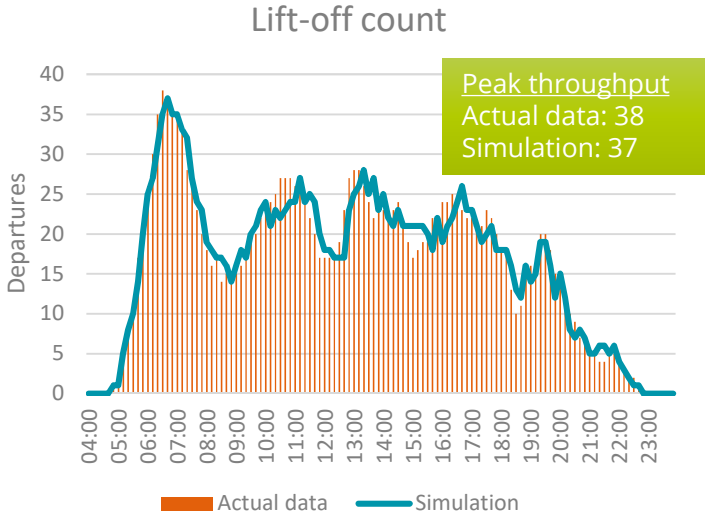
*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).

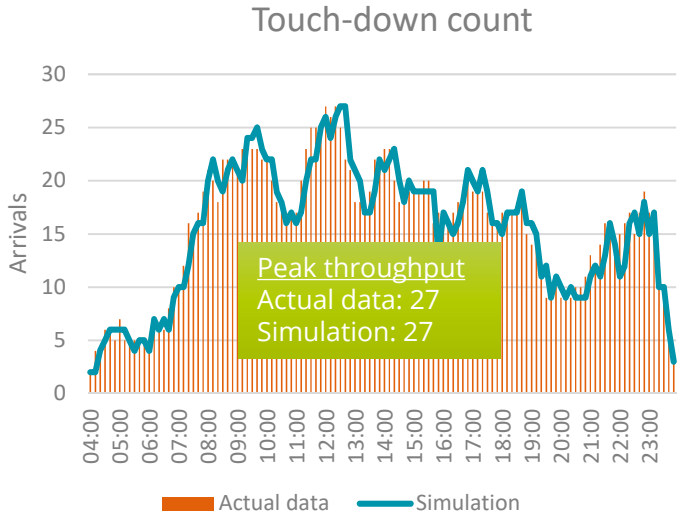


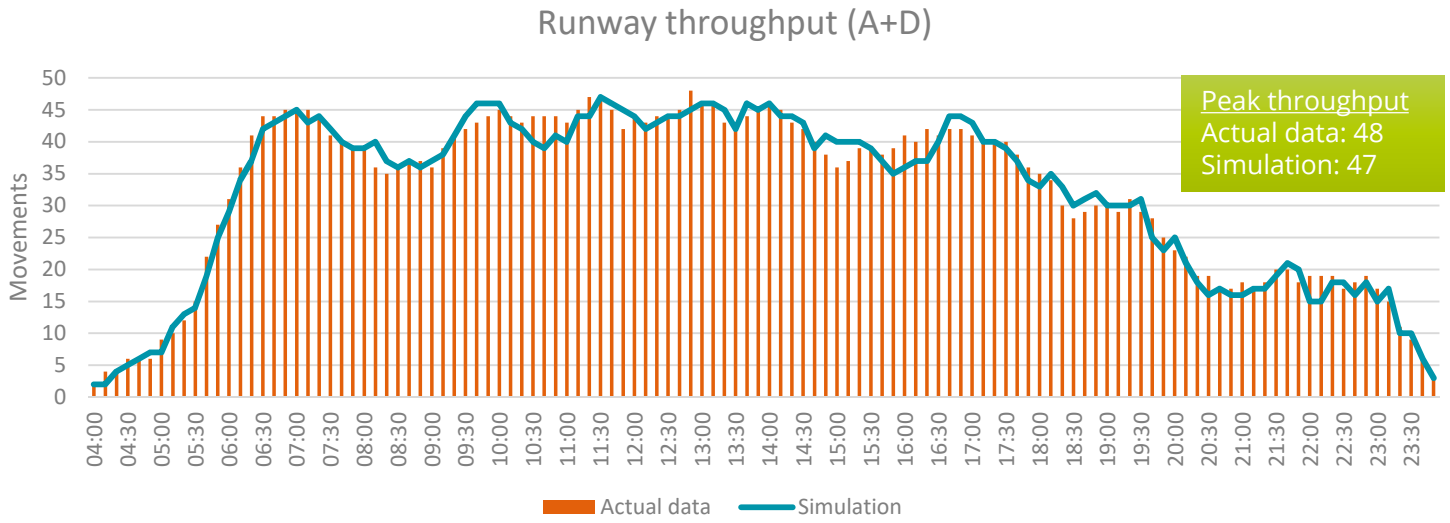
Metric definition:
The number of aircraft that have reached their arrival parking position in the last rolling period. The count is incremented when aircraft reaches its in-blocks position.

* 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 (02 JUN 2018)







Metric definition:

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

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

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

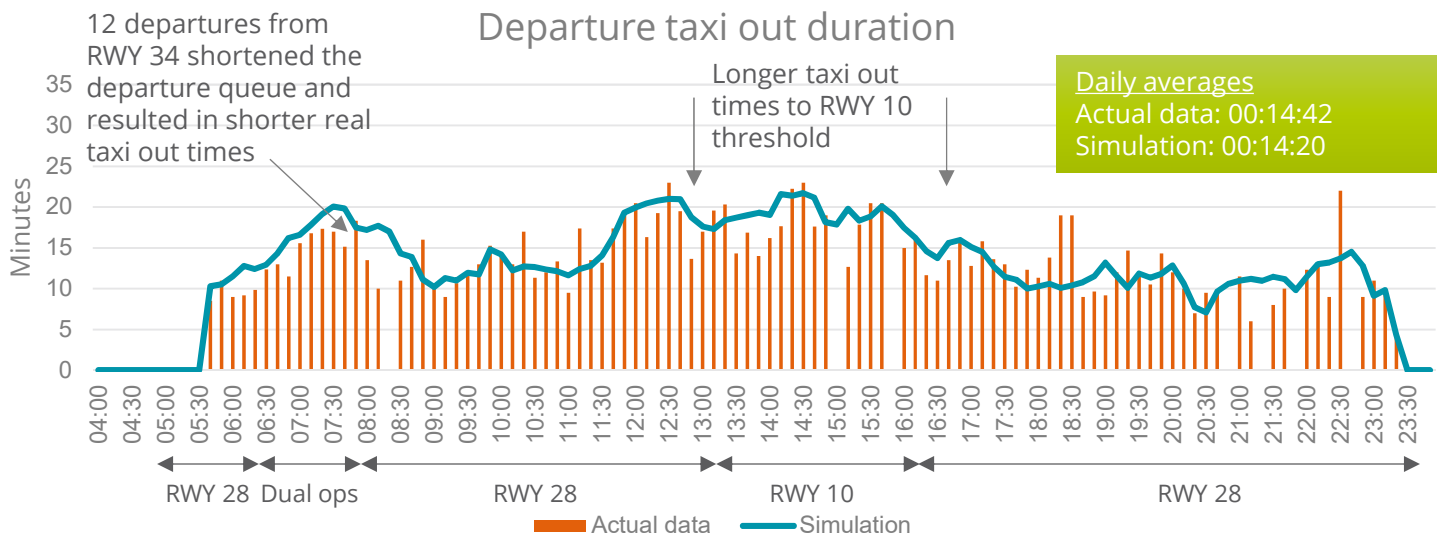
* All graphs are presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

VALIDATION EXERCISE 2: AGAINST 05 JULY 2018

SELECTED DAY SIMULATED FOR VALIDATION PURPOSES (05 JULY 2018)

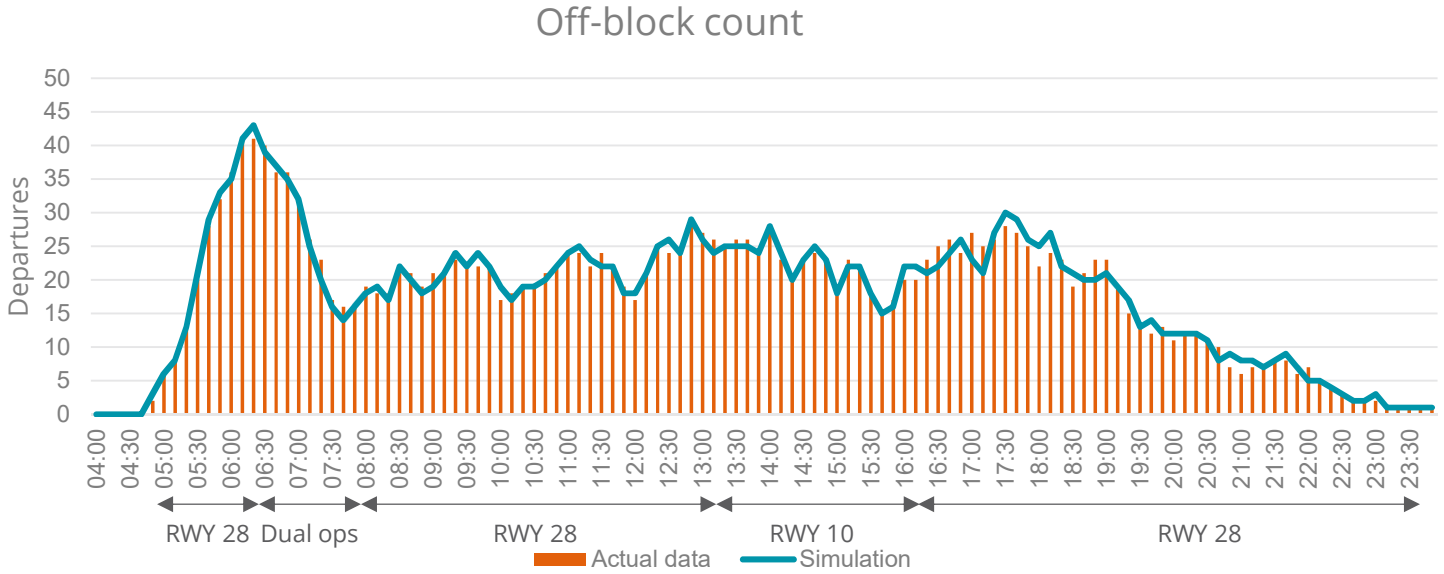
- RWY 28 in operations for 79% of the time
  - 19% of flights simulated from RWY 10 (early afternoon),
  - 12 early morning departures which used RWY 34 simulated on RWY 28,
- 735 flights total, incl. GA and cargo
  - 372 arrivals and 363 departures

CALIBRATION OF DEPARTURE PERFORMANCE (05 JULY 2018)



Metric definition:
Time duration between the off-block time and aircraft lifting off

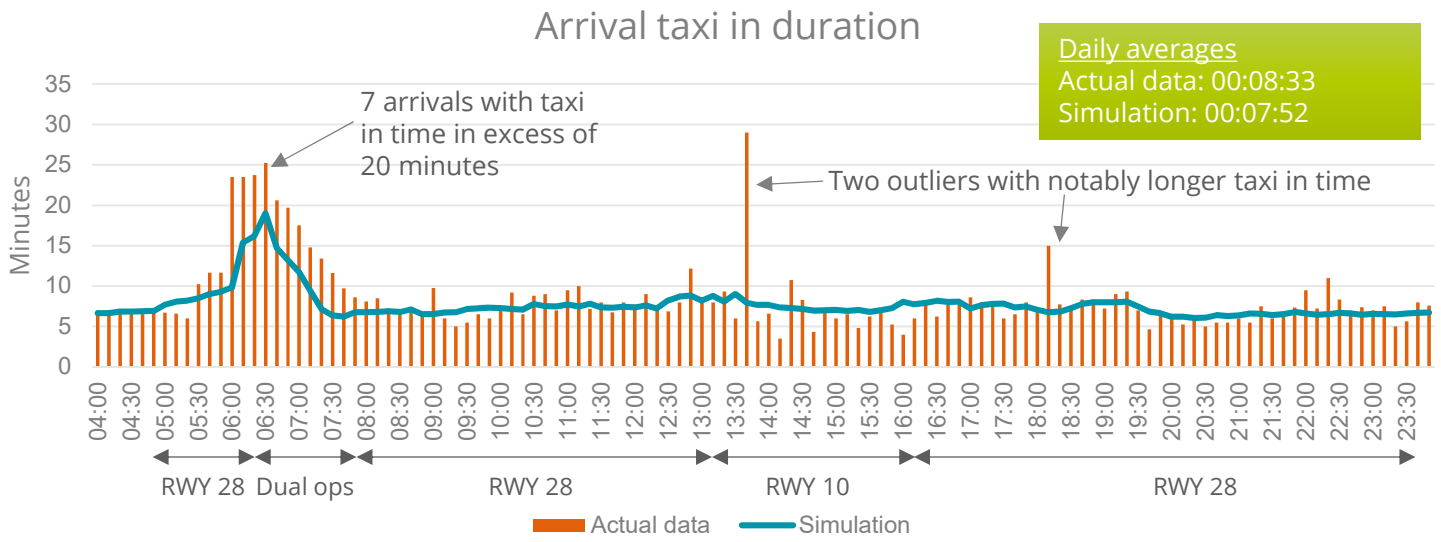
*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).



