DUBLIN AIRPORT SECURITY EFFICIENCY ASSESSMENT

Annex A: Security efficiency assessment – technical evidence report

IAA

19th February 2026

Introduction

This annex presents technical analysis of Dublin Airport's Security operation, with a particular focus on central search

CEPA and Think Research assessed Dublin Airport's Security operation, with particular focus on the in-lane central search processes in Terminal 1 and Terminal 2. The assessment covers four areas:

- **Qualitative review of the end-to-end passenger screening process.**
  We defined Dublin Airport's concept of operations (ConOps) for security screening, covering both legacy processes and the current operating model following the introduction of C3 computed tomography scanners, body scanners and Automatic Tray Return Systems. We used the ConOps and process maps to examine the end-to-end passenger and cabin-bag screening process, identify potential process pinch points, and highlight areas of strong practice or potential improvement.
- **Quantitative assessment of security operational performance**
  We assessed the productivity of Dublin Airport's Security operation and how it has evolved over time. Using available operational data, we analysed the factors that appear to influence queue performance, passenger throughput and resource utilisation.
- **Analysis of lane opening and roster efficiency**
  We examined how Dublin Airport plans and operates the in-lane security process. This included assessing how recorded lane openings compare with passenger presentation patterns and how staff rosters align with required staffing levels across the two terminals.
- **Implications for Security opex assumptions**
  Drawing on the preceding workstreams, we considered what the evidence implies for throughput, lane deployment, roster alignment, data quality and resilience in the Security opex assessment.

Our approach combines analysis of operational data, site observations and engagement with Dublin Airport

Our approach

Our assessment draws on multiple sources of evidence to develop a rounded understanding of Dublin Airport's Security operation:

- **Data analysis:** We analysed operational data from 2024 and 2025, covering passenger volumes, forecast and actual passenger presentation by 15-minute interval, planned and actual lane openings, staffing levels, overtime, rosters, lane configurations, screening technology, image throughput and queue lengths.
- **Field visit:** We conducted an on-site visit on 22 July 2025, during which we observed security screening operations across both terminals and reviewed how the process operates in practice.
- **Stakeholder engagement:** We held discussions with Dublin Airport's Security management and operations teams to understand the operating context, planning processes, operational constraints and management perspectives on performance.

Report structure

The remainder of this annex is structured as follows:

- **Section 2: The security operation**
  Explains how central search operates, the factors affecting efficiency, and the planning and forecasting process.
- **Section 3: Productivity metrics**
  Assesses the productivity of Dublin Airport's Security operation and how this has changed over time.
- **Section 4: Quantitative assessment**
  Analyses the drivers of queue performance, including passenger demand, lane openings, images per passenger and available staffing.
- **Section 5: Lane opening analysis**
  Compares recorded lane openings with the modelled lane requirement implied by passenger presentation and throughput assumptions.
- **Section 6: Rostering analysis**
  Assesses how well staff supply aligns with required staffing levels across the Security operation.

Overview of the security operation

Central search is a multi-stage process where each stage can affect lane throughput

Dublin Airport's central search process can be summarised as five linked stages. Each stage can affect the flow of passengers, trays and staff through the lane.

Entry → Divestment → Scanning → Manual search → Reconciliation

The ConOps and process maps, presented in **Annex C: Security Process Efficiency Report**, show that central search is not a single scanner-driven process. Effective throughput depends on the interaction between passengers, staff, screening technology and lane infrastructure.

Our process review identifies several points where flow can be affected:

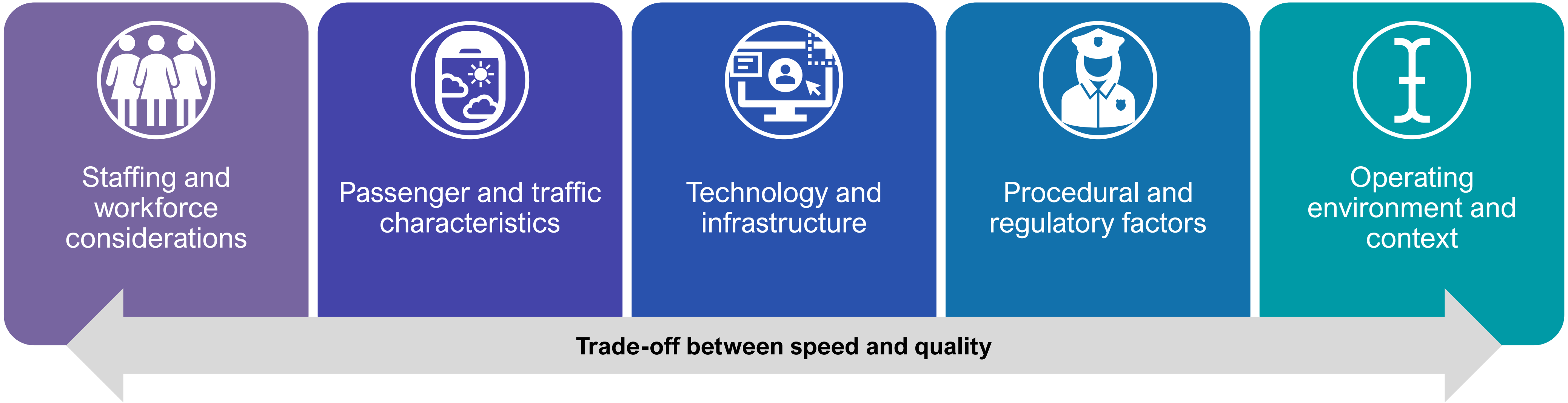
- passenger preparation before reaching the divestment point;
- the availability and use of divestment positions;
- the balance between passenger screening and cabin-bag screening;
- manual body-search and manual bag-search capacity;
- the management of rejected bags and reconciliation areas; and
- tactical lane-flow management by hosts, divestors, queue managers and lane troubleshooters.

The process evidence also indicates that scanner capacity is not the only determinant of lane performance. Divestment, manual bag search, manual body search, reconciliation and lane-flow management can all constrain effective throughput. The evidence should therefore be interpreted as identifying interacting operational pinch points, rather than a single binding constraint.

Finally, we find that central search differs between the terminals. Terminal 1 has a more varied lane configuration, while Terminal 2 has a more consistent lane configuration. This means that terminal-specific assumptions are needed when interpreting throughput, lane opening and staffing evidence.

There are many factors that affect the overall efficiency of the security screening process

Security screening efficiency is influenced by several interacting factors. These factors are particularly important for Dublin Airport because the 2024–2025 period included significant operational transition from C3 computed tomography scanners, body-scanning technology and revised passenger divestment requirements.



The following slides summarise how these factors affect the operation and why they need to be considered when interpreting the quantitative evidence.

The factors affecting the overall efficiency of the security screening process: staffing and passengers

	Main considerations	How they affect Dublin Airport's operation
Staffing and workforce	▪ Number of screening lanes open at any given time and the number of security officers available to staff those lanes. ▪ Staff experience and skill levels, including training quality. ▪ Scheduling of breaks to balance maintaining lane coverage against the need (and regulatory requirement) for breaks. ▪ Developing rosters that balance providing predictability and sociable working patterns, against maintaining flexibility to handle peakiness and seasonality in passenger volumes. ▪ Overall working conditions including pay, shift patterns and availability / management of annual leave.	▪ C3 rollout requires substantial retraining of security screeners, with a learning curve as officers adapt to new imagery. ▪ Processing speeds are likely to initially be slower until staff gain proficiency. ▪ Introduction of matrix screening distributes image-review workload across staff, enabling experienced officers to handle more volume while newer staff build skill. ▪ Cross-terminal deployment of security officers allows resources to shift dynamically, reducing pinch points that were previously terminal-specific. ▪ Rosters must balance training time with operational needs.
Passenger and traffic characteristics	▪ Overall number of passengers that need to be screened. ▪ Peakiness and seasonality of traffic patterns, which has a knock-on effect on the passenger processing capacity required at different times. ▪ Predictability and variability of passenger arrivals at screening. ▪ The composition of the passenger population, such as the balance between frequent travellers familiar with security procedures vs infrequent travellers. The number of passengers requiring special assistance or family groups with young children etc.	▪ Passenger volumes have increased substantially over 2024 and 2025, potentially beyond Dublin Airport's planning assumptions. ▪ We understand from Dublin Airport that much of the growth has been during the shoulder periods, making traffic patterns and passenger volumes less seasonal. ▪ Passengers are simultaneously adapting to new technology and its associated rules, particularly around liquids, aerosols and gels (LAGs) and whether laptops need to be removed from bags. The LAGs rules in particular have been subject to change recently. ▪ New technologies are being introduced to allow better modelling of passenger arrivals at security screening.

The factors affecting the overall efficiency of the security screening process: other factors

	Main considerations	How they affect Dublin Airport's operation
Technology and Infrastructure	▪ Screening technology, which affects both throughput rates and alarm frequencies. ▪ Physical layout of lanes, including the distance between identity verification and screening points, the number and configuration of lanes, the space available for divesting and recomposing, and queuing arrangements.	▪ Both terminals at Dublin Airport have seen the introduction of C3 scanners and full body scanners. ▪ The introduction of C3 scanners has been accompanied by a general reconfiguration of screening lanes to be longer. ▪ Full body scanners change the flow dynamics at the person-screening stage.
Procedural and regulatory factors	▪ Stringency of screening protocols including requirements to remove shoes, LAGs and laptops. ▪ Secondary screening rates, behavioural detection programmes and enhanced screening. ▪ Standard operating procedures around bag searches, pat-downs, and equipment anomalies.	▪ Some procedural uncertainty around LAGs rules which have changed during the rollout. ▪ The C3 technology is designed to eventually allow passengers to leave LAGs and laptops in bags, simplifying procedures and reducing divest time.
Environmental and contextual factors	▪ Time of day affects both passenger volumes and staff alertness. ▪ Seasonal variations bring different passenger mixes and overall demand levels. ▪ Major events, weather disruptions, and security incidents can create sudden surges that overwhelm normal capacity. ▪ The predictability of demand patterns influences how effectively resources can be pre-positioned.	▪ Information from Dublin Airport indicates that shoulder periods are becoming fuller, meaning there is less seasonality.

The forecasting and planning process for the hiring and deployment of security officers

Dublin Airport's security operation is supported by multiple layers of planning, from strategic capacity decisions several years ahead to tactical resource optimisation in the short term, as shown in the diagram below. Software tools such as the Better Security Model have made the medium- and short-term planning and deployment process increasingly data-driven. A clearer feedback loop between operational performance data and medium- to long-term planning assumptions would strengthen future planning.

Strategic level

- Capacity planning extends up to **5-7 years** out from the operation
- **Annual budgeting** and forecasting set overall resource parameters
- **Rosters are revised annually**, with current patterns having been introduced in March and August/September 2025
- Current rosters have **stable shift patterns** with **limited seasonality**

Medium-term planning

- The **Better Security Model** operates on a 30-day rolling horizon (in use for 6-7 years). Inputs include:
  - Passenger forecasts converted to presentation profiles (split by T1/T2/Transfers/Fast Track)
  - Throughput targets (base and stretch)
  - IPP assumptions (revised regularly)

Short term / tactical

- **Rostering and resource optimisation** within a 10-day window
- Decisions on **lane opening/closing** and **body scanner allocation** adjusted on a tactical basis on the day
- Staff can be **deployed at either terminal** depending on the need

Dublin Airport's security operation has undergone a number of changes in recent years

Rosters

In recent years, Dublin Airport has introduced a new set of rosters that provide staff with greater certainty and consistency around the shifts they work. Staff work a consistent shift each day (e.g. early morning), rather than an alternating pattern. Staff are only able to change their shift pattern after one full year on a particular roster.

Dublin Airport has also reduced its use of seasonal staff, taking the view that passenger volumes exhibit less seasonality than they have done in the past.

Dublin Airport uses the planned rosters to build up staff in advance of the daily operation. When required, staff are deployed to either terminal, on a tactical basis, to tackle peaks in demand or cover staff absences etc.

What are the potential implications of this?

By moving to stable shift patterns with a much lower level of seasonality (if any), it would be expected that there will be times where staff may be idle in the day-to-day operation. While this may, at face value, reduce the productivity of the overall operation, we would also expect to see lower levels of absenteeism and attrition levels within the operation.

At this stage of changes in the operation, Dublin Airport states that it is too soon to tell whether this is the case, but levels of absenteeism and attrition should be monitored as further evidence becomes available.