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)

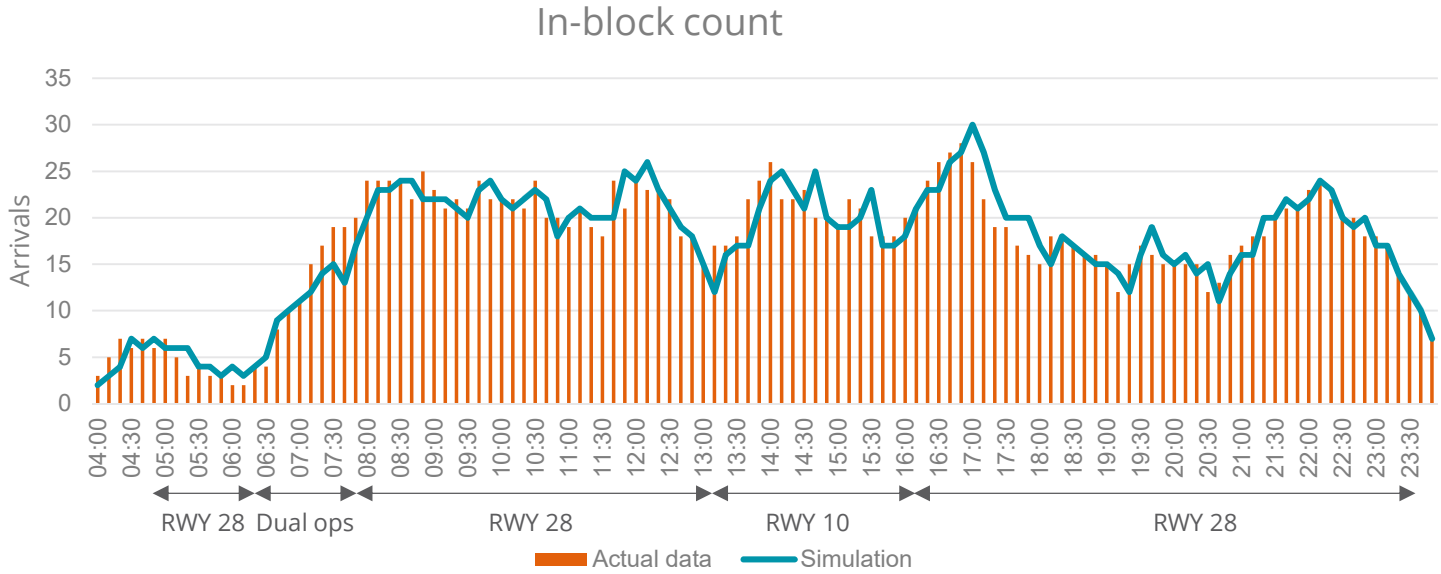
* This graph is presented as a rolling 60-minute average (value for each time period has been calculated as average of values of all events occurring within the T+60 minutes window from the start of the measurement).

CALIBRATION OF ARRIVAL PERFORMANCE (05 JULY 2018)



Metric definition:
Time duration between touch-down and aircraft parking on-blocks

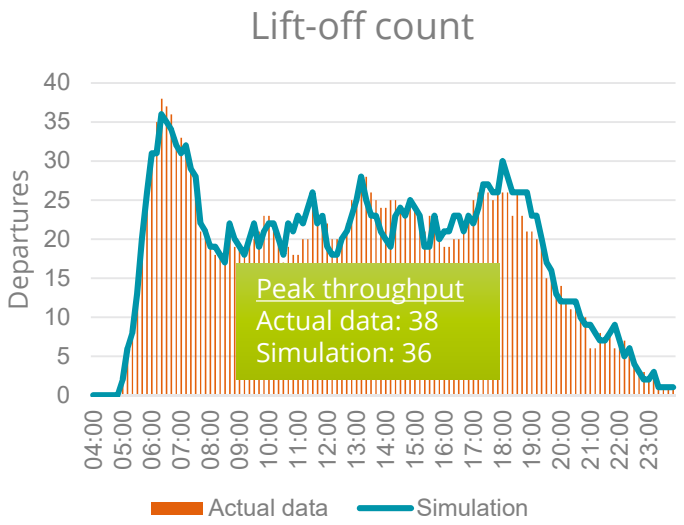
*This graph is presented as a rolling 10-minute average (value for each time period has been calculated as average of values of all events occurring within the T+10 minutes window from the start of the measurement).

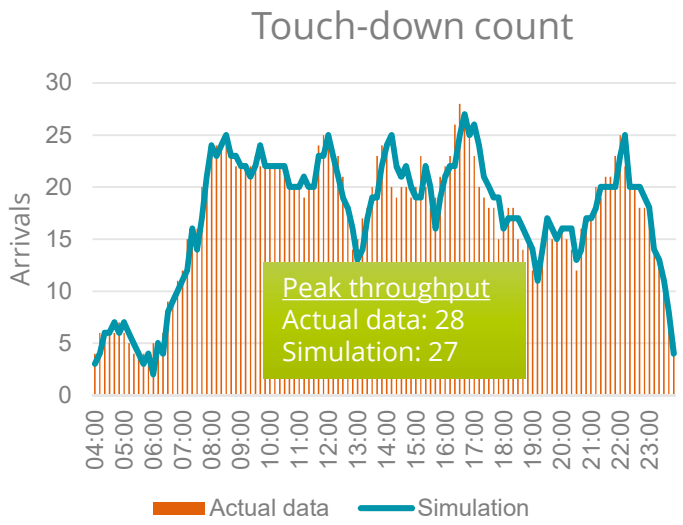


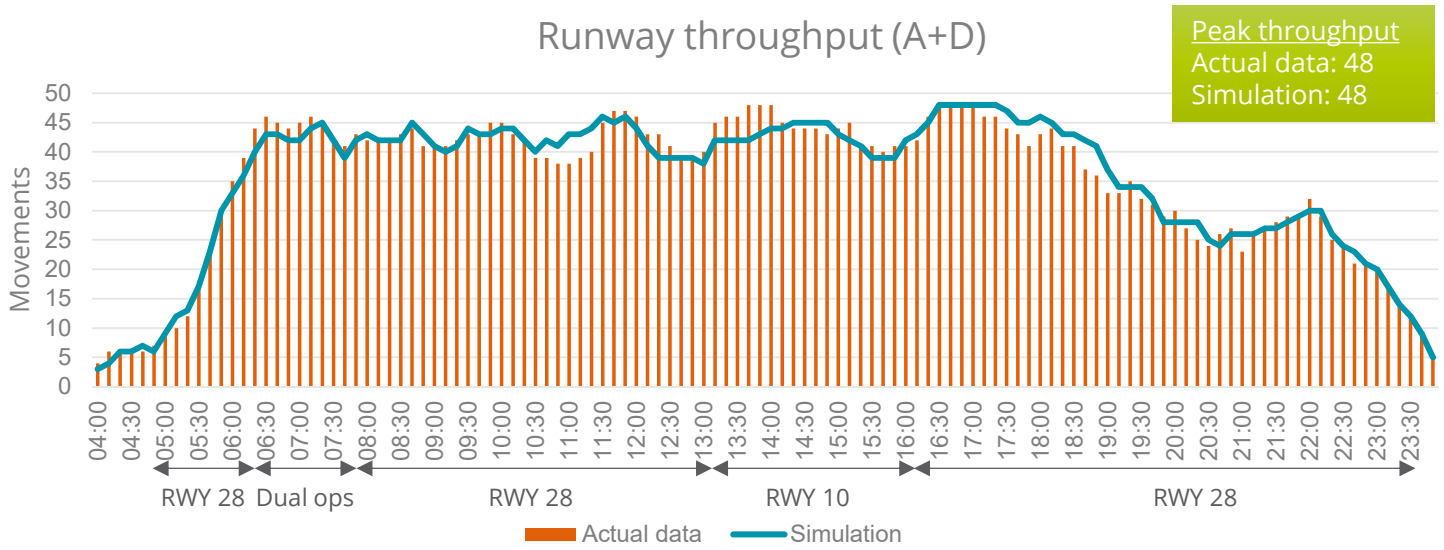
Metric definition:
The number of aircraft that have reached their arrival parking position in the last rolling period. The count is incremented when aircraft reaches its in-blocks position.

* 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 (05 JULY 2018)







Metric definition:

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

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

Runway throughput: Sum of all aircraft touching down and lifting-off in the last 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

- Validation against both selected days resulted in a similar degree of match with reality.
- As the metrics calculated through the FTS model closely match the real-world data, both in terms of the magnitude and the shape of profile throughout the day, the model can be considered as a satisfactorily representation of reality for the purpose of evaluating the impact of proposed changes in 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.

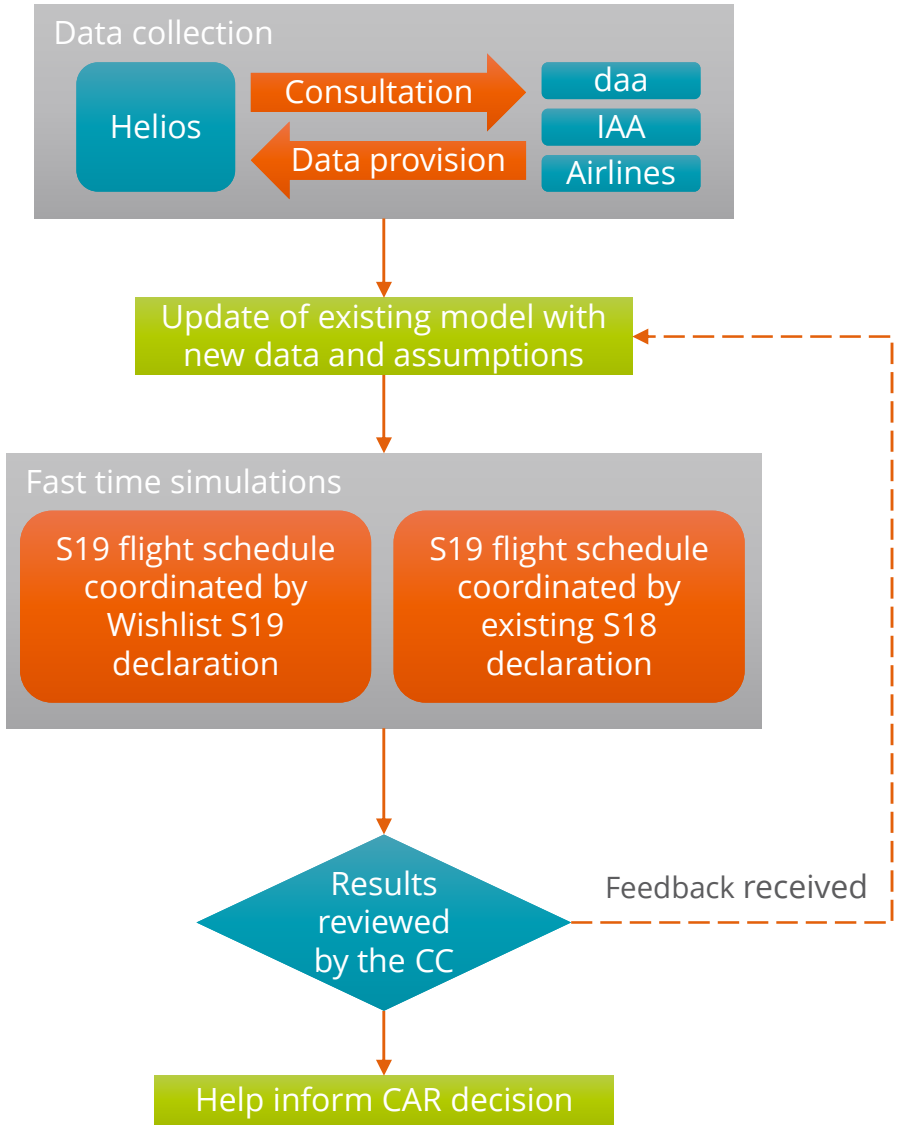
S19 - METHODOLOGY

Photo source: http://www.daa.ie/media-centre/image-library/

TASK DESCRIPTION

- The purpose of this comparison is to assess the likely effect of either:
  - declaring an increased runway capacity, as per the Wishlist*, or
  - maintaining the Summer 2018 capacity declaration limits
- In both cases it is presumed that the Summer 2019 schedule of increased demand materialises as expected.
- The same number of movements are modelled in both 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 2019 day.
- * The Wishlist used for the purposes of this assessment is the set of amendments which has been proposed by Dublin Airport. This set of amendments is a reduced form of the Wishlist compiled by ACL, which contained significantly more increases to the Runway limits.
- Following the Coordination Committee pre-meeting this assessment was complemented with evaluation of additional three alternative Wishlists. For more information see slides 35 to 42.

APPROACH AND KEY CHANGES IN THE MODEL



- Runway occupancy times have been updated taking into account Summer 2018 averages to-date.
- Rule-based stand allocation driven by historic data
  - Towing implemented to manage demand for Code E stands
- No changes to the airfield layout (taxiways, stands)
- No changes to operating procedures
  - Departure-departure separation kept at minimum of 84 seconds
  - Arrival-arrival separation kept at minimum of 3.5 NM
  - A-D-A separation kept at 5.5 NM
- No A-CDM assumptions have been included

SUMMER 2019 FLIGHT SCHEDULE

- The flight schedule used for modelling of both scenarios:
  - Is based on 5th of July 2018 flight schedule (which was already a busy day before the new services were added)
  - Contains total of 771 flights (384 arrivals and 387 departures)
  - Contains 37 new services (18 new arrivals and 19 new departures)

PROPOSED S19 WISHLIST

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 S18 arrivals capacity	23	23	23	23	23	23	20	25	24	24	27	27	23	27	23	26	25	23	23	23	25	30	28	23	**584**
Proposed S19 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	28	23	27	23	26	25	23	23	23	25	30	28	23	**587**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	0	+1	0	0	0	0	0	0	0	0	0	0	0	0	**+3**
Departures																									
Existing S18 departures capacity	25	25	25	25	25	36	31	25	25	24	27	28	27	24	26	25	29	27	24	22	22	25	25	25	**622**
Proposed S19 departures capacity	25	25	25	25	25	36	31	25	25	24	28	28	28	24	26	25	29	27	26	22	22	25	25	25	**626**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	0	0	+1	0	+1	0	0	0	0	0	+2	0	0	0	0	0	**+4**
Totals																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	32	**949**
Proposed S19 totals capacity	32	32	32	32	32	40	42	42	44	44	46	48	47	46	44	46	49	45	39	39	38	36	32	32	**959**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	+1	+1	+1	0	0	0	+1	+1	+2	+1	0	0	0	0	**+10**

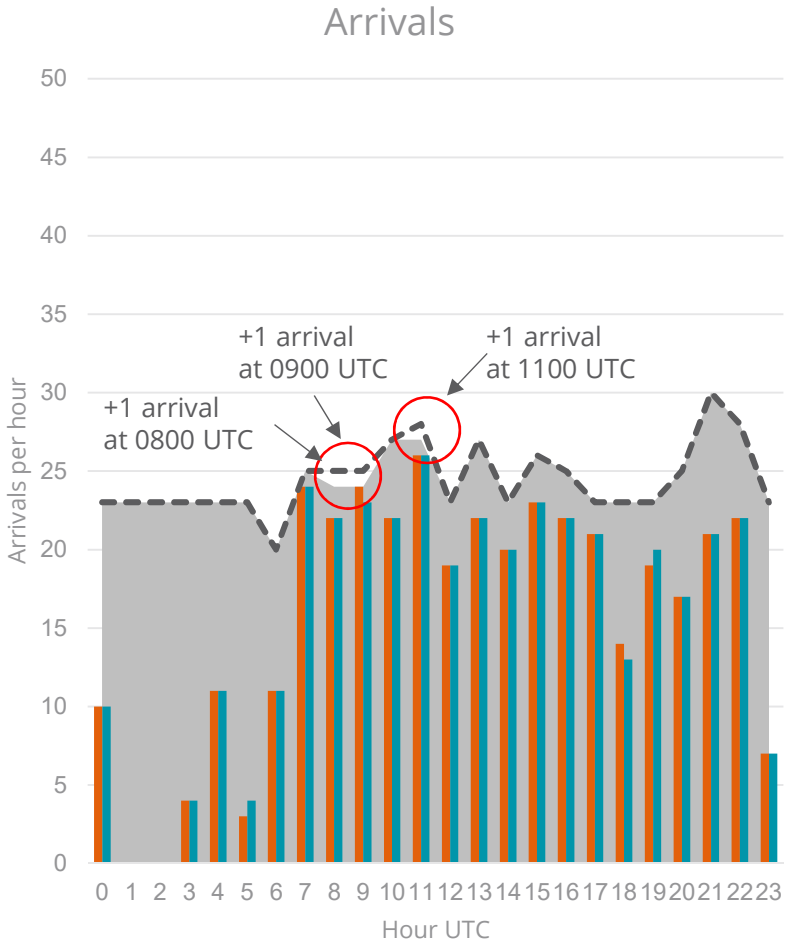
S19 COORDINATED TO PROPOSED S19 LIMITS

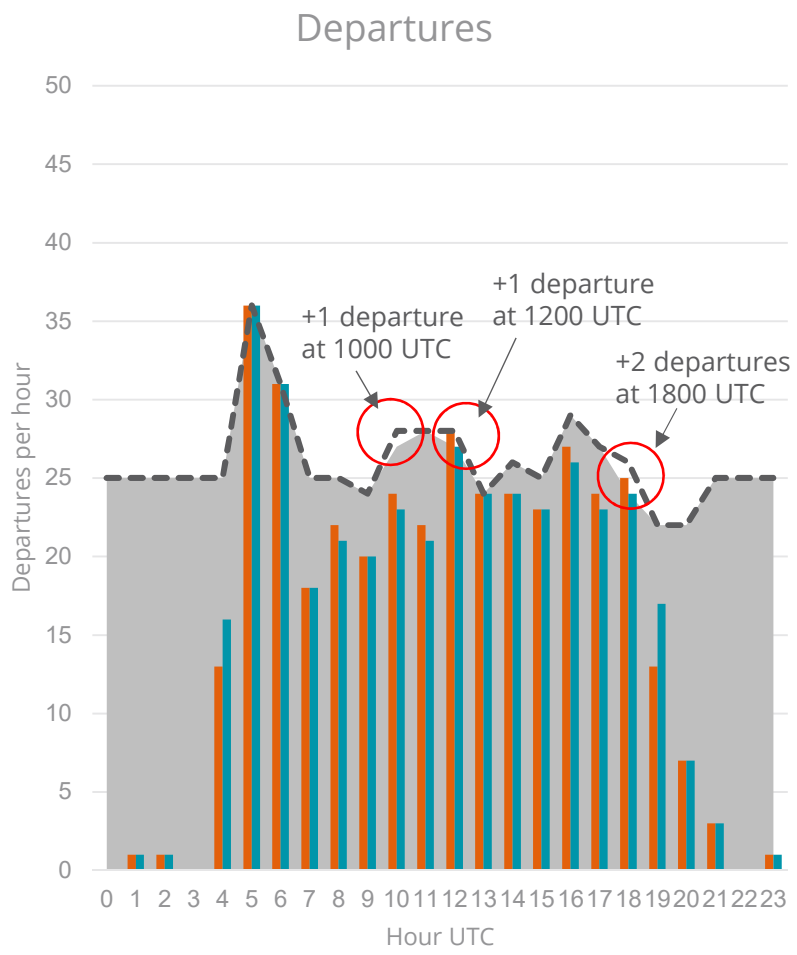
Hour UTC	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	Total
Arrivals																									
Wishlist S19 arrivals capacity	23	23	23	23	23	23	20	25	25	25	27	28	23	27	23	26	25	23	23	23	25	30	28	23	**587**
Arrivals in simulated S19 schedule	10	0	0	4	11	3	11	24	22	24	22	26	19	22	20	23	22	21	14	19	17	21	22	7	**384**
Historic	*10*	*0*	*0*	*4*	*10*	*2*	*10*	*23*	*22*	*23*	*22*	*26*	*17*	*20*	*20*	*22*	*20*	*21*	*13*	*17*	*17*	*20*	*20*	*7*	***366***
Additional arrivals proposed for S19	*0*	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*1*	*0*	*0*	*2*	*2*	*0*	*1*	*2*	*0*	*1*	*2*	*0*	*1*	*2*	*0*	***18***
Spare capacity (against S19 wishlist)	13	23	23	19	12	20	9	1	3	1	5	2	4	5	3	3	3	2	9	4	8	9	6	16	**203**
Departures																									
Wishlist S19 Departures capacity	25	25	25	25	25	36	31	25	25	24	28	28	28	24	26	25	29	27	26	22	22	25	25	25	**626**
Departures in simulated S19 schedule	0	1	1	0	13	36	31	18	22	20	24	22	28	24	24	23	27	24	25	13	7	3	0	1	**387**
Historic	*0*	*1*	*1*	*0*	*10*	*36*	*31*	*18*	*21*	*19*	*23*	*21*	*28*	*22*	*21*	*23*	*24*	*23*	*24*	*12*	*6*	*3*	*0*	*1*	***368***
Additional departures proposed for S19	*0*	*0*	*0*	*0*	*3*	*0*	*0*	*0*	*1*	*1*	*1*	*1*	*0*	*2*	*3*	*0*	*3*	*1*	*1*	*1*	*1*	*0*	*0*	*0*	***19***
Spare capacity (against S19 wishlist)	25	24	24	25	12	0	0	7	3	4	4	6	0	0	2	2	2	3	1	9	15	22	25	24	**239**
Totals																									
Wishlist S19 Totals capacity	32	32	32	32	32	40	42	42	44	44	46	48	47	46	44	46	49	45	39	39	38	36	32	32	**959**
Totals in simulated S19 schedule	10	1	1	4	24	39	42	42	44	44	46	48	47	46	44	46	49	45	39	32	24	24	22	8	**771**
Historic	*10*	*1*	*1*	*4*	*20*	*38*	*41*	*41*	*43*	*42*	*45*	*47*	*45*	*42*	*41*	*45*	*44*	*44*	*37*	*29*	*23*	*23*	*20*	*8*	***734***
Additional movements proposed for S19	*0*	*0*	*0*	*0*	*4*	*1*	*1*	*1*	*1*	*2*	*1*	*1*	*2*	*4*	*3*	*1*	*5*	*1*	*2*	*3*	*1*	*1*	*2*	*0*	***37***
Spare capacity (against S19 wishlist)	22	31	31	28	8	1	0	0	0	0	0	0	0	0	0	0	0	0	0	7	14	12	10	24	**188**