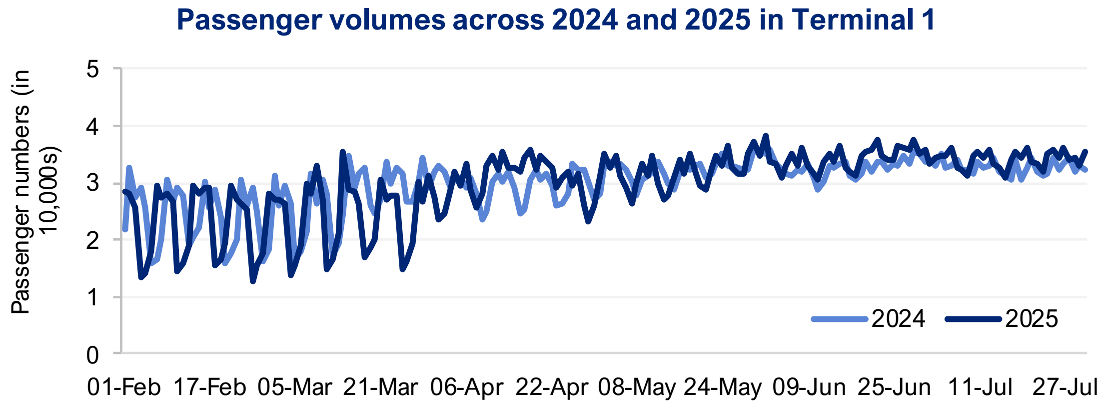
Timeline of key events

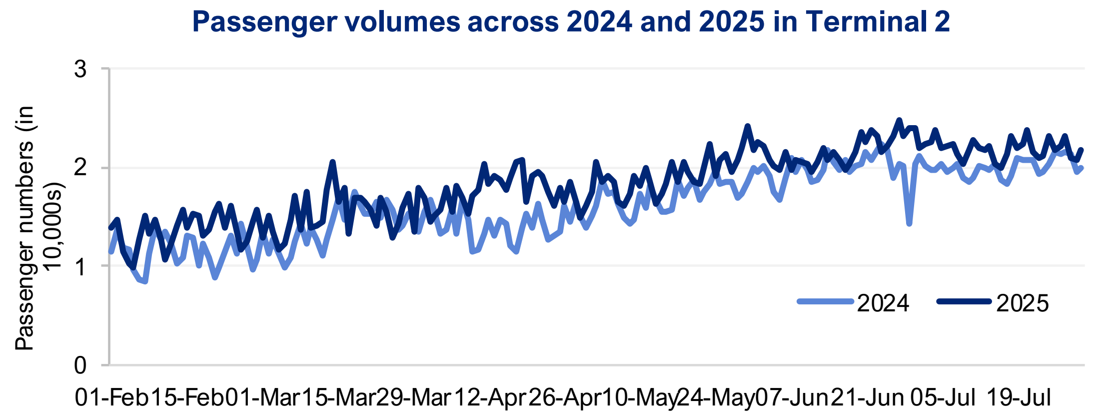
Change	Terminal 1	Terminal 2
C3 introduction	C3 introduction began in 2023, with 1 lane. In 2024, one additional lane was added in Jan'24 and Jun'24. The C3 update was completed by Autumn 2025 (all 12 lanes operating C3).	C3 introduction began in 2023, with 3 lanes. Additional lanes were added in 2024. The C3 update was completed by the start of 2025 (all 14 lanes operating C3).
Changes to rosters	Roster changes commenced in 2020 and are still in progress. Both flexible and core rosters were used.	Roster changes commenced in 2020 and are still in progress. Both flexible and core rosters were used but flexible rosters were being phased out (completely phased out by 2025).

Evolution of passenger volumes

Overall passenger volumes expectedly increase in both terminals between Feb and Jul, though the increase is more significant in T2 in both years.

Weekly volatility is greater in the winter than in the summer, particularly in T1. Comparing the first week of Feb with the first week of Jul, passenger volumes increased across both terminals in 2024 and 2025. T1 volumes rose by 42% in 2024 and 51% in 2025, while T2 volumes increased by 79% in 2024 and 75% in 2025.





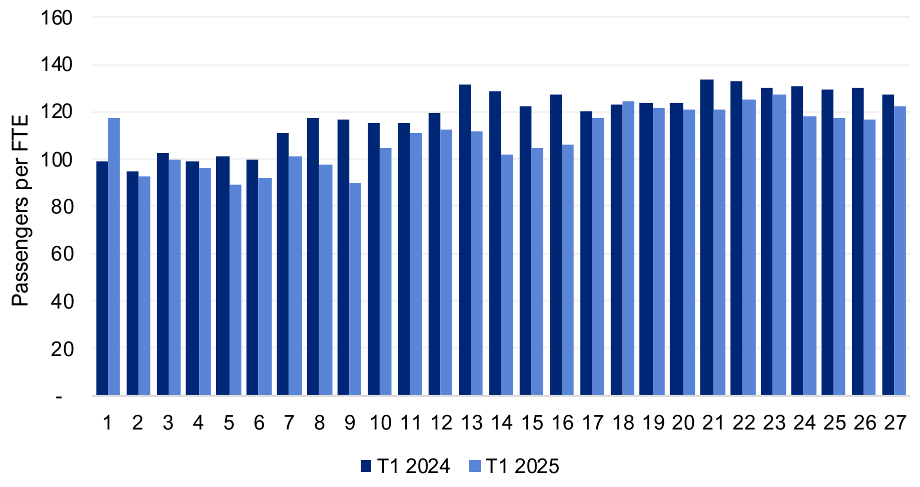
Productivity of Dublin Airport's security

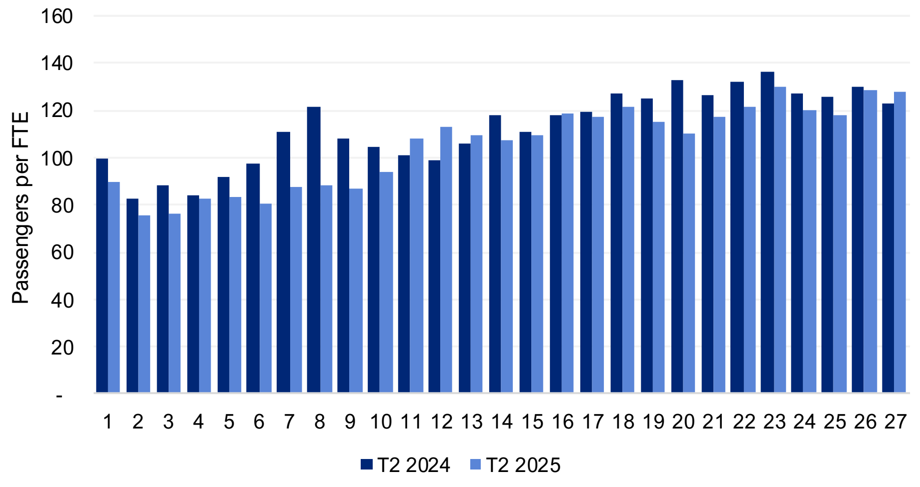
Overall productivity of Dublin Airport's security operation

The charts below show the number of passengers per security FTE at each terminal for the weeks between February and July for 2024 and 2025.[1] We use this as an overall indicator of the productivity of Dublin Airport's security operation.

We make the following observations:

- For both terminals, productivity is generally lower during the winter months (~weeks 1–10) and higher during the summer period.
- Productivity levels in 2025 were, overall, lower than those observed in 2024.
- Although productivity at Terminal 2 has historically been lower than at Terminal 1, by Summer 2025 productivity at both terminals converges to broadly comparable levels.
- Terminal 2 operates with 17m roller bed lanes, generally shorter than Terminal 1 which has a mixture of 17m, 19m, and 23m lanes. This reduces the number of passengers that can be processed within a given time period. In addition, the Automatic Tray Return System (ATRS) was implemented in Terminal 1 in 2016, but only introduced in Terminal 2 in 2025. Taken together, these factors explain why Terminal 2 has historically been less productive than Terminal 1, and why a small efficiency gaps remains.





As a separate exercise, we have also benchmarked the productivity of Dublin Airport's security operation against a selection of comparator terminals from the UK. The results of that benchmarking exercise are presented in Annex B.

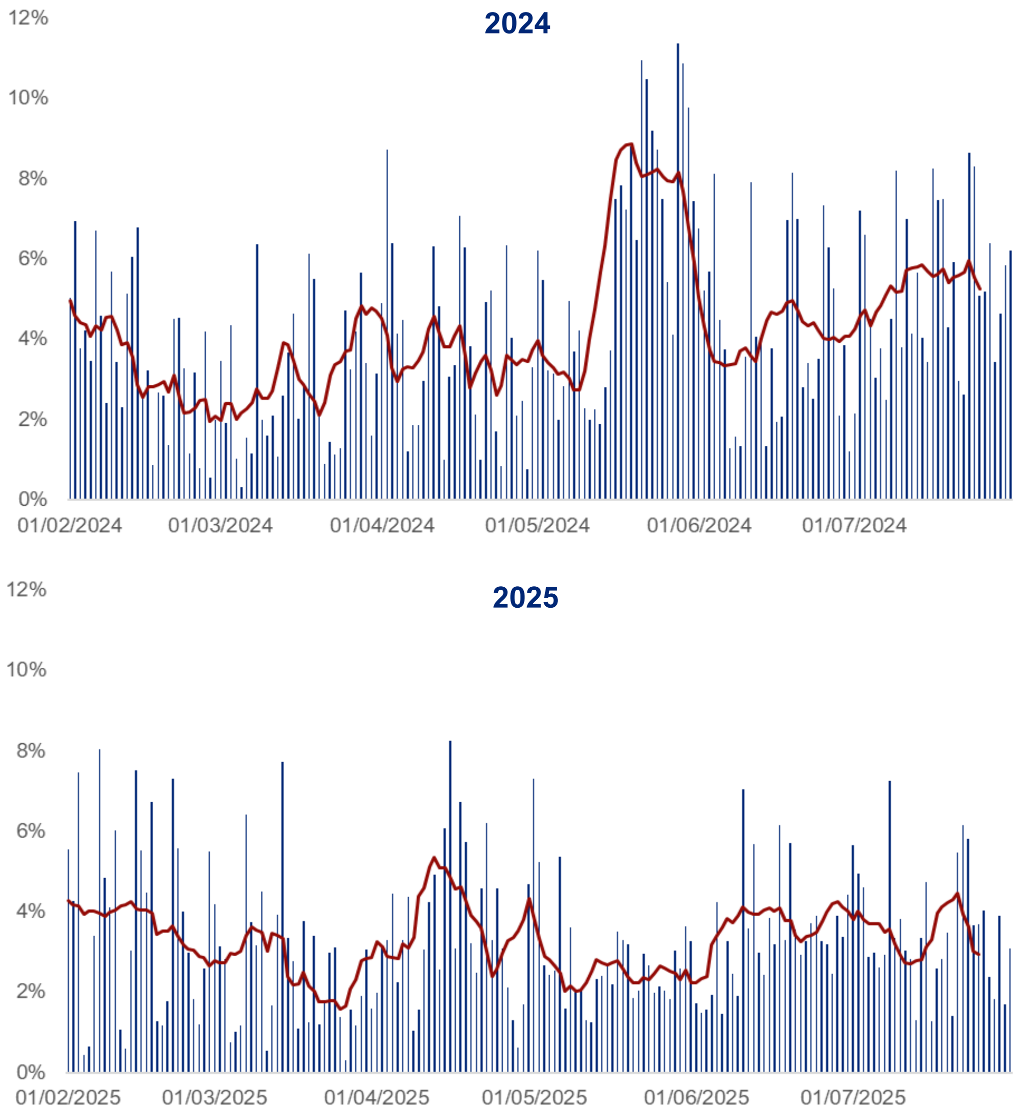
An assessment of overtime levels

The charts on the right show overtime as a percentage of total hours worked by terminal for 2024 and 2025 separately.

We calculate the total hours worked using the rostering data, aggregating it to a daily frequency over February to July 2024 and 2025.

Key findings

- Overtime worked by staff peaks in May–June 2024 but is significantly lower during the same shoulder periods in 2025.
- In 2025, overtime is more evenly distributed throughout the year, indicating a reduced impact of seasonality. Flexible rosters were fully phased out by this stage.
- As passenger profiles during these shoulder periods appear similar in 2024 and 2025, this suggests that changes to rostering have reduced the need for overtime rather than changes in demand.
- Overall, the proportion of overtime is lower in 2025, compared to 2024. This is consistent with improved roster alignment in 2025.