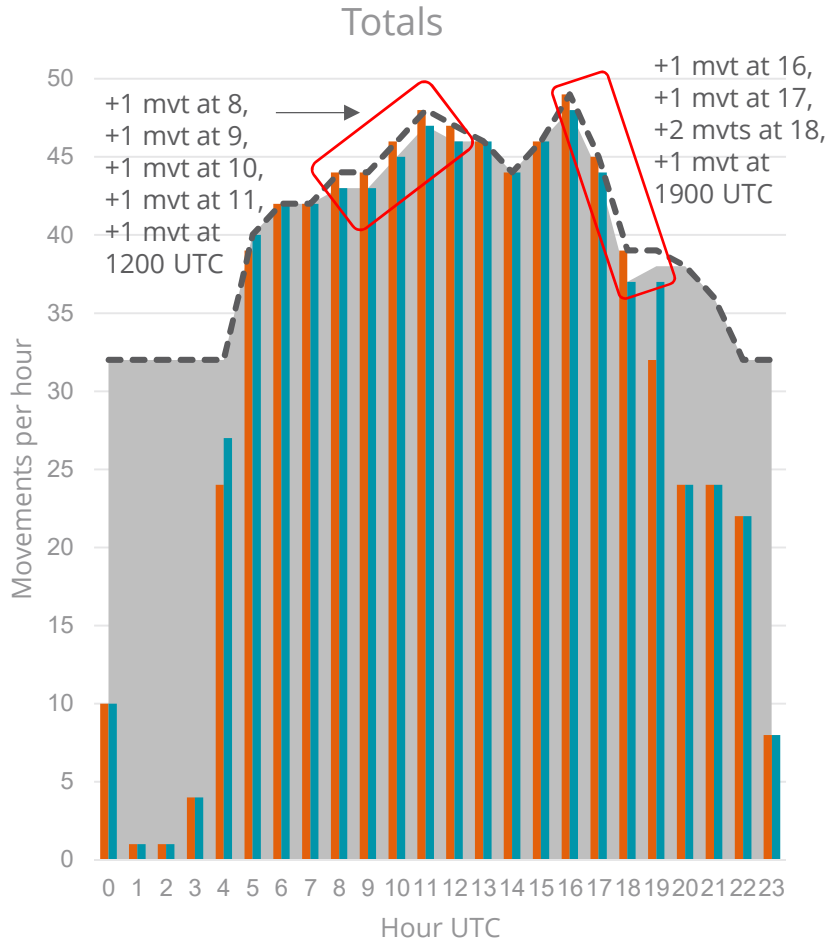
S19 COORDINATED TO S18 LIMITS

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 S18 arrivals capacity	23	23	23	23	23	23	20	25	24	24	27	27	23	27	23	26	25	23	23	23	25	30	28	23	**584**
Arrivals in simulated S19 schedule	10	0	0	4	11	4	11	24	22	23	22	26	19	22	20	23	22	21	13	20	17	21	22	7	**384**
Historic	*10*	*0*	*0*	*4*	*10*	*2*	*10*	*23*	*22*	*23*	*22*	*26*	*17*	*20*	*20*	*22*	*20*	*21*	*13*	*17*	*17*	*20*	*20*	*7*	***366***
Additional arrivals proposed for S19	*0*	*0*	*0*	*0*	*1*	*2*	*1*	*1*	*0*	*0*	*0*	*0*	*2*	*2*	*0*	*1*	*2*	*0*	*0*	*3*	*0*	*1*	*2*	*0*	***18***
Spare capacity (against S18 declaration)	13	23	23	19	12	19	9	1	2	1	5	1	4	5	3	3	3	2	10	3	8	9	6	16	**200**
Departures																									
Existing S18 departures capacity	25	25	25	25	25	36	31	25	25	24	27	28	27	24	26	25	29	27	24	22	22	25	25	25	**622**
Departures in simulated S19 schedule	0	1	1	0	16	36	31	18	21	20	23	21	27	24	24	23	26	23	24	17	7	3	0	1	**387**
Historic	*0*	*1*	*1*	*0*	*10*	*36*	*31*	*18*	*21*	*19*	*23*	*21*	*27*	*22*	*21*	*23*	*24*	*23*	*24*	*13*	*6*	*3*	*0*	*1*	***368***
Additional departures proposed for S19	*0*	*0*	*0*	*0*	*6*	*0*	*0*	*0*	*0*	*1*	*0*	*0*	*0*	*2*	*3*	*0*	*2*	*0*	*0*	*4*	*1*	*0*	*0*	*0*	***19***
Spare capacity (against S18 declaration)	25	24	24	25	9	0	0	7	4	4	4	7	0	0	2	2	3	4	0	5	15	22	25	24	**235**
Totals																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	25	**942**
Totals in simulated S19 schedule	10	1	1	4	27	40	42	42	43	43	45	47	46	46	44	46	48	44	37	37	24	24	22	8	**771**
Historic	*10*	*1*	*1*	*4*	*20*	*38*	*41*	*41*	*43*	*42*	*45*	*47*	*44*	*42*	*41*	*45*	*44*	*44*	*37*	*30*	*23*	*23*	*20*	*8*	***734***
Additional movements proposed for S19	*0*	*0*	*0*	*0*	*7*	*2*	*1*	*1*	*0*	*1*	*0*	*0*	*2*	*4*	*3*	*1*	*4*	*0*	*0*	*7*	*1*	*1*	*2*	*0*	***37***
Spare capacity (against S18 declaration)	22	31	31	28	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	14	12	10	17	**171**

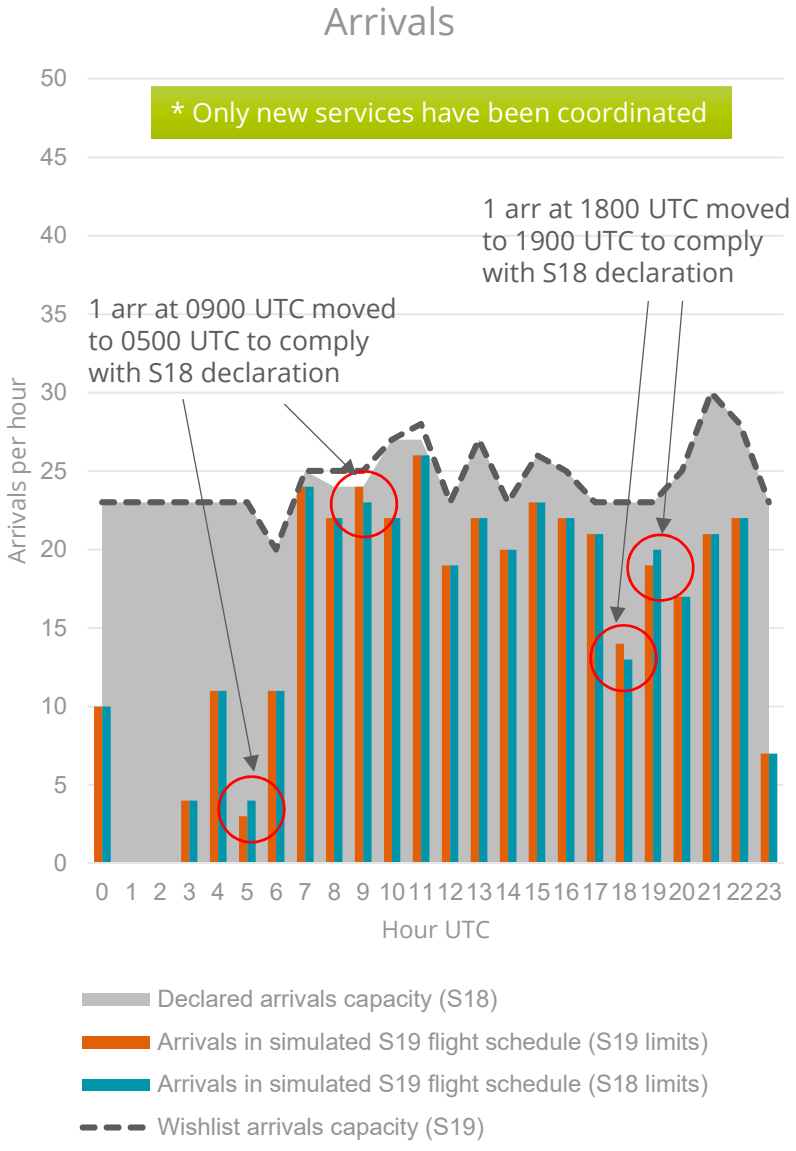
DIFFERENCE BETWEEN EXISTING S18 AND PROPOSED S19 CAPACITY DECLARATION

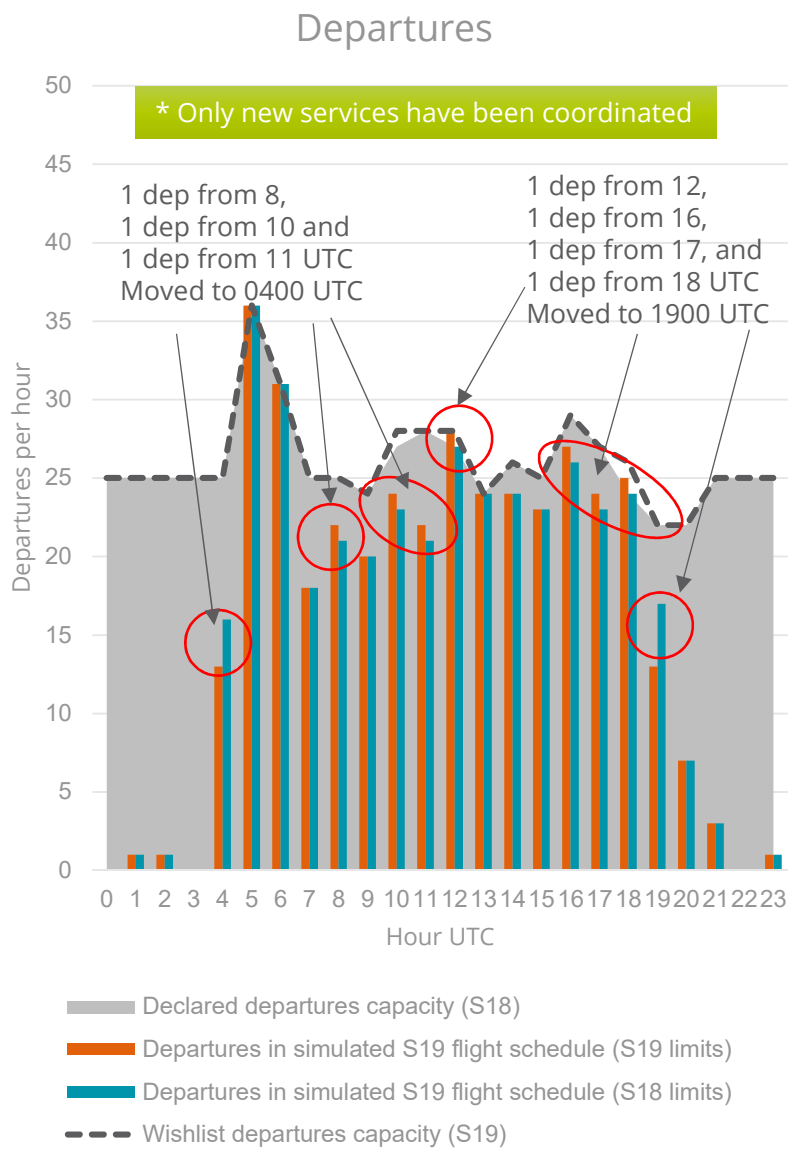


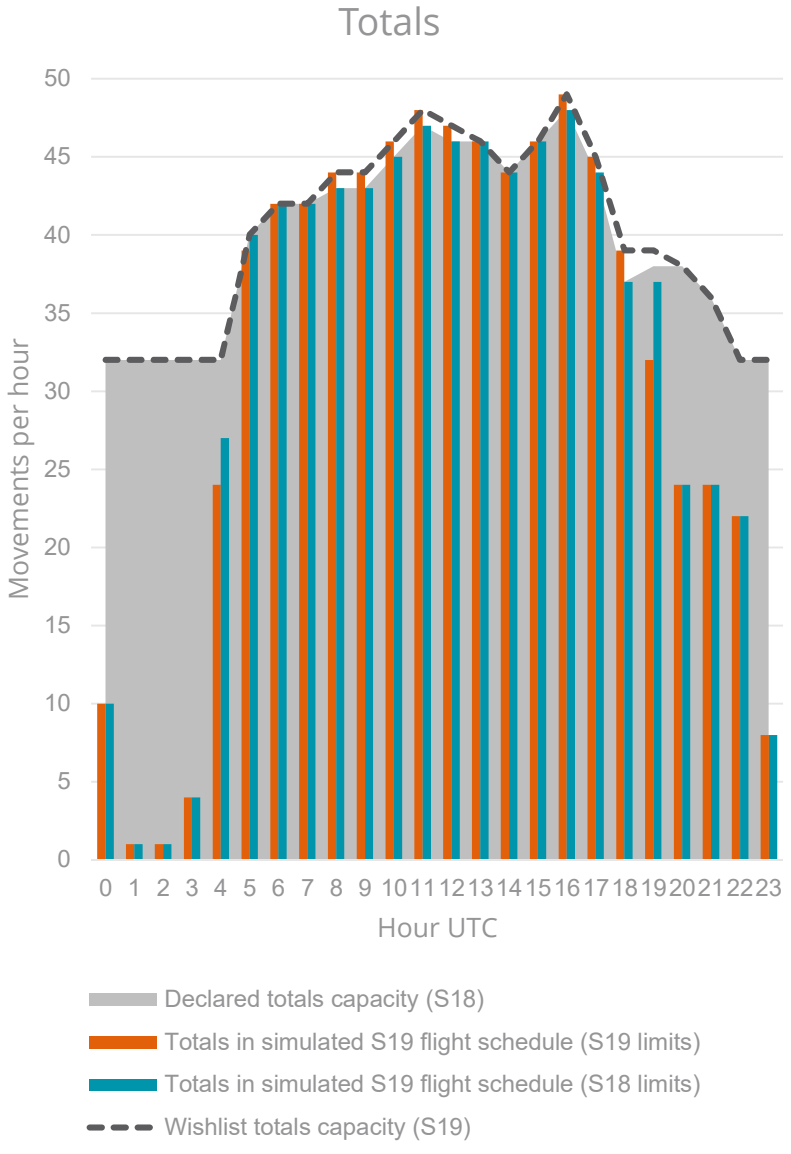




COORDINATING THE SCHEDULE TO THE S18 LIMITS RESULTS IN FLIGHT TIME CHANGES





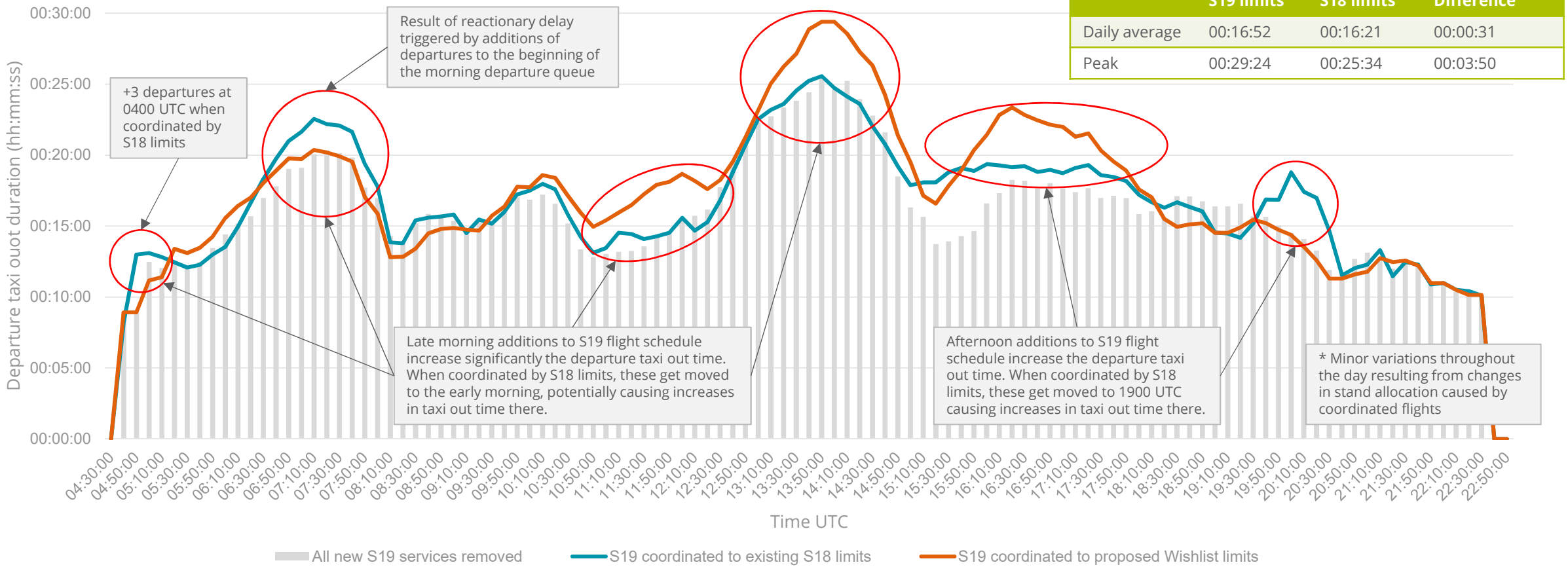


RESULTS (RUNWAY 28)

DEPARTURE TAXI OUT TIME

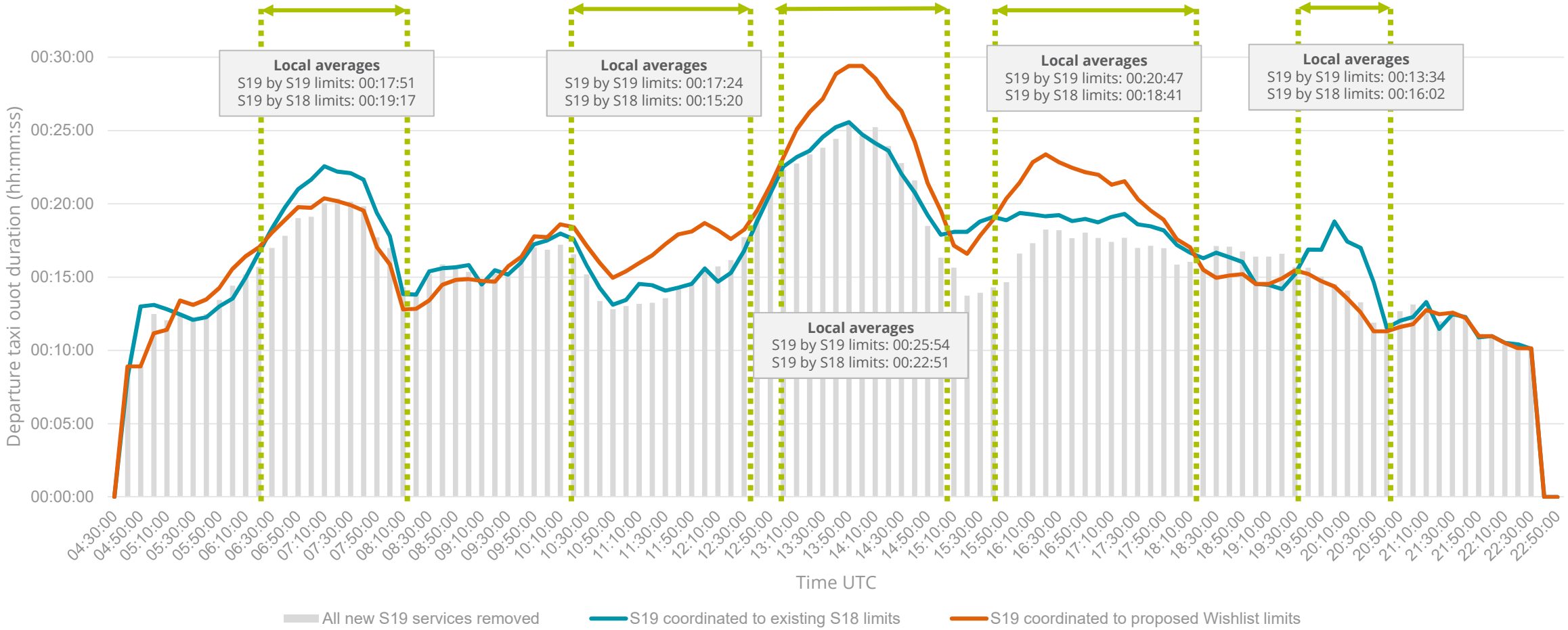
Definition: The time duration the aircraft has been taxiing for departure on the ground of its departure airport. This value is updated every second of simulation time when the aircraft is taxiing for departure even if the aircraft is stopped on ground. This metric is defined to be the time period between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

	S19 limits	S18 limits	Difference
Daily average	00:16:52	00:16:21	00:00:31
Peak	00:29:24	00:25:34	00:03:50