Dark red line shows a 7-day moving average

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Quantitative assessment of the security queue performance drivers

We have identified several key themes from our quantitative analysis of terminal security at each terminal

At both terminals, there were fewer periods of high queueing in 2025 compared to 2024.[1]

There were more high queuing period in Terminal 1 compared to Terminal 2, although high queueing did occur in all intervals assessed.

From 2024 to 2025, both terminals saw a decrease in the number of high queueing periods.

In both terminals, periods of high queuing were most likely to occur when lanes were near capacity.

Across both terminals actual passenger demand varied greatly compared to the forecast

In both terminals, there were frequent instances of significant under- and over-forecasting, resulting in substantial differences between the forecast and actual number of lanes open.

This indicates periods where planning and real-time deployment may not have been fully aligned with actual demand.

In both terminals, images per passenger (IPP) increased at the end of high queuing period as demand starts to decrease

Across both terminals, IPP sees a spike at the end of high queueing periods.

We suspect this is likely to be a data artefact rather than an operational observation – potentially due to a misalignment between passenger counts and image counts when calculating IPP.

Our regression analysis highlights several statistically significant variables affecting queue performance

This includes the number of lanes open, IPP, passenger demand, scheduled staff and the difference between forecast and actual lanes open.

However, an adjusted R^2 of ~0.41 suggests that around 60% of the variation in maximum queue times is due to factors that are not reflected in the recorded data.

[1] High queuing is identified as 15-minute intervals where maximum queues exceeded 20 minutes.

We make a number of recommendations for future data collection, drawing on the issues we have identified through our analysis of the data

Think CEPA economics matters

Data describing several key drivers were missing or inconsistently provided, limiting their usefulness for our analysis and reducing confidence in the results

Data on lane passenger throughput, one of the principal performance drivers, was not provided in the required timeframe or time interval, limiting the analysis. Other key variables that were not available include causes of bottlenecks, such as instances of backlogs due to dieback, and passenger profile data, such as instances of PRM passengers.

Values for the same variables, when derived from different sources, sometimes differed beyond normal variation and could not be reconciled. This included the number of lanes open, which differed depending on whether it was reported alongside lane data or staff data. No definitive source of 'truth' data could be identified.

Queue length data provided by Dublin Airport could not be completely reconciled with data provided by the IAA, undermining confidence in the analysis. While a possible explanation for this was provided by the Dublin Airport, this does not appear to be causing the differences observed.

There are several recommendations for improving security performance measurement at Dublin Airport

1. Queue length definition and calculation should be consistent between Dublin Airport and IAA to provide an easily understandable performance baseline.
2. Key variables, such as lane throughput, vital for security performance analysis should be recorded and accessible (we understand that this is in progress).
3. Data should be collected in small and consistent time intervals, say one minute, to enable detailed statistical analysis in support of continuous performance improvement.
4. A system for recording, storing and retrieving queue performance data should be implemented to allow for easy retrieval of data.
5. Data collection methods should be reconciled to ensure consistency of outputs across multiple data sources and establish a definitive source of 'truth'.
6. Lane opening and closing should be logged to facilitate analysis of individual lane performance and the impact of different lane configurations.

Overall passenger demand distributions[1] shift to the right between 2024 and 2025, reflecting increased passenger traffic

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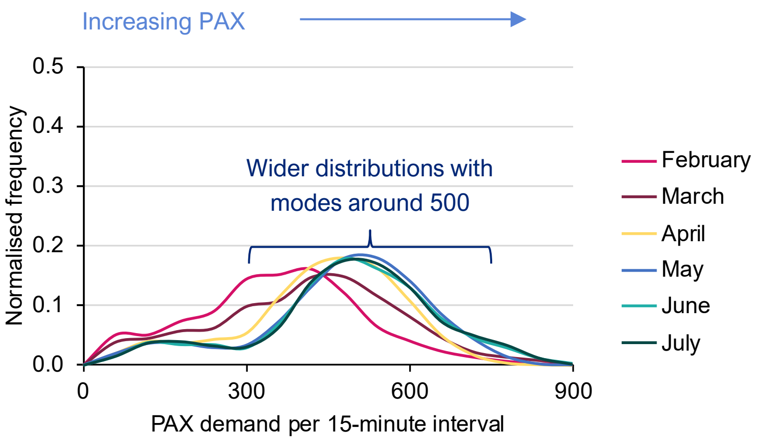
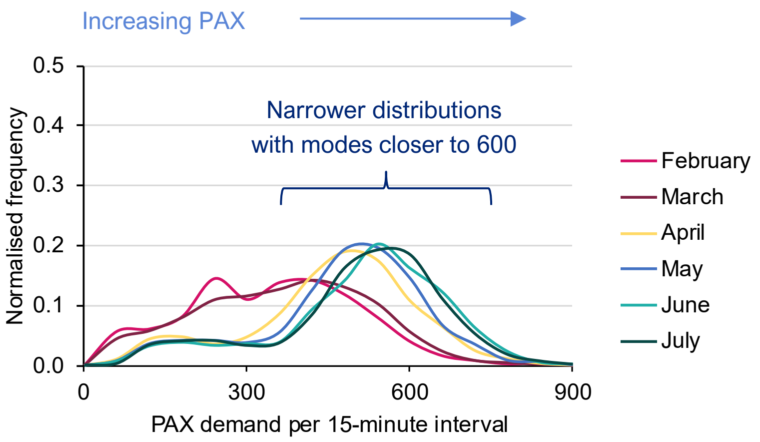
T1 2024



T1 2025



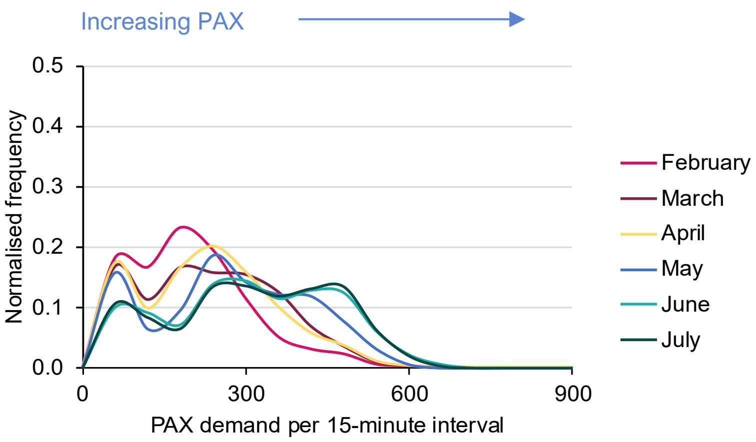
The normalised frequency distribution line graphs on this slide show how **passenger arrival distributions** have changed over time at the two terminals.

Across both terminals, the passenger distributions became narrower as the months advanced, with modes shifting to the right. This has occurred under a backdrop of increased total passenger traffic in 2025 compared to 2024.

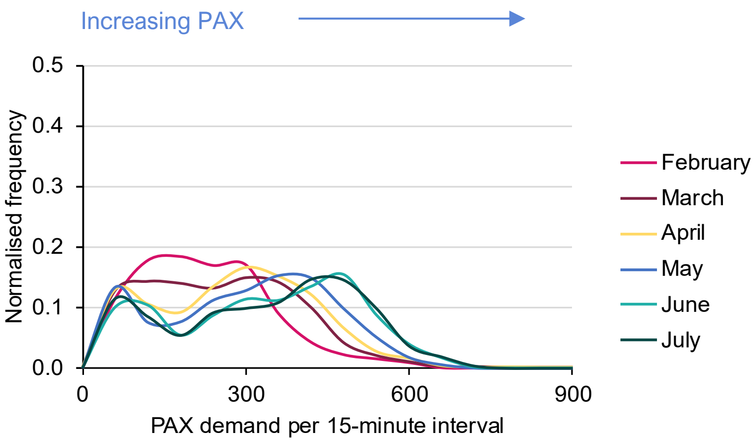
T1 – During the summer months, the mode of the distributions shift to the right between 2024 and 2025. Additionally, the distributions appeared narrower. This suggests that passenger demand increased and became more concentrated within the 15-minute periods.

T2 – Distributions for passenger demand were less smooth and trends were less notable between 2024 and 2025.

T2 2024

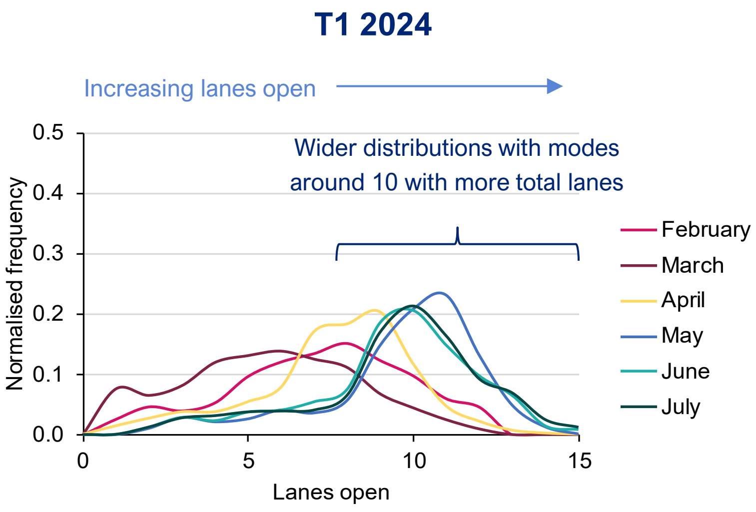


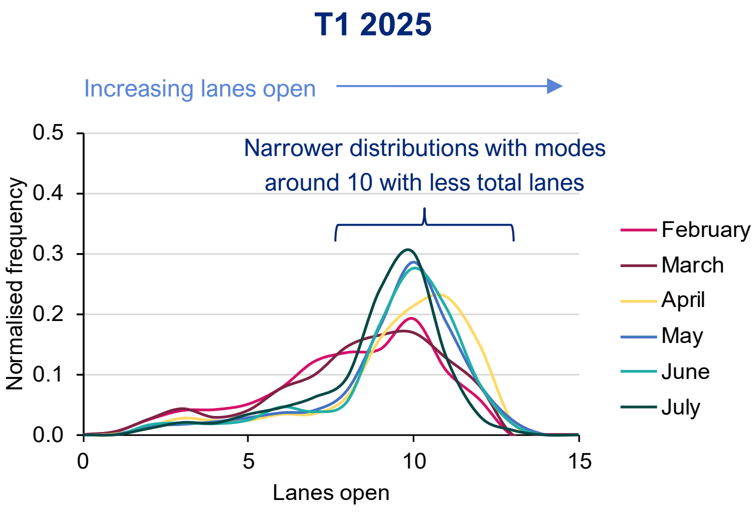
T2 2025



[1] Passenger demand per 15-minute interval is the count of the number of passengers presenting at the entrance to the security area per 15-minute interval

Terminal 2 opened more lanes on average in 2025 compared to 2024, while Terminal 1 remained more consistent across both years

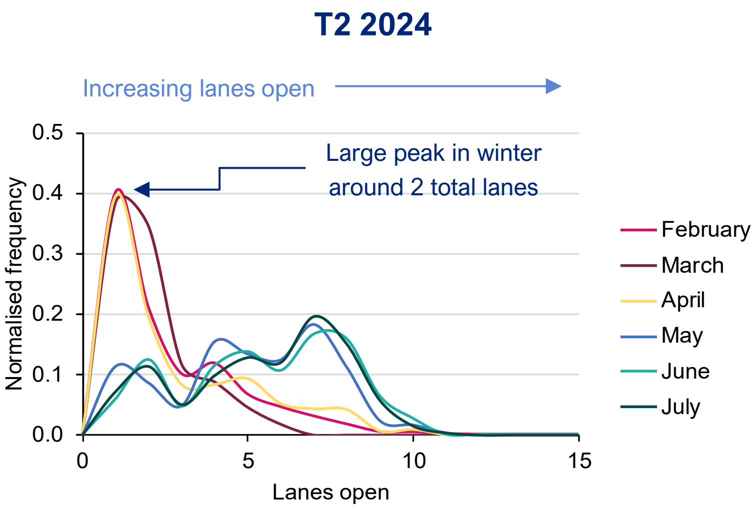


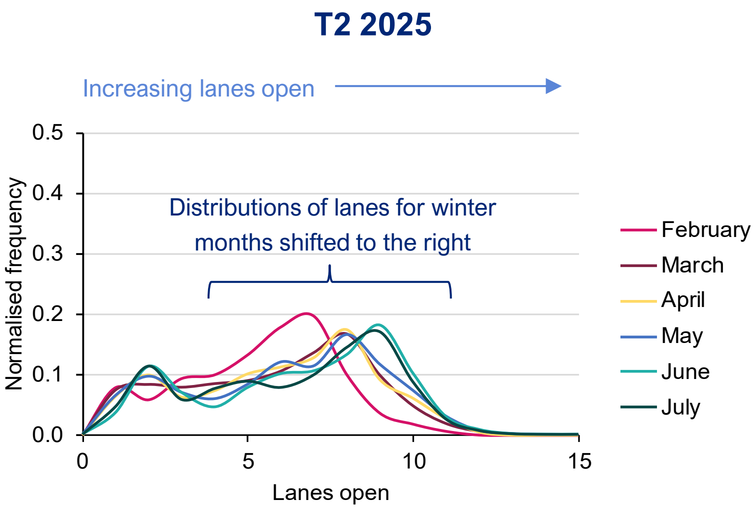


The frequency distribution graphs on this slide show how the **number of open lanes** change over time.