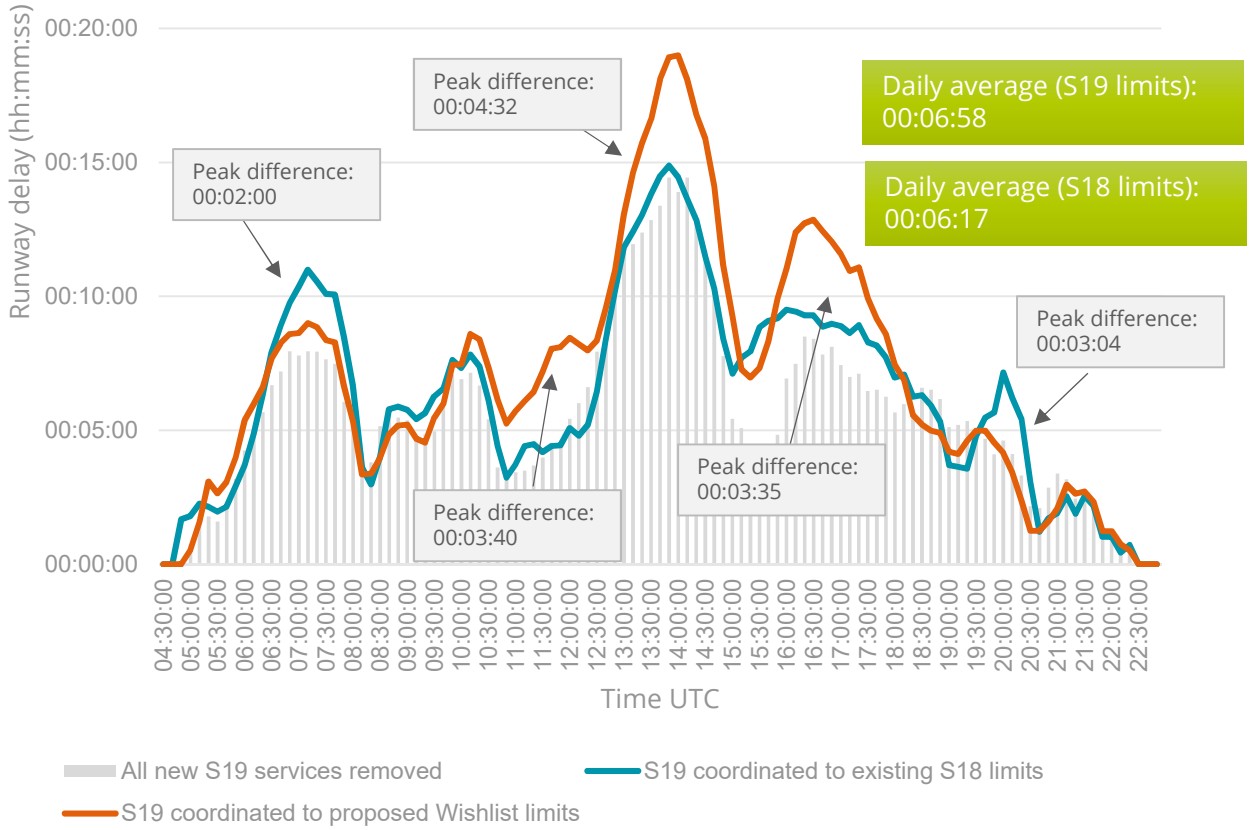
DEPARTURE TAXI OUT TIME

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

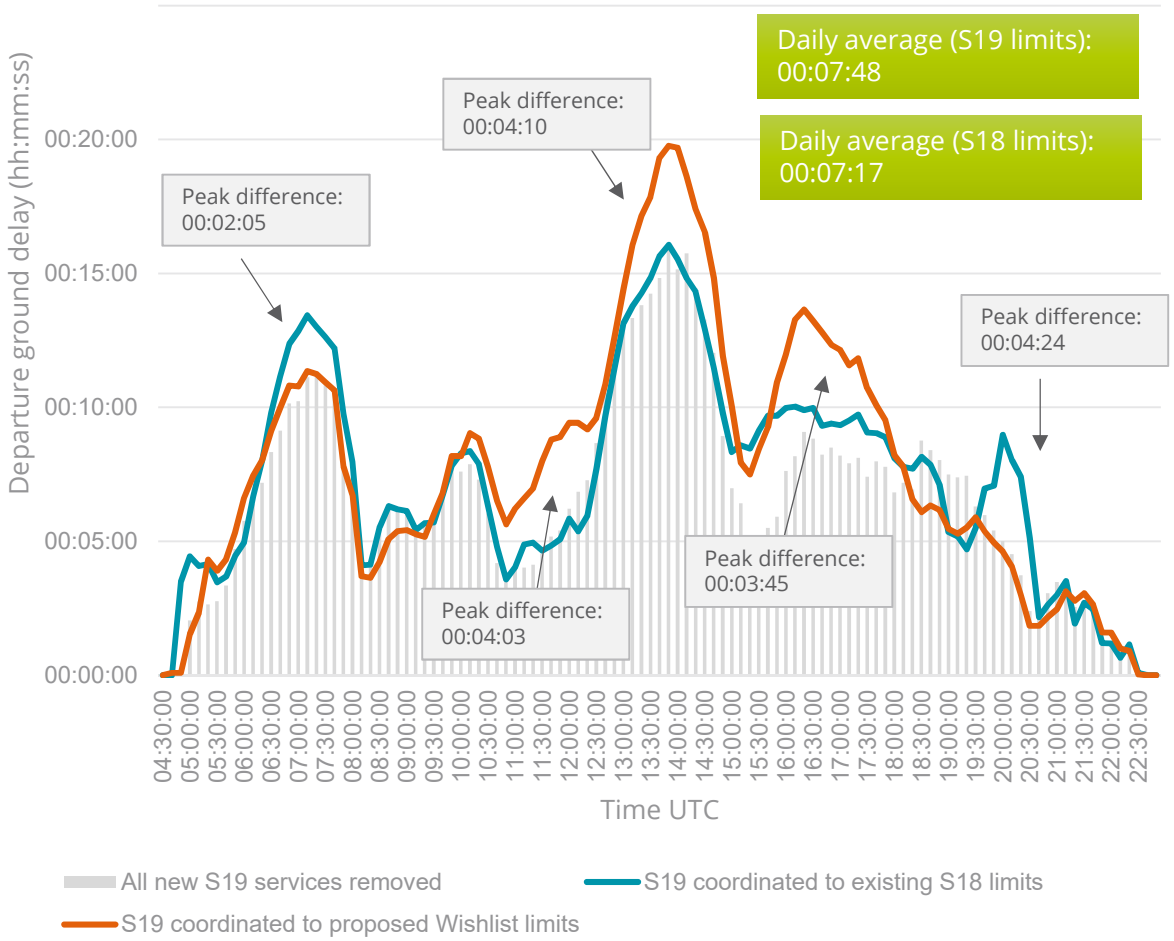


RUNWAY HOLDING DELAY AND DEPARTURE GROUND DELAY

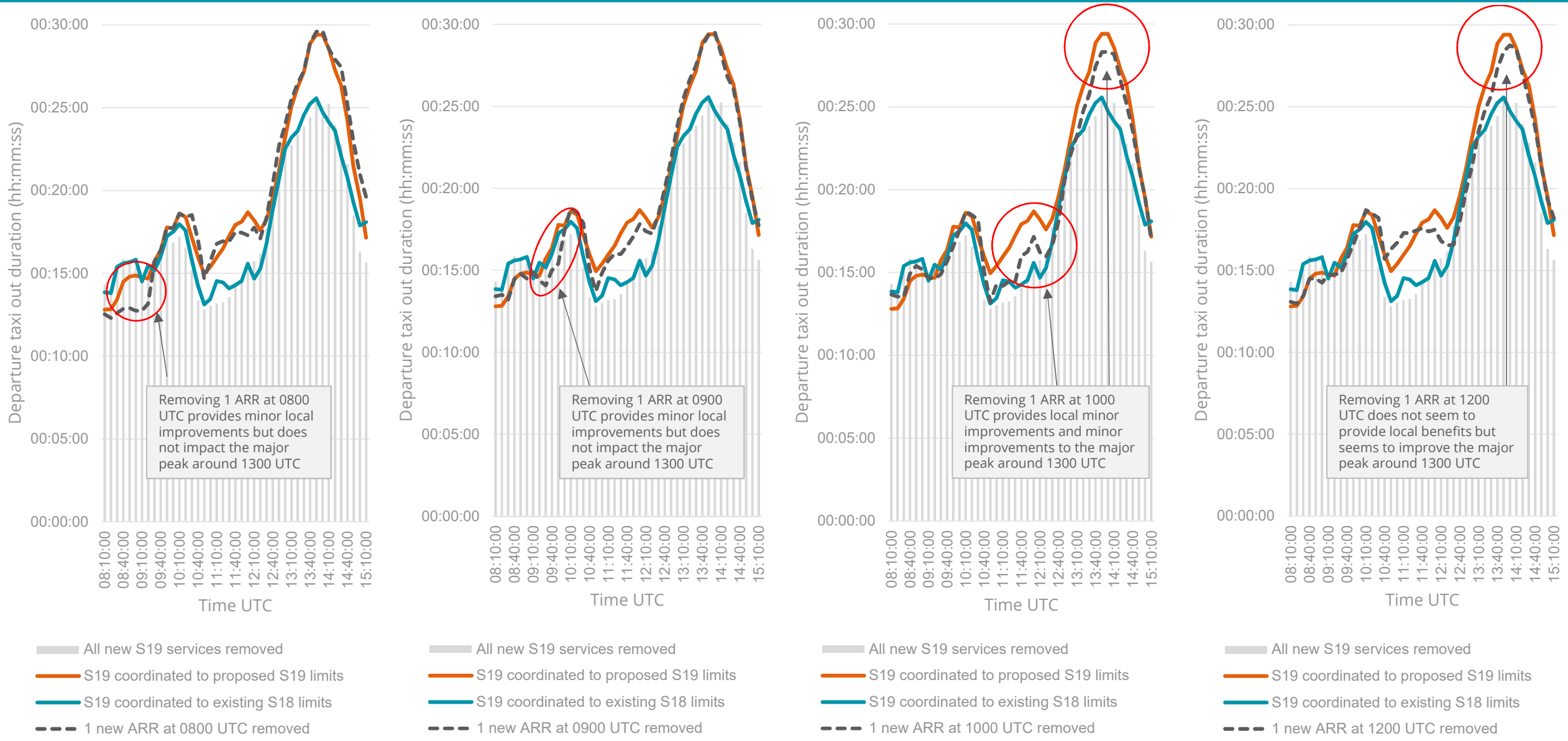
Runway holding delay: The delay experienced while the aircraft is queueing for runway entry. The delay can be caused by other aircraft (being slowed down or stopped) or when waiting at runway stop-bar (because the runway is not free for lining up). This metric is defined to be the time period between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



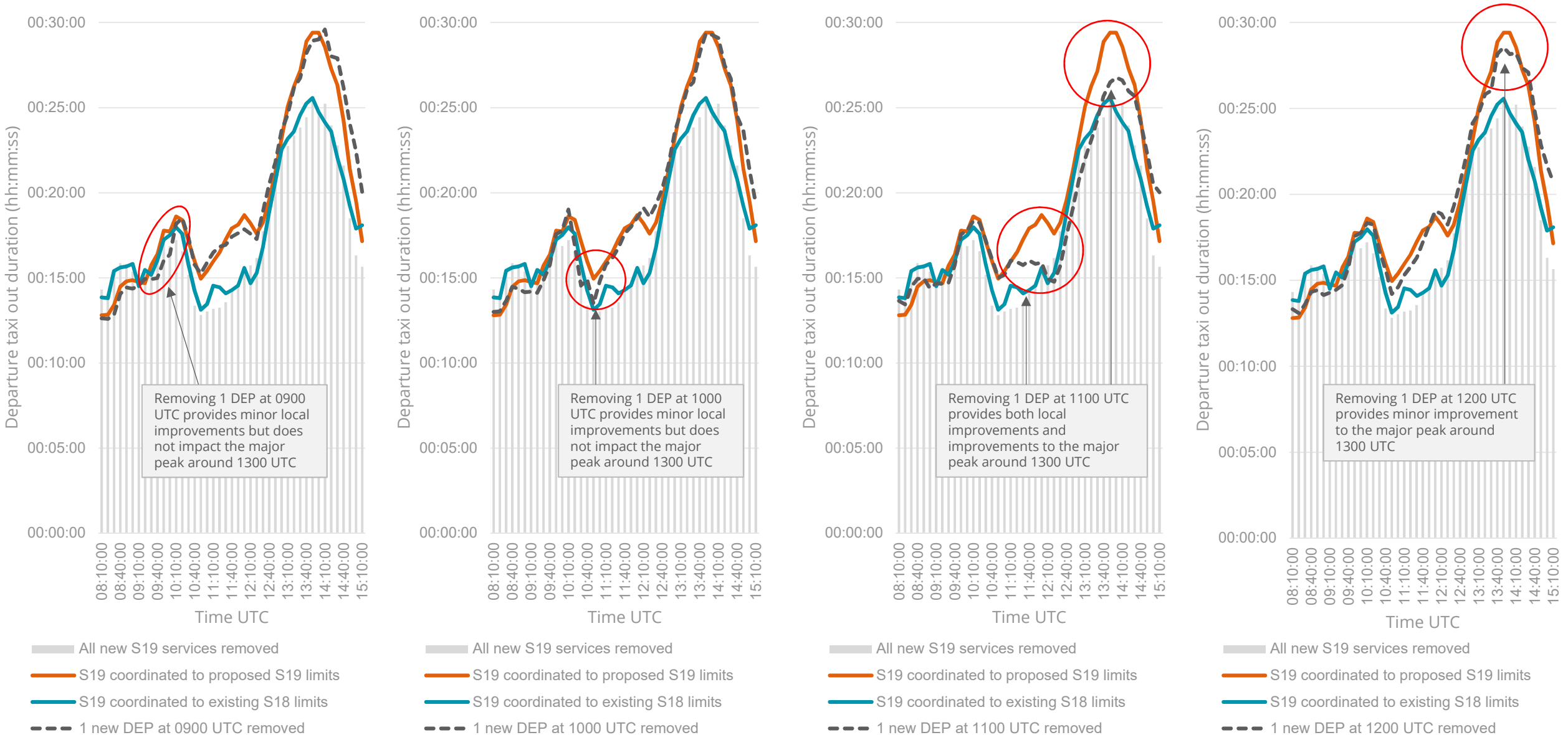
Departure ground delay: Total delay of departing aircraft accumulated between off-block and entering the runway. It is effectively the sum of runway holding delay and other delays.