T1 – The were fewer open lanes in 2025 compared to 2024, due to the C3 transition. Despite this, the modal number of open lanes has remained consistent (at around 10). Given the increased throughput per lane associated with the transition from C2 to C3, we might have expected a reduction in the peak number of open lanes between 2024 and 2025. The consistent number of peak open lanes suggests that higher per lane throughput has been offset by higher passenger demand.

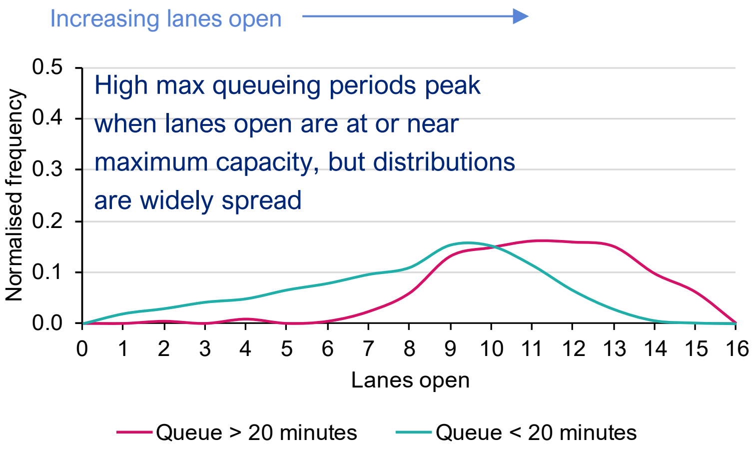
T2 – Distributions suggest that more lanes were open in 2025 than in 2024, with the number of lanes increasing as the year progressed. This suggests that higher passenger demand has more than offset any increases in lane throughput.



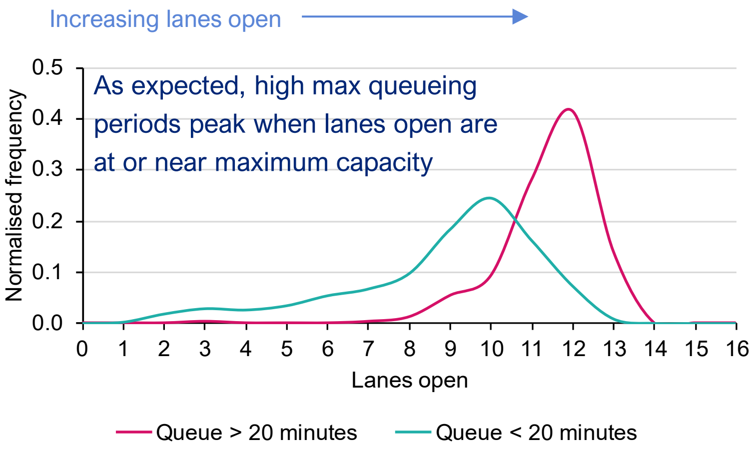


Our analysis shows that longer maximum queues were more likely to occur when more lanes are open

T1 2024



T1 2025



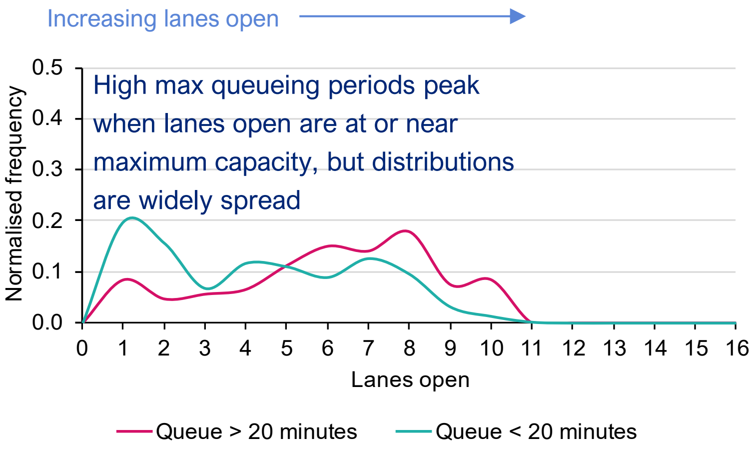
The graphs on this slide show the **number of lanes that were open when maximum queues exceeded 20 minutes** within a 15-minute interval.

Across both terminals, instances of maximum queues breaching 20 minutes were more frequent when the terminal approached the maximum lane capacity.

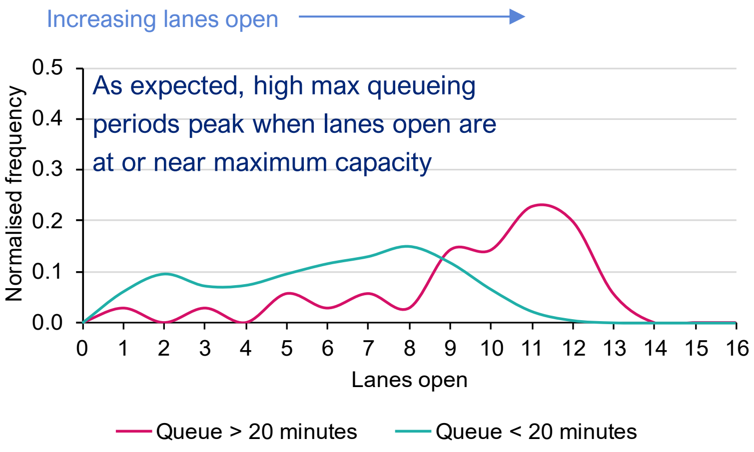
T1 – Between 2024 and 2025, the distribution for maximum queues above 20 minutes shifted to the right. This suggests that in 2025, when queues above 20 minutes did occur, it was more likely that lanes were near peak capacity.

T2 – In both 2024 and 2025 there were few instances of queues exceeding 20 minutes. However, the distributions suggest that when these did occur it was more likely to be when more lanes were open.

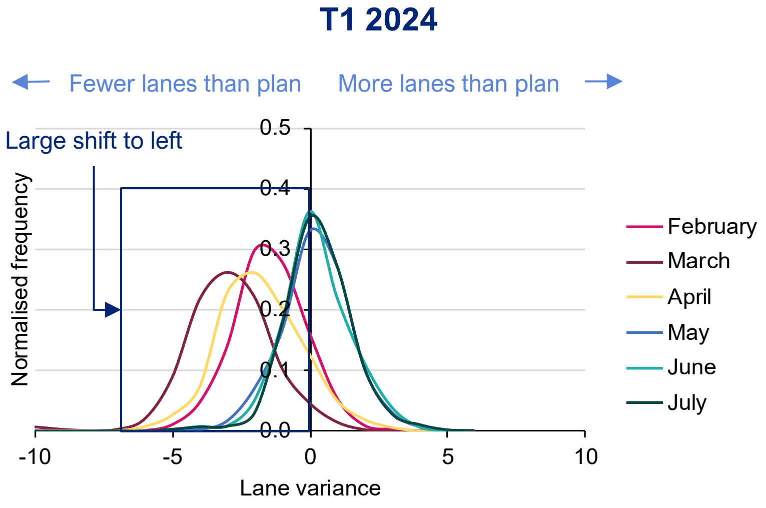
T2 2024



T2 2025



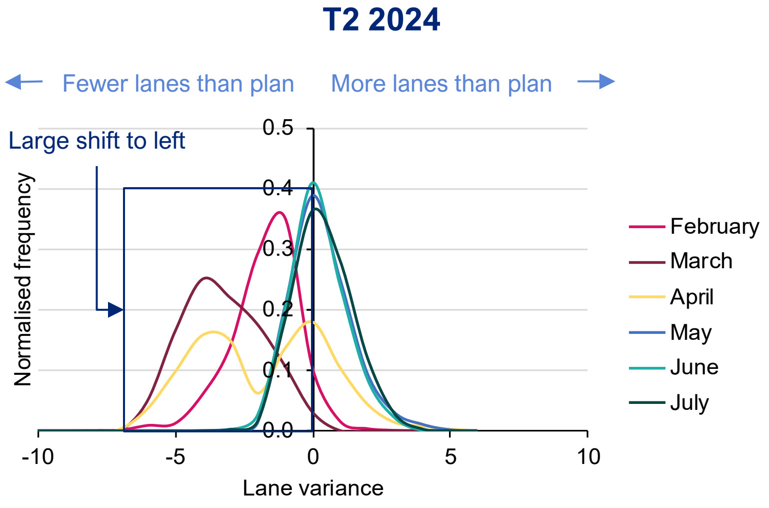
Our lane variance distributions may suggest systematic overplanning of lanes in 2024, although also highlight issues in 2025

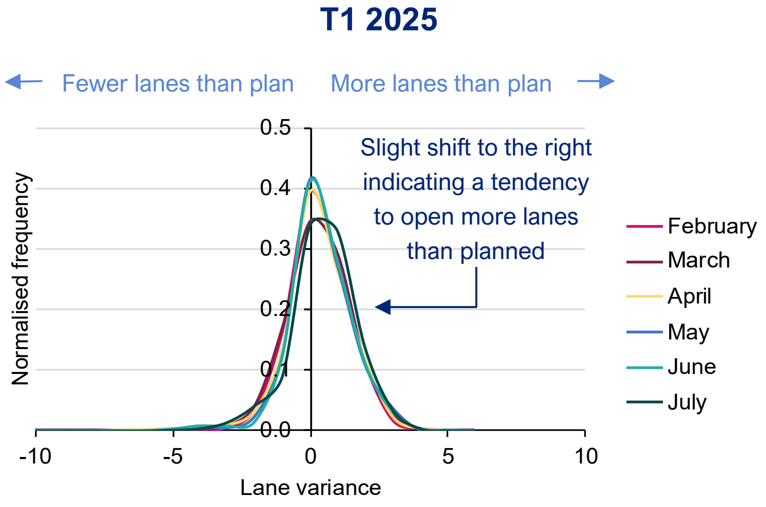


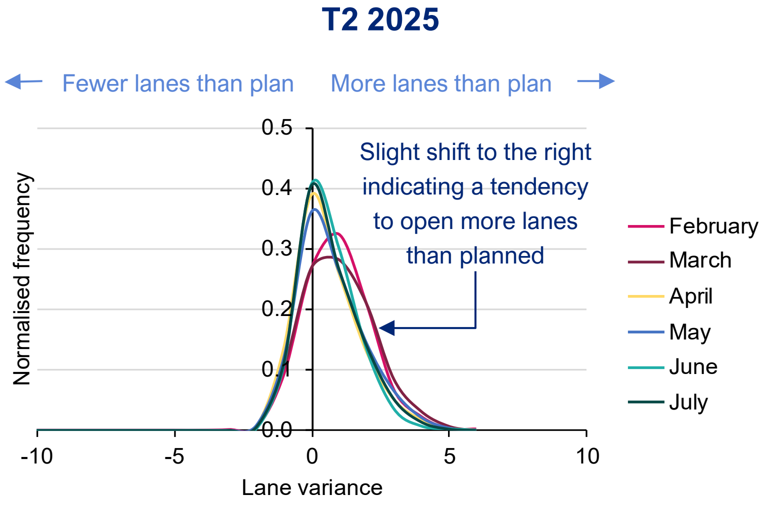
The graphs on this slide show the **difference between the actual number of open lanes and the planned number of open lanes.**

For both terminals in 2024, the negative shift of the distributions implies that fewer lanes were opened in practice than was planned for. The size of the negative shift in the February, March and April distributions suggest systematic issues of overplanning in these months across the airport.

In 2025, the distributions are shifted slightly positively, more so in Terminal 2 than in Terminal 1. While the mode remains centred around zero, suggesting largely random variation, the rightward shift indicates a tendency to either under-plan the number of lanes required or to open more lanes than necessary. This is explored further in the heatmap analysis.