SENSITIVITY OF THE DEPARTURE TAXI OUT TIME TO CHANGES IN ARRIVALS



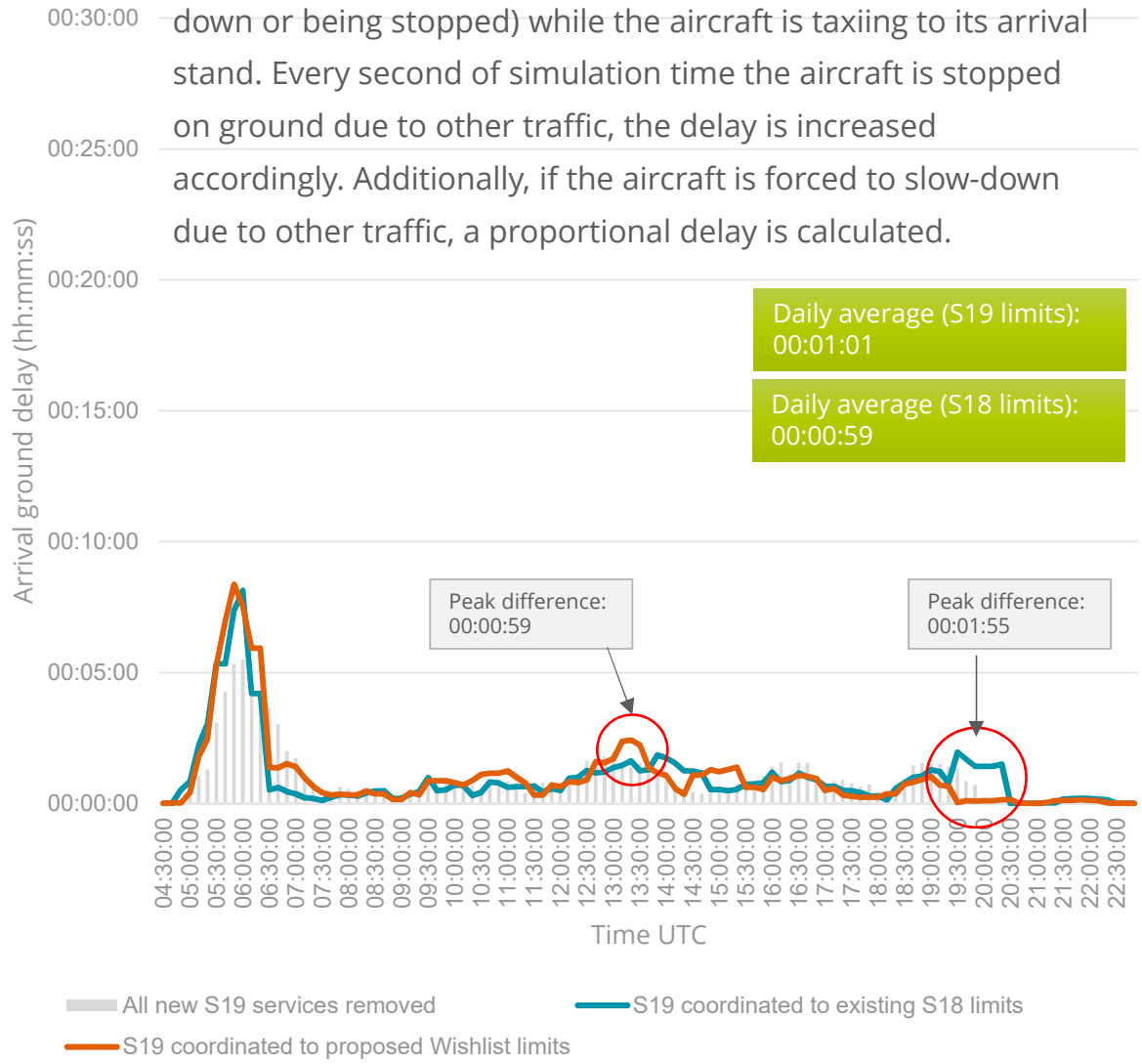
SENSITIVITY OF THE DEPARTURE TAXI OUT TIME TO CHANGES IN DEPARTURES



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.

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.



FINDINGS (WISHLIST)

Photo source: http://www.daa.ie/media-centre/image-library/

INCREASING THE RUNWAY LIMITS IN LINE WITH THE S19 WISHLIST

Increasing the Runway Limits in line with the S19 Wishlist:

- Is likely to increase the departure taxi out time of flights operating in the 1020-1240 UTC by more than 2 minutes on average.
- Is likely to introduce significant departure delays in the early afternoon period (1300-1459 UTC), indicating the runway may not be able to handle all the demand in a timely fashion.
- Is likely to increase the departure taxi out time of flights operating in the 1300-1459 UTC by more than 3 minutes on average.
- Is likely to increase the absolute peak departure taxi out time in this period by 3 minutes 50 seconds.
- Is likely to increase the departure taxi out time of flights operating in the 1540-1810 UTC by more than 2 minutes on average.
- Overall daily average taxi out time would increase on average by 31 seconds per flight.
- May introduce minor increases of arrival taxi duration (caused by increase in arrival ground delay) between 1300 and 1330 UTC.

MAINTAINING THE RUNWAY LIMITS IN LINE WITH THE S18 DECLARATION

Maintaining the Runway Limits in line with the S18 declaration:

- Is likely to lead to redistribution of delays from the peaks to early morning and late afternoon hours.
- Is likely to keep the existing peak departure taxi out time (and associated runway /ground delays) during the early afternoon period (1300-1459 UTC) at the existing levels.
- However, due to the need to move 3 proposed departures from 0800, 1000 and 1100 UTC hour to 0400 UTC and due to the need to move 1 proposed arrival from 0900 UTC hour to 0500 UTC hour it is likely that the period between 0630 UTC and 0800 UTC will experience an increase in departure taxi out time of 1 minute and 26 seconds on average as a result of reactionary delays caused by early morning additions to the flight schedule.
- Similarly, moving 4 departures from 1200, 1600, 1700 and 1800 to 1900 UTC and moving 1 arrival from 1800 to 1900 UTC is likely to cause an average increase of 2 minutes 28 seconds in departure taxi out time per flight operating between 1930 -2040 UTC.
- May introduce minor increases of arrival taxi duration (1 minute 16 seconds) between 1930-2030 UTC.

ALTERNATIVE WISHLISTS

Photo source: http://www.daa.ie/media-centre/image-library/

NEXT STEPS

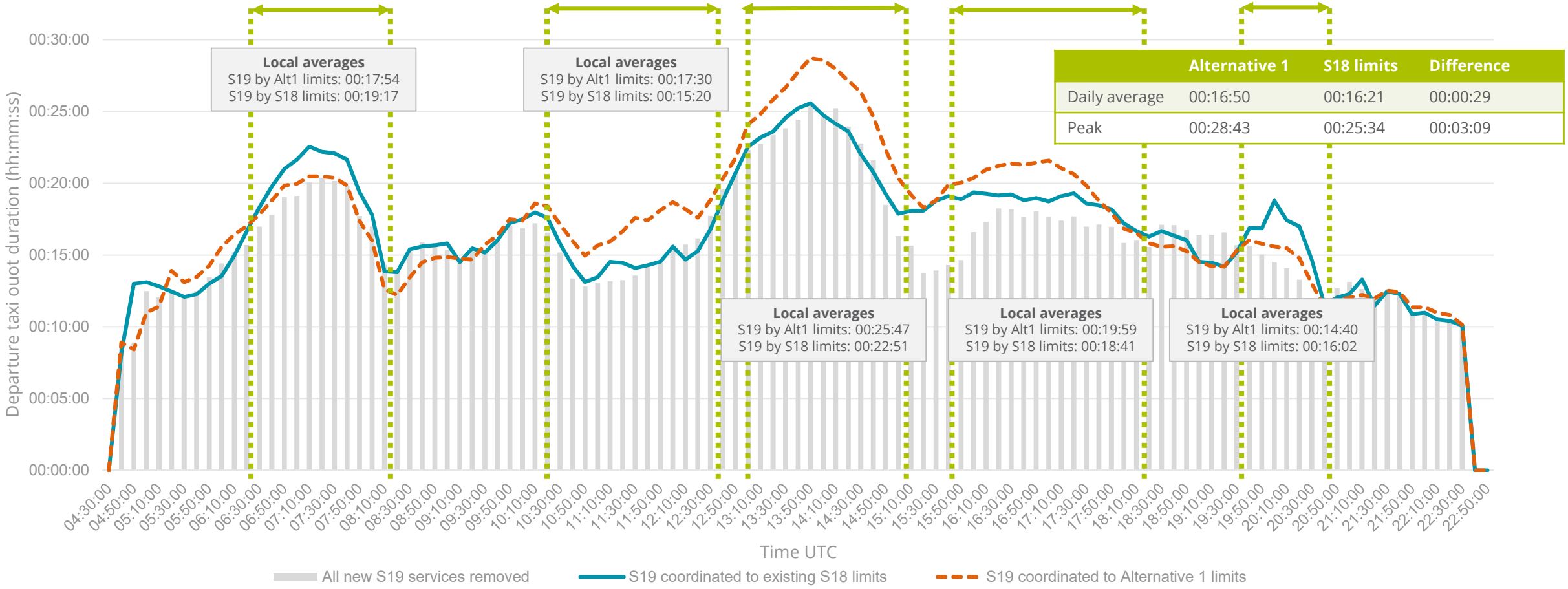
- Following the Coordination Committee pre-meeting, the Commission asked Helios to assess some further reduced S19 Wishlist scenarios.
- These are based on the proposed S19 Wishlist with selective decreases of the desired capacity in busy hours:
  - Alternative 1: S19 Wishlist without proposed increases at 12 and 16 UTC,
  - Alternative 2: S19 Wishlist without proposed increases at 11, 12 and 16 UTC and
  - Alternative 3: S19 Wishlist without proposed increases at 10, 11, 12 and 16 UTC.
- As with the S19 Wishlist, any flights that did not fit under either of the three Alternative proposals were coordinated to the closest available slot. Only new services were coordinated.
- The same busy day flight schedule as used for modelling S19 Wishlist was used for modelling of all three Alternatives.

ALTERNATIVE WISHLISTS

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
S19 Wishlist																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	32	**949**
Proposed S19 totals capacity	32	32	32	32	32	40	42	42	44	44	46	48	47	46	44	46	49	45	39	39	38	36	32	32	**959**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	+1	+1	+1	0	0	0	+1	+1	+2	+1	0	0	0	0	**+10**
Alternative 1																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	32	**949**
Proposed Alternative 1 totals capacity	32	32	32	32	32	40	42	42	44	44	46	48	46	46	44	46	48	45	39	39	38	36	32	32	**957**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	+1	+1	0	0	0	0	0	+1	+2	+1	0	0	0	0	**+8**
Alternative 2																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	32	**949**
Proposed Alternative 2 totals capacity	32	32	32	32	32	40	42	42	44	44	46	47	46	46	44	46	48	45	39	39	38	36	32	32	**956**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	+1	0	0	0	0	0	0	+1	+2	+1	0	0	0	0	**+7**
Alternative 3																									
Existing S18 totals capacity	32	32	32	32	32	40	42	42	43	43	45	47	46	46	44	46	48	44	37	38	38	36	32	32	**949**
Proposed Alternative 3 totals capacity	32	32	32	32	32	40	42	42	44	44	45	47	46	46	44	46	48	45	39	39	38	36	32	32	**955**
Difference (against S18 declaration)	0	0	0	0	0	0	0	0	+1	+1	0	0	0	0	0	0	0	+1	+2	+1	0	0	0	0	**+6**

ALTERNATIVE 1 (DEPARTURE TAXI OUT DURATION)