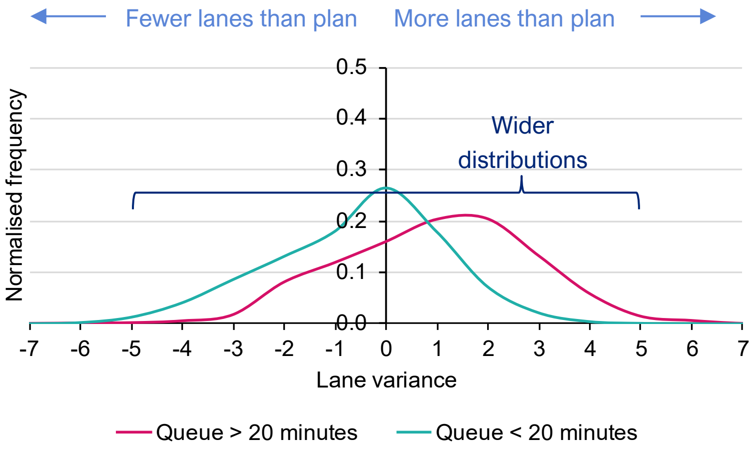




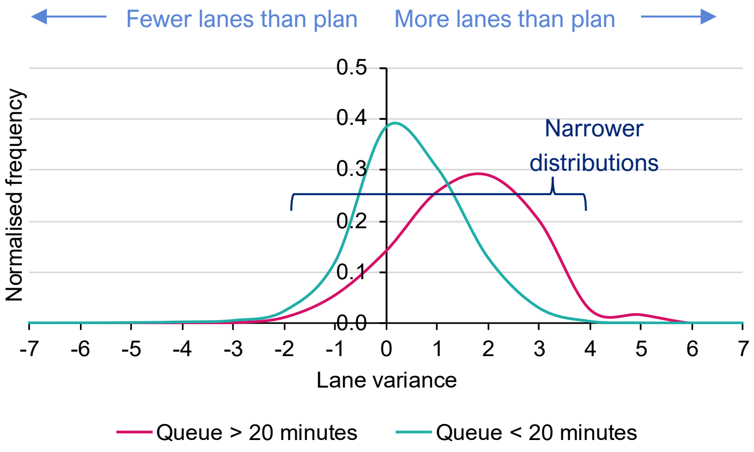


During instances of high queues, this often led to more lanes being opened compared to the plan

T1 2024



T1 2025



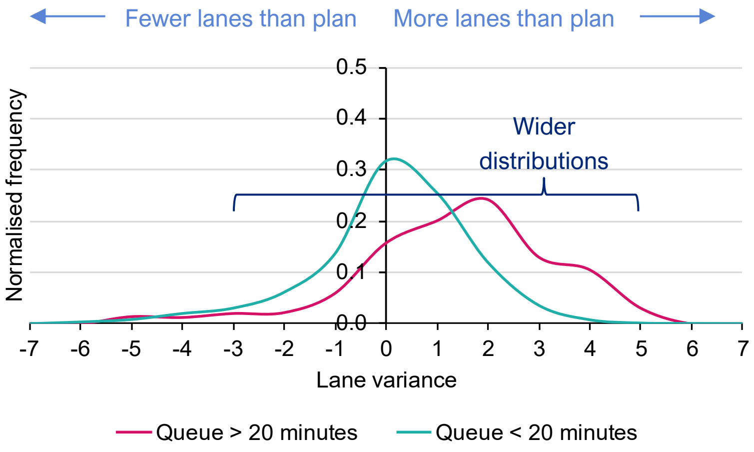
The graphs on this slide show **how many lanes were open over the plan when maximum queues exceeded 20 minutes** with the 15-minute intervals.

Our observation that more lanes are open than planned when queues are high is likely to be an effect rather than a cause, with more lanes opened to counter the building queues.

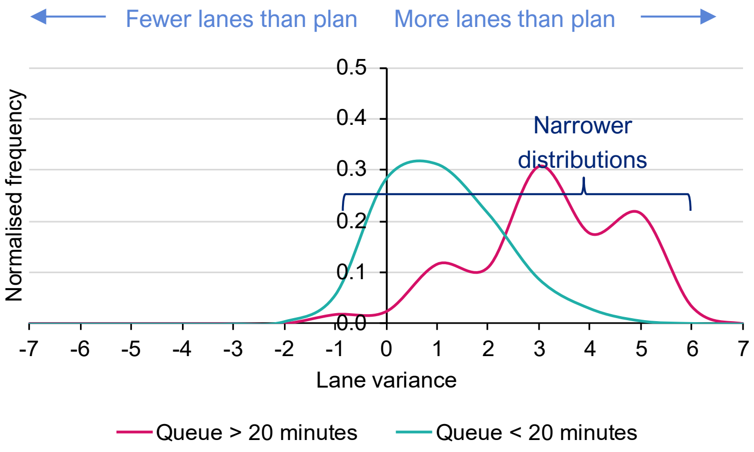
Across both terminals, the variability in lane opening at both levels of queueing (maximum queues above and below 20 minutes) narrowed between 2024 and 2025. This could suggest some improvement in operational planning over time.

In 2025, the number of instances where fewer lanes were open than planned, reduced.

T2 2024

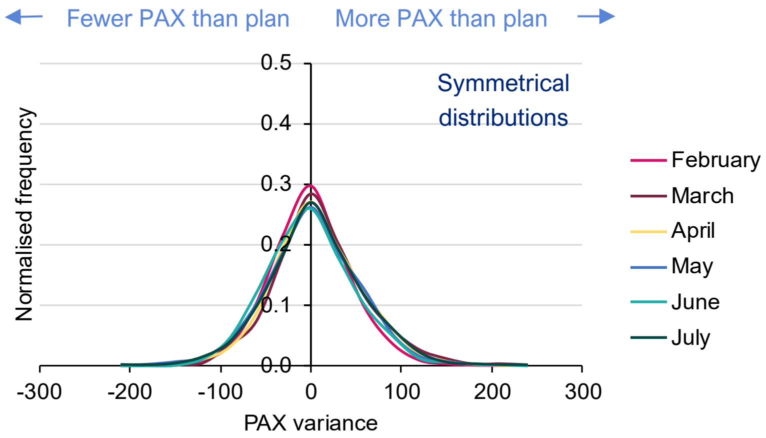


T2 2025

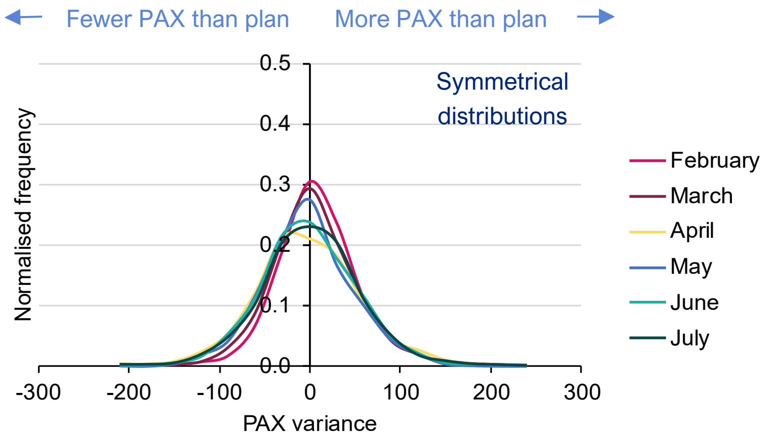


The distributions of passenger variance do not show large changes between the year, indicating little change in passenger forecasting accuracy

T1 2024



T1 2025



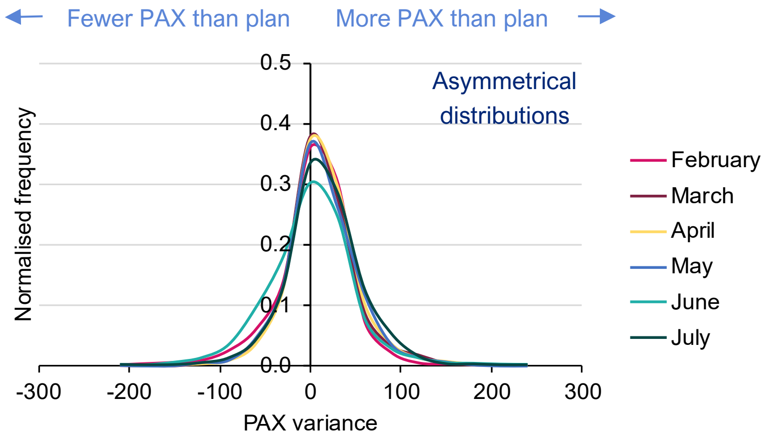
The graphs on this slide show **the difference between actual and planned passenger demand.**

For both terminals, the peaks in the distributions are around zero, highlighting that there is no systematic bias in forecasts.

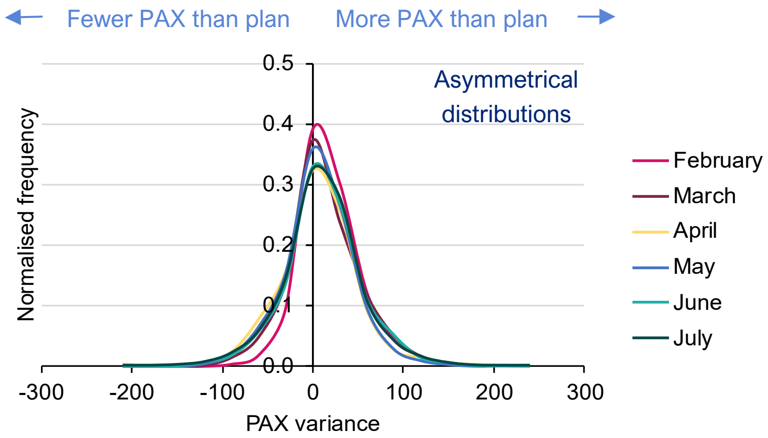
Passenger variance had a tighter distribution in Terminal 2 compared to Terminal 1, indicating more accurate forecasting in Terminal 2. However, this was likely due to Terminal 2 having lower overall passenger numbers.

The Terminal 1 distributions are broadly symmetrical, indicating that forecasts are equally likely to under- or overestimate demand. In contrast, the Terminal 2 distributions are right-skewed, indicating that under-planning occurred more frequently than over-planning.

T2 2024

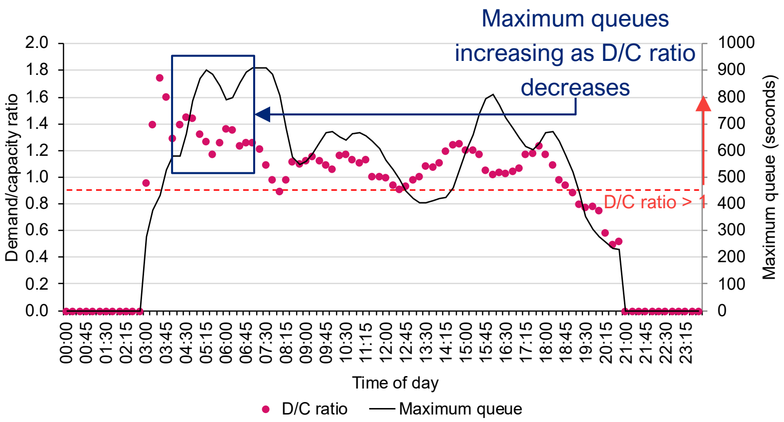


T2 2025

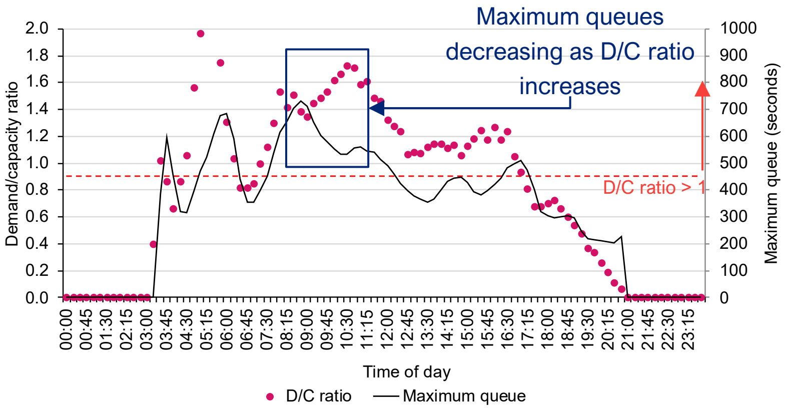


Analysis of the ratio of demand to capacity does not align with when we observe high queues, suggesting potential data issues

T1 2024



T2 2024



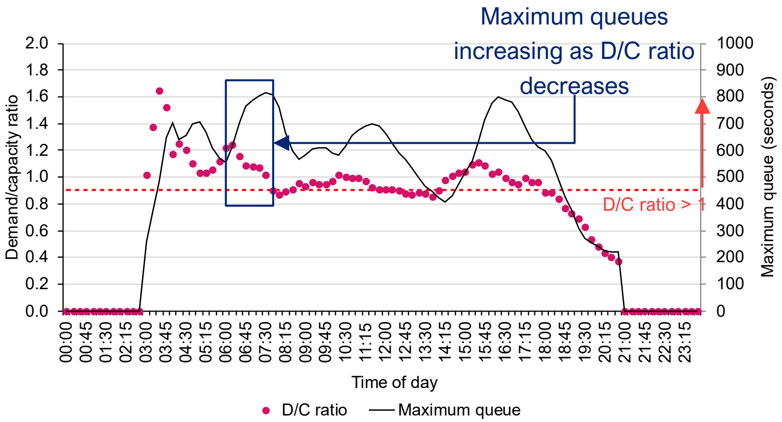
Queueing theory suggests that the ratio of demand to capacity needs to be around 0.9 to meet a queue target of 30 minutes 99.99% of the time, assuming a processing rate of approximately 190 per hour. Ratios higher than this would risk breaching the daily target.