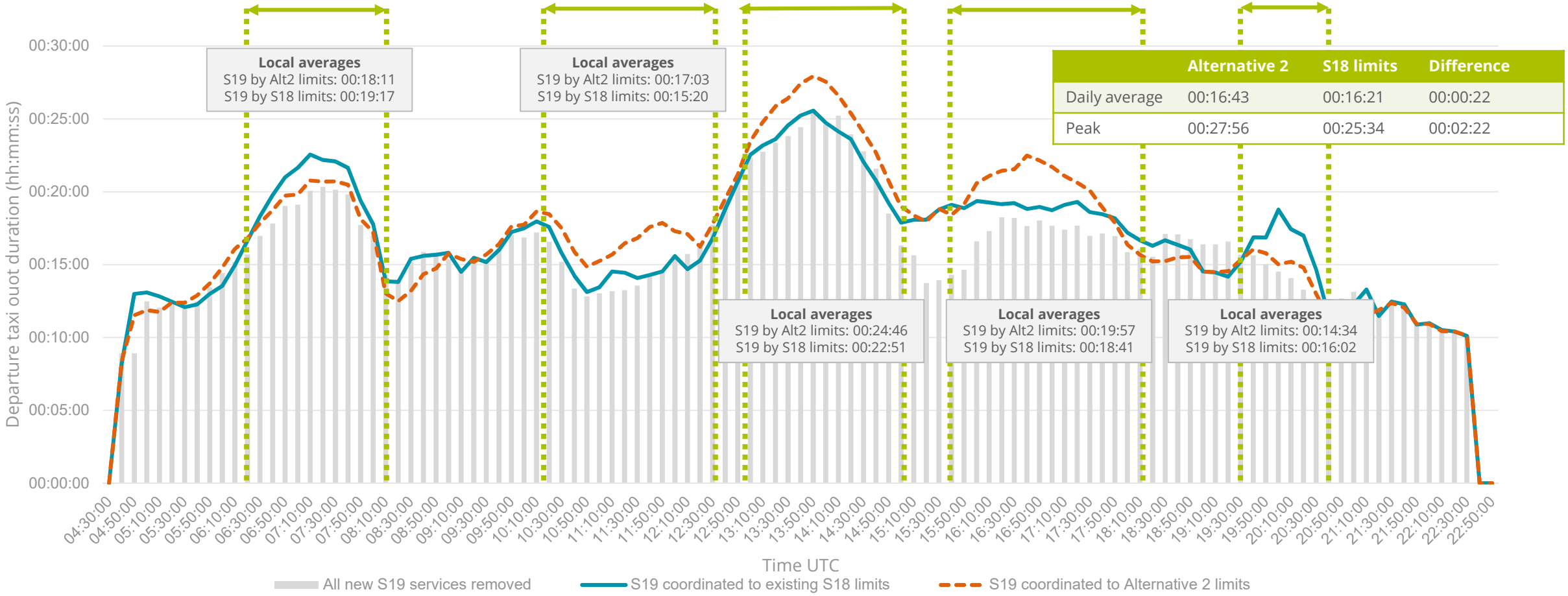
Definition: The time duration the aircraft has been taxiing for departure on the ground of its departure airport. This value is updated every second of simulation time when the aircraft is taxiing for departure even if the aircraft is stopped on ground. This metric is defined to be the time period between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



	Alternative 1	S18 limits	Difference
Daily average	00:16:50	00:16:21	00:00:29
Peak	00:28:43	00:25:34	00:03:09

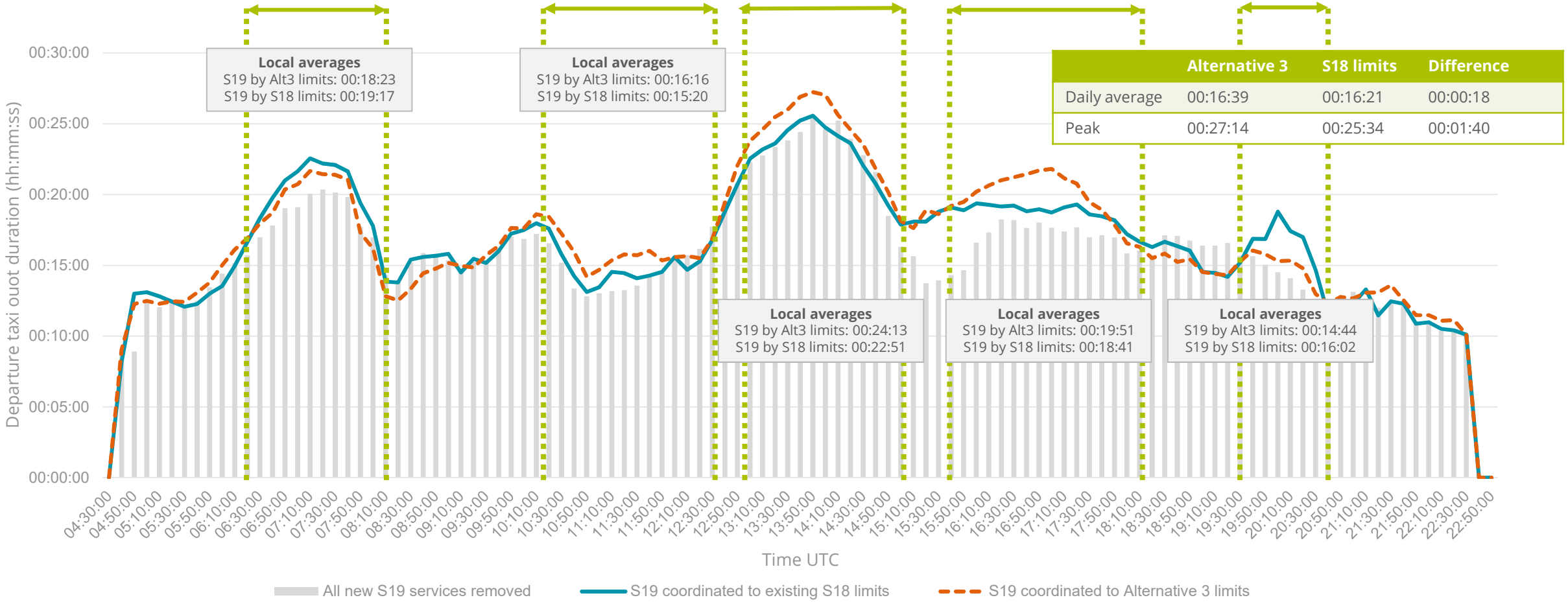
ALTERNATIVE 2 (DEPARTURE TAXI OUT DURATION)

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



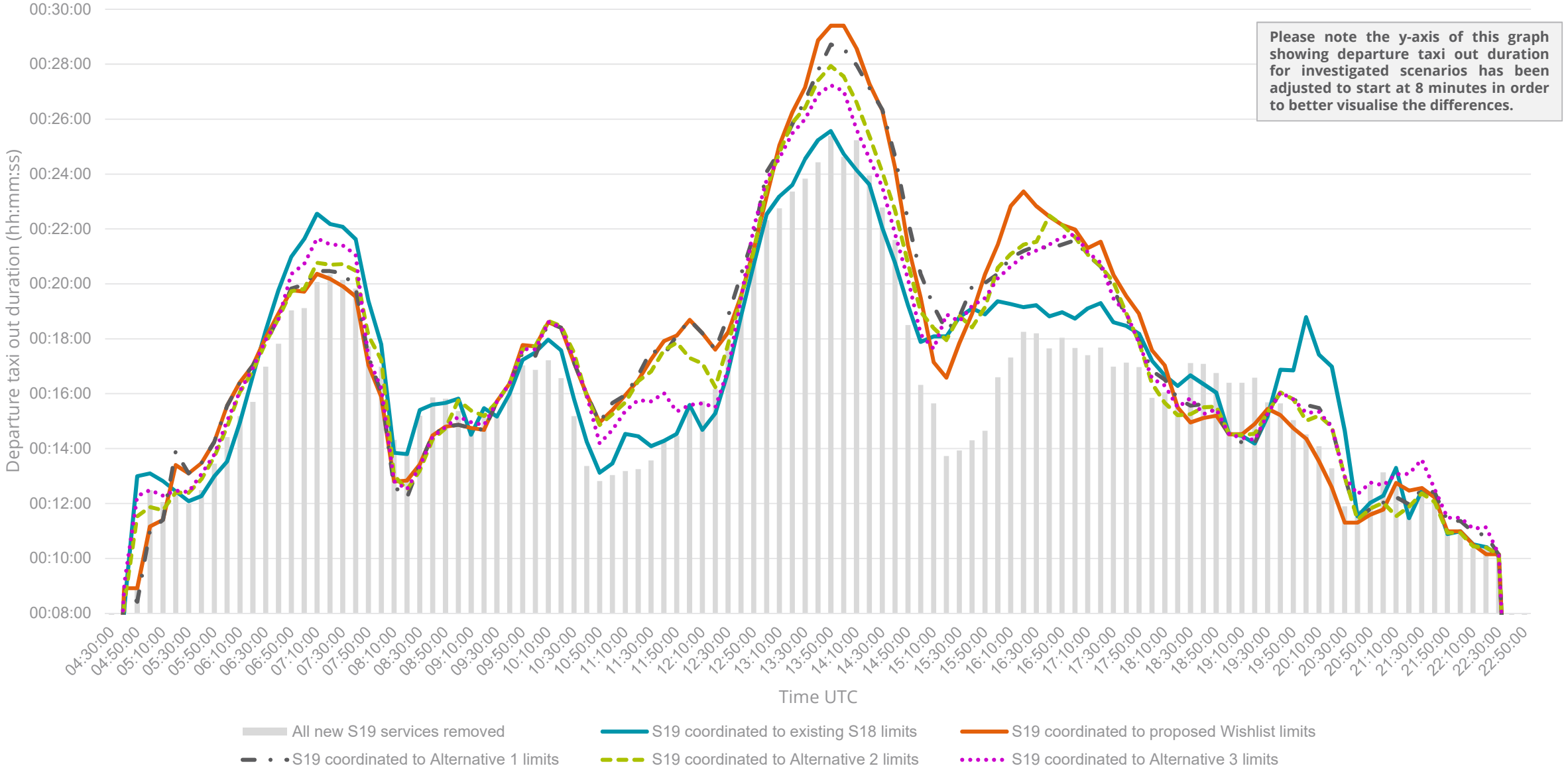
ALTERNATIVE 3 (DEPARTURE TAXI OUT DURATION)

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



	Alternative 3	S18 limits	Difference
Daily average	00:16:39	00:16:21	00:00:18
Peak	00:27:14	00:25:34	00:01:40

COMBINED VIEW ON ALL ALTERNATIVES ASSESSED (DEPARTURE TAXI OUT DURATION)



COMPARISON OF DEPARTURE TAXI OUT DURATION IN ALL INVESTIGATED SCENARIOS

Hour UTC	Proposed increases against S18 limits									
	8	9	10	11	12	16	17	18	19	Total
S19 Wishlist	+1	+1	+1	+1	+1	+1	+1	+2	+1	+10
Alternative 1	+1	+1	+1	+1	0	0	+1	+2	+1	+8
Alternative 2	+1	+1	+1	0	0	0	+1	+2	+1	+7
Alternative 3	+1	+1	0	0	0	0	+1	+2	+1	+6
S18 limits	0	0	0	0	0	0	0	0	0	0

Local averages (time UTC)					Daily average	Daily peak
0620-0820	1010-1240	1300-1500	1540-1810	1930-2040		
00:17:51	00:17:24	00:25:54	00:20:47	00:13:34	00:16:52	00:29:24
00:17:54	00:17:30	00:25:47	00:19:59	00:14:40	00:16:50	00:28:43
00:18:11	00:17:03	00:24:46	00:19:57	00:14:34	00:16:43	00:27:56
00:18:23	00:16:16	00:24:13	00:19:51	00:14:44	00:16:39	00:27:14
00:19:17	00:15:20	00:22:51	00:18:41	00:16:02	00:16:21	00:25:34

Hour UTC	Proposed increases against S18 limits									
	8	9	10	11	12	16	17	18	19	Total
S19 Wishlist	+1	+1	+1	+1	+1	+1	+1	+2	+1	+10
Alternative 1	+1	+1	+1	+1	0	0	+1	+2	+1	+8
Alternative 2	+1	+1	+1	0	0	0	+1	+2	+1	+7
Alternative 3	+1	+1	0	0	0	0	+1	+2	+1	+6
S18 limits	0	0	0	0	0	0	0	0	0	0

Difference in local averages against S18 limits (time UTC)					Daily average	Daily peak
0620-0820	1010-1240	1300-1500	1540-1810	1930-2040		
- 00:01:26	+ 00:02:04	+ 00:03:03	+ 00:02:06	- 00:02:28	+ 00:00:31	+ 00:03:50
- 00:01:23	+ 00:02:10	+ 00:02:56	+ 00:01:18	- 00:01:22	+ 00:00:29	+ 00:03:09
- 00:01:06	+ 00:01:43	+ 00:01:55	+ 00:01:16	- 00:01:28	+ 00:00:22	+ 00:02:22
- 00:00:54	+ 00:00:56	+ 00:01:22	+ 00:01:10	- 00:01:18	+ 00:00:18	+ 00:01:40
n/a	n/a	n/a	n/a	n/a	n/a	n/a

Daily taxi out duration profile of the three additional alternatives is similar to the original Wishlist profile. With progressive removal of proposed increases from Alternatives 1, 2 and 3 the magnitude of the difference relative to maintaining the existing S18 limits decreases. As expected, gradually reducing the number of flights in the Wishlist will eventually bring the daily profile closer to S18 limits profile.

HELIOS

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