We have modelled lane capacity using the 95%ile of observed throughput.[1] This is then multiplied by the number of open lanes to give search capacity.

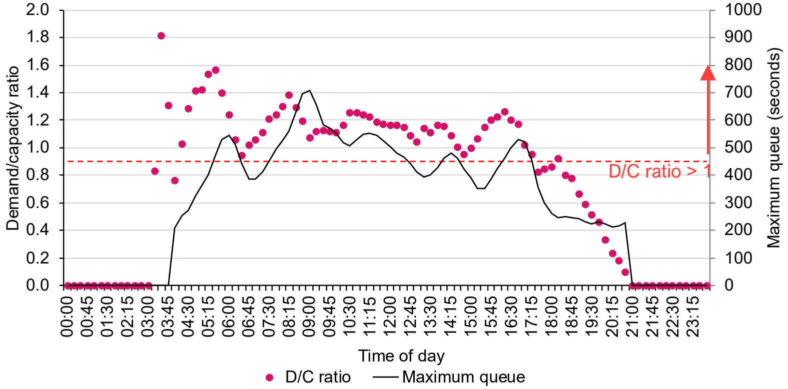
We see that the periods of high demand/capacity ratios does not align with high maximum queues, suggesting issues with some of the data:

- The 95%ile throughput is too conservative.
- The actual lane open data is lower than reality.
- The demand recorded is higher than reality.

T1 2025



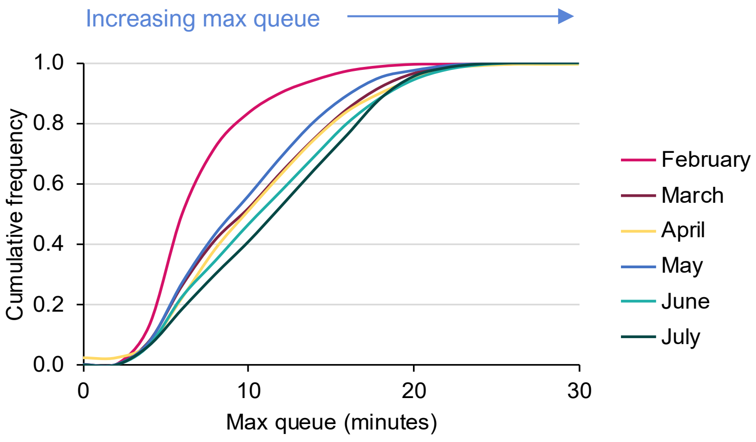
T2 2025



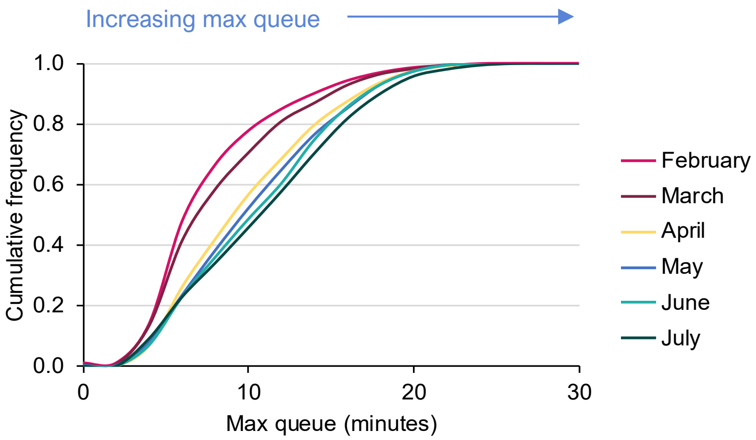
[1] The 95th percentile has been assumed at 190 as provided by Dublin Airport

Maximum queue distributions generally indicated that queueing increased towards the summer

T1 2024



T1 2025



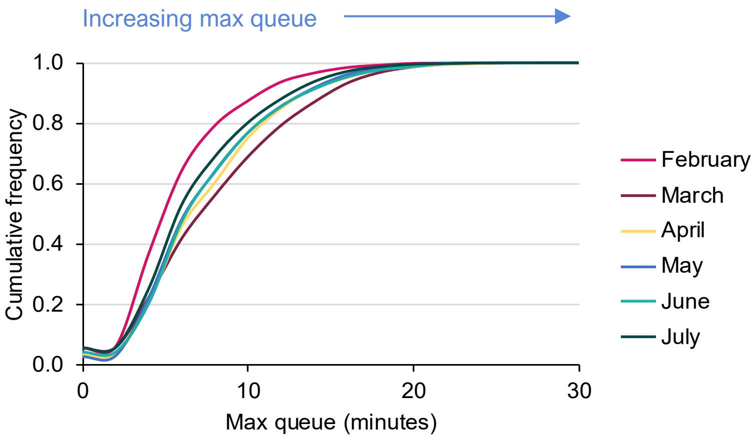
The graphs on the slide show **maximum queue distributions**.

Overall, maximum queue times were consistently higher in the months closer to summer, as expected. Despite this, the queue was below 20-minute queue threshold more than 90% of the time in all cases, well above the 70% target.

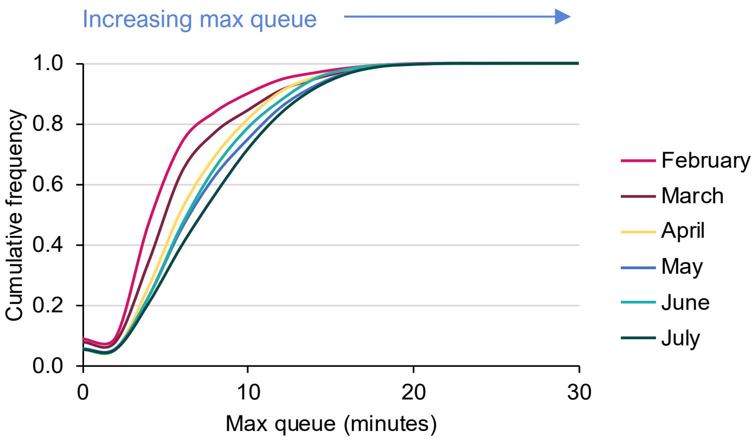
T1 – February stood out as an outlier in 2024, showing shorter maximum queues more consistently than other months, which are more closely aligned.

T2 – February had consistently shorter queues than other months, but the overall variance between months is smaller than for T1. In 2024, March and April bucked the general trend and had higher queues than the summer months. This coincides with the months where significantly fewer lanes were open.

T2 2024

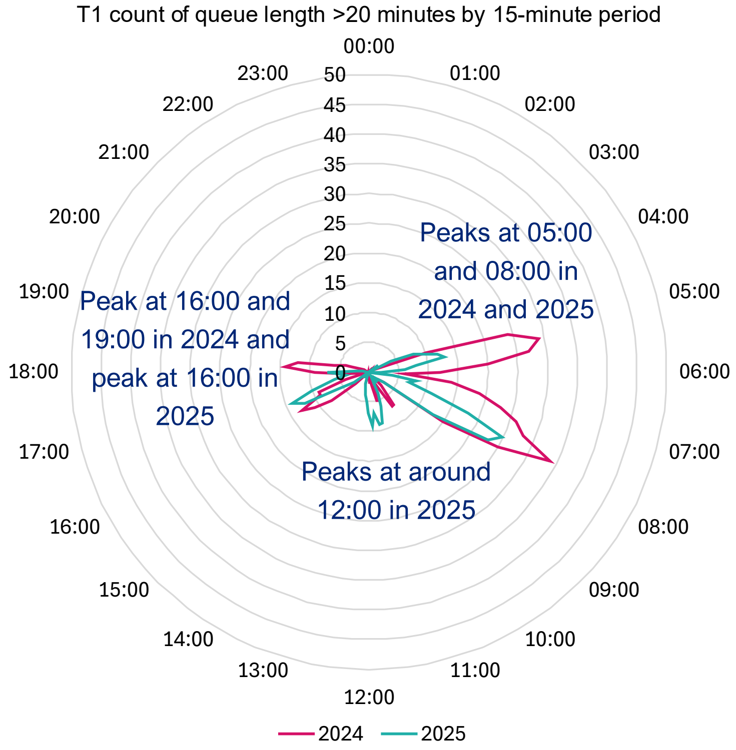


T2 2025



We observe that instances of high peak queues have reduced considerably in frequency between 2024 and 2025

T1



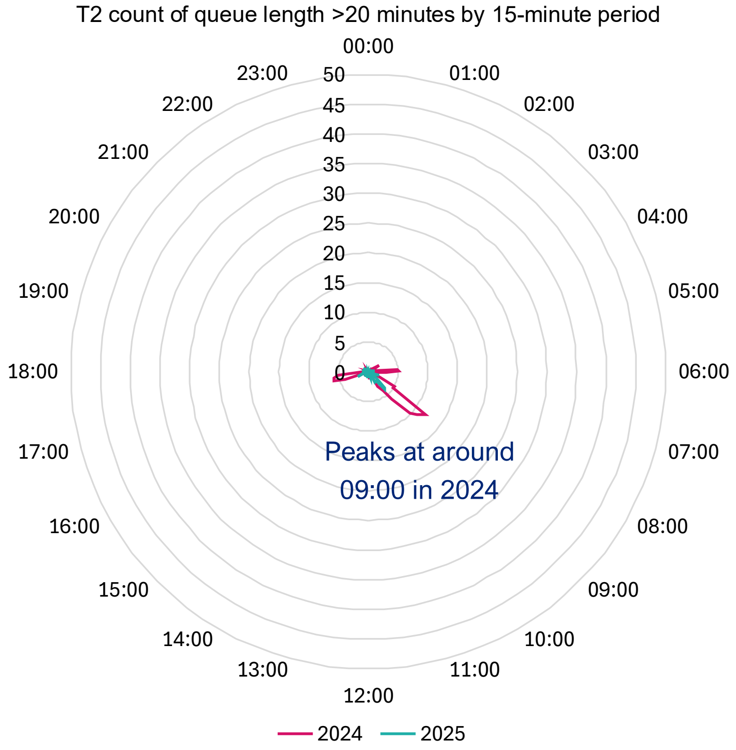
The charts on this slide show **how often maximum queues exceeded 20 minutes**, highlighting trends in peak queueing.

Across both terminals, instances of maximum queues breaching 20 minutes dropped dramatically between 2024 and 2025, indicating better performance.

T1 – In 2024, major queueing peaks occurred around 05:00 and 08:00, with smaller peaks at 16:00 and 19:00. By 2025, the only major peak occurred at 08:00, with minor peaks at 05:00, 12:00 and 16:00. This suggested that early morning queues were being better managed, while later morning peaks remain an issue.

T2 – Queues were much less likely to exceed 20 minutes compared to T1. In 2024 the only major peak occurred around 09:00. By 2025, queues rarely surpassed 20 minutes, with no clear trends in peaks.

T2



The current regression model explains ~40% of queue variability but is not sufficiently precise to use as a predictor

We have used multivariate regression analysis to determine the statistical relationship between queue length and the factors expected to influence queue length

Our approach is dependent on having access to relatively granular data on as many of the potential influences of queue length as possible.

We have used a simple linear regression to analyse the relationship between queue length (the independent variable) and the drivers we expect to influence queue length (the dependent variable):

$$Q(t) = A_0 + \sum_{i=1}^{N} a_i x_i(t)$$

While the regression highlights several statistically significant variables affecting queue performance, it also highlights that a significant proportion of the drivers influencing maximum queues were not being gathered at the time the data was recorded.

Using the data provided, the regression model had an adjusted R^2 of 0.41 indicating that these input variables account for around 40% of the variation in queue length.

The other 60% is likely from factors not included in the available data, suggesting that variables not being recorded during data collection play a significant role in explaining queue length.

Identifying the missing variables would require staff input and brainstorming of what logically effects queue length, followed by statistical testing using up-to-date data.

Regression statistics	
Adjusted R^2	0.41
Standard error	3.62
Observations	46771

The standard error from the regression was high, limiting the applicability of the results

Considering the high standard error presented by this regression analysis, these results would be unsuitable for application to planning and forecasting.

However, the outputs of the regression do identify several significant variables which are useful as explanatory insights.

Regression with maximum queue length as the dependent variable highlighted some key drivers of security performance

Commentary on significant drivers

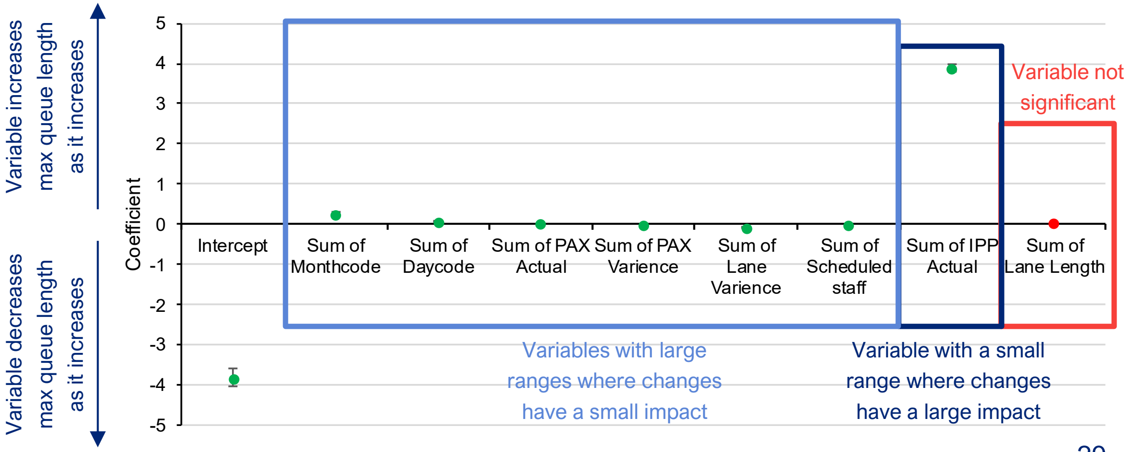
- Except for total lane length, all of the variables we analysed were statistically significantly linked to queue length. This included:
  - Month, with a range of February (2) to July (7) – positive coefficient – maximum queues tend to increase during summer compared to the winter.
  - Day, ranging the week from Sunday (1) to Saturday (7) – slight positive coefficient – maximum queues tend to increase later in the week.
  - PAX actual – slight positive coefficient – maximum queues tend to increase when the passenger demand increases.
  - PAX variance – close to zero coefficient (<+- 0.01) – passenger demand variance from the plan can affect queueing when it is positive and when it is negative.
  - Lane variance – negative coefficient – maximum queues tend to decrease when more lanes are open than planned in line with intuition.
  - IPP actual – high positive coefficient – maximum queues tend to be higher when IPP increases.
  - Scheduled staff – slight negative coefficient – maximum queues tend to be lower as scheduled staff levels increase.

ANOVA

	Regression	Residual	Total
Degrees of freedom (df)	8	46,762	46,770
Sum of squares (SS)	420,075	612,381	1,032,456
Mean square (MS)	52,509	13	
F-statistic	4,010		
Significance F	0		

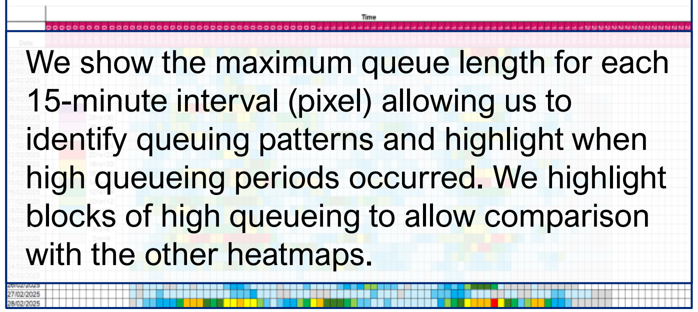
SS values indicate that the regression explains just under half of the regression, when using the eight independent variables listed (df). However, the F-statistic and the significance of F suggest that the results are accurate.

Regression coefficients



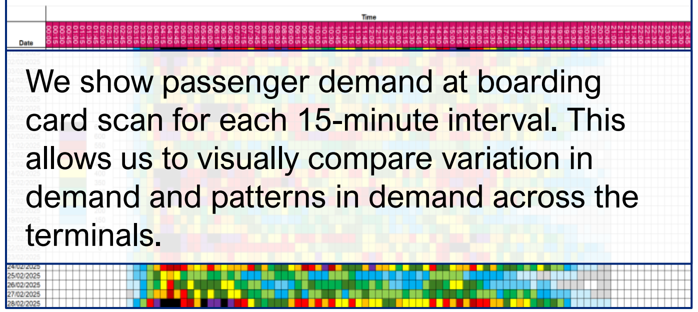
We compare different heatmaps at high queueing times to help identify root causes of high queues

Maximum queue length



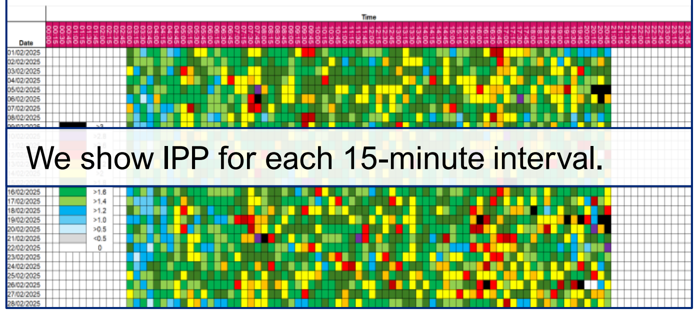
We show the maximum queue length for each 15-minute interval (pixel) allowing us to identify queuing patterns and highlight when high queueing periods occurred. We highlight blocks of high queueing to allow comparison with the other heatmaps.

Demand



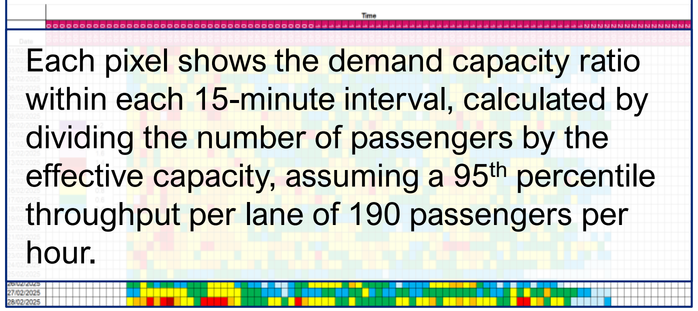
We show passenger demand at boarding card scan for each 15-minute interval. This allows us to visually compare variation in demand and patterns in demand across the terminals.

IPP



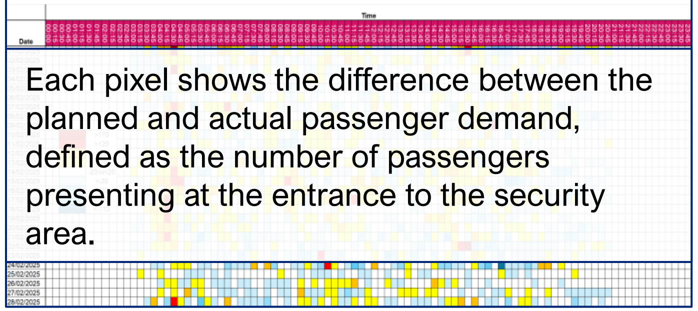
We show IPP for each 15-minute interval.

Demand capacity ratio



Each pixel shows the demand capacity ratio within each 15-minute interval, calculated by dividing the number of passengers by the effective capacity, assuming a 95th percentile throughput per lane of 190 passengers per hour.

Delta demand, actual vs plan

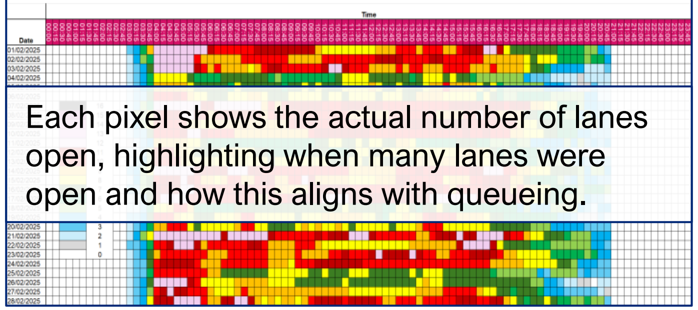


Each pixel shows the difference between the planned and actual passenger demand, defined as the number of passengers presenting at the entrance to the security area.

Scheduled staff

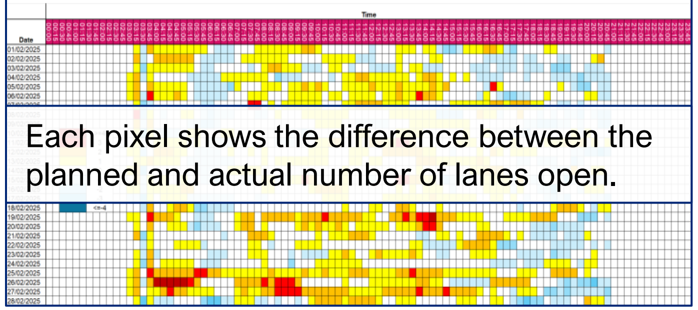
Each pixel shows the ‘scheduled staff’, that is the number of security staff planned/rostered for duty.

Lanes open



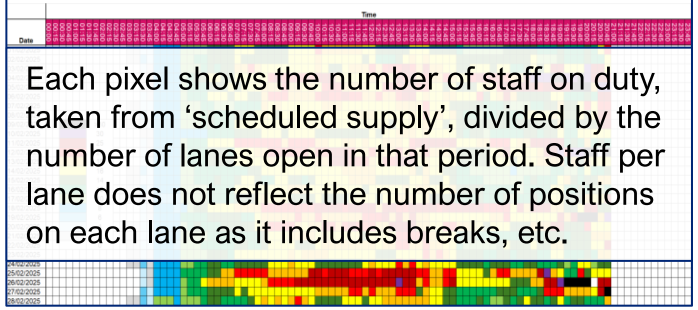
Each pixel shows the actual number of lanes open, highlighting when many lanes were open and how this aligns with queueing.

Delta lanes open, actual vs plan



Each pixel shows the difference between the planned and actual number of lanes open.

Scheduled staff per lane



Each pixel shows the number of staff on duty, taken from ‘scheduled supply’, divided by the number of lanes open in that period. Staff per lane does not reflect the number of positions on each lane as it includes breaks, etc.

The heatmaps highlight common themes and differences across the months and the terminals

Maximum queue length

All months experienced periods of high maximum queueing, although queues exceeding 20 minutes was more prevalent in Terminal 1 than Terminal 2.

There were no trends between months for when queues most often occurred.

Demand

In both terminals peak daily passenger demand occurred early in the morning, usually between 04:00 and 06:00.

In Terminal 2 demand drops dramatically directly after the early morning peak, before building up again later in the day.

IPP

IPP was significantly higher in winter months compared to the summer months, with peaks exceeding three in February in both terminals.

In winter particularly, IPP increased dramatically at the end of higher maximum queues as demand started to decrease.

Demand capacity ratio

Demand capacity appeared excessively high across all terminals, although this is likely to consequence of the assumptions made on lane capacity. Generally, a demand capacity figure exceeding one would lead to unmanageable queueing. This figure is exceeded many times across all months.

Delta demand, actual vs plan

Across both terminals actual passenger demand varied greatly to the plan. In some months, certain times of the day appeared to show systemic over or under planning of passenger demand.

Scheduled staff

In Terminal 1 staffing increased dramatically between winter and summer, while in Terminal 2 there was less of a difference.

In both terminals there was some evidence correlating higher maximum queues with times when fewer staff were scheduled.

Lanes open

In Terminal 1, high maximum queueing generally occurred when a high or the maximum number of lanes were open.

In Terminal 2, findings were more mixed, although queues generally also occurred when higher numbers of lanes were open.

Delta lanes open, actual vs plan

Consistently across the whole dataset, more lanes were opened than planned. This is likely due to the under-forecasting of passenger demand, although more lanes were also opened than planned at times when passenger demand were over-forecast.

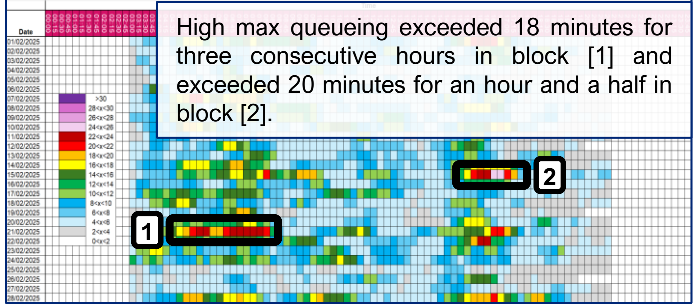
Scheduled staff per lane

In Terminal 2 scheduled staff per lane suggests that there is an excess of staff late in the evenings, like due to rostering restrictions.

In both terminals there was some evidence correlating higher maximum queues with lower scheduled staff per lane.

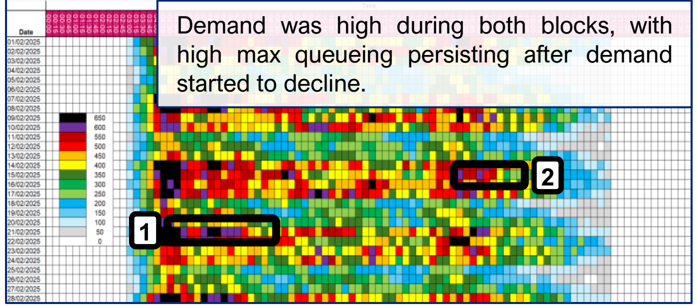
Terminal 1 in February 2025 had two notable periods of high maximum queueing

Maximum queue length



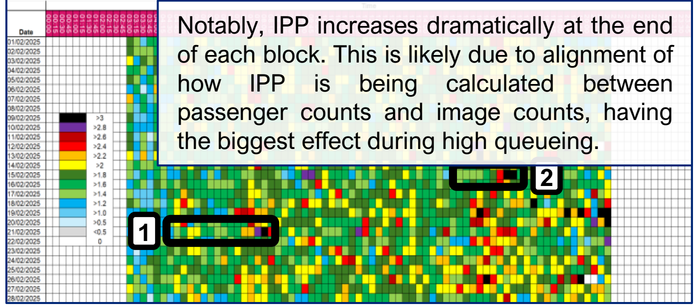
High max queueing exceeded 18 minutes for three consecutive hours in block [1] and exceeded 20 minutes for an hour and a half in block [2].

Demand



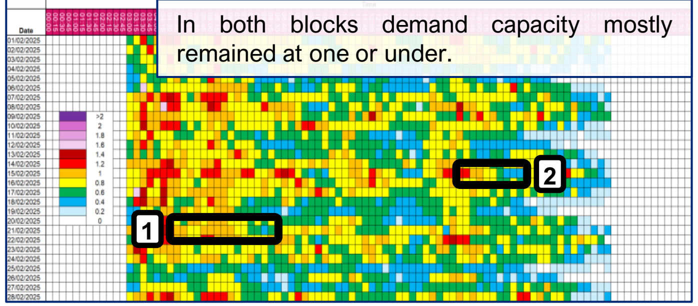
Demand was high during both blocks, with high max queueing persisting after demand started to decline.

IPP



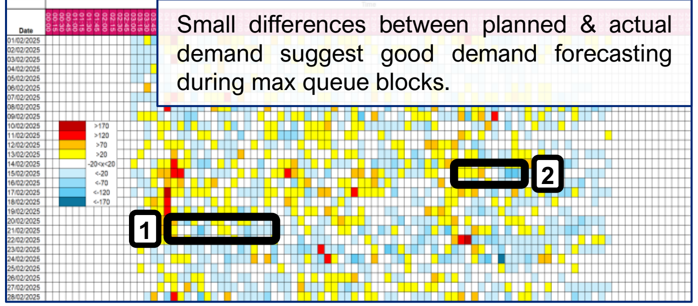
Notably, IPP increases dramatically at the end of each block. This is likely due to alignment of how IPP is being calculated between passenger counts and image counts, having the biggest effect during high queueing.

Demand capacity ratio



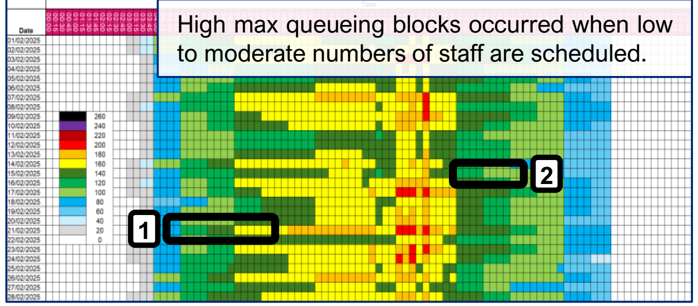
In both blocks demand capacity mostly remained at one or under.

Delta demand, actual vs plan



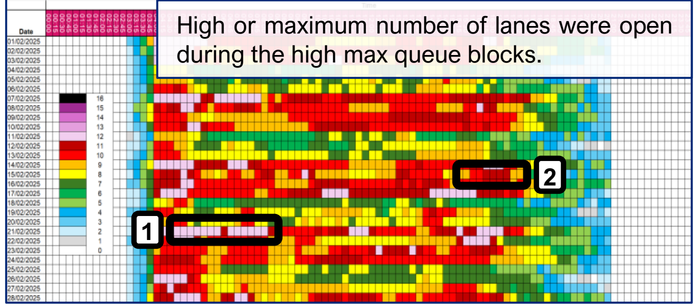
Small differences between planned & actual demand suggest good demand forecasting during max queue blocks.

Scheduled staff



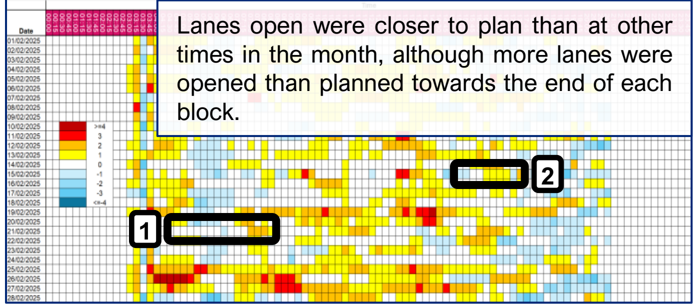
High max queueing blocks occurred when low to moderate numbers of staff are scheduled.

Lanes open



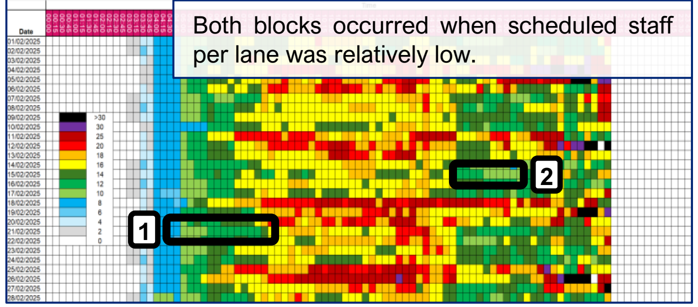
High or maximum number of lanes were open during the high max queue blocks.

Delta lanes open, actual vs plan



Lanes open were closer to plan than at other times in the month, although more lanes were opened than planned towards the end of each block.

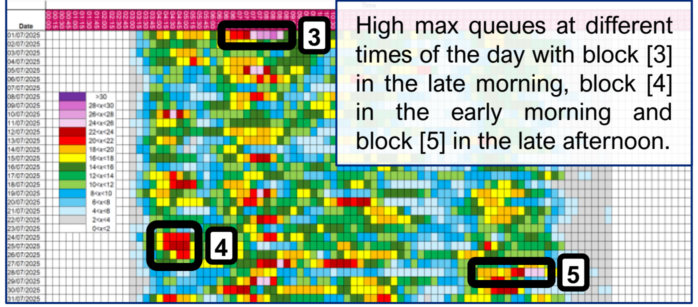
Scheduled staff per lane



Both blocks occurred when scheduled staff per lane was relatively low.

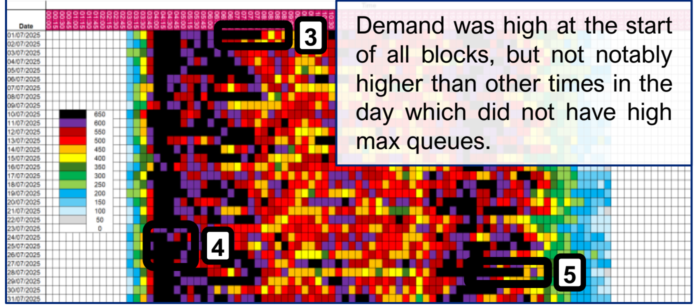
Terminal 1 in July 2025 saw high maximum queue periods on several days throughout the month

Maximum queue length



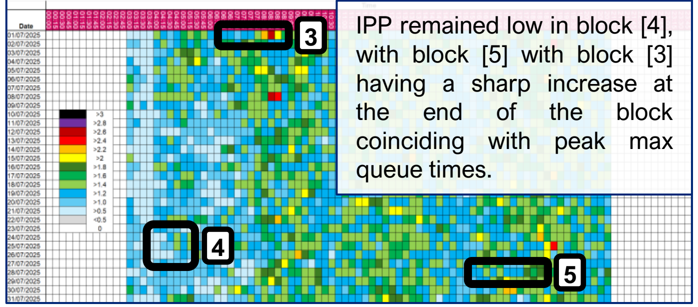
High max queues at different times of the day with block [3] in the late morning, block [4] in the early morning and block [5] in the late afternoon.

Demand



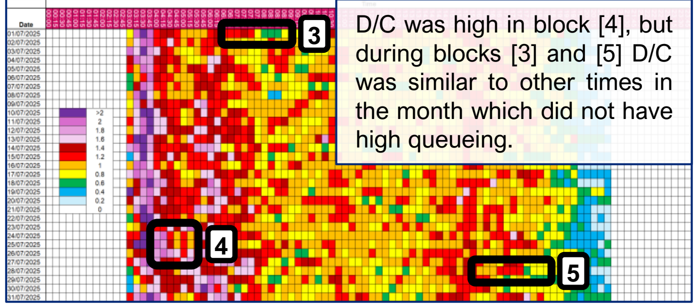
Demand was high at the start of all blocks, but not notably higher than other times in the day which did not have high max queues.

IPP



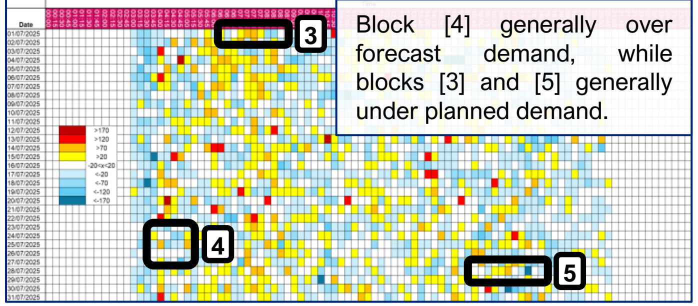
IPP remained low in block [4], with block [5] with block [3] having a sharp increase at the end of the block coinciding with peak max queue times.

Demand capacity ratio



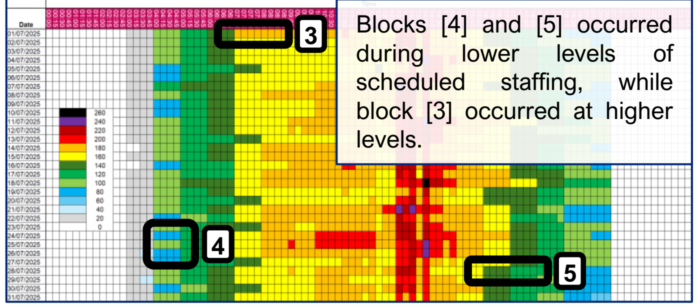
D/C was high in block [4], but during blocks [3] and [5] D/C was similar to other times in the month which did not have high queueing.

Delta demand, actual vs plan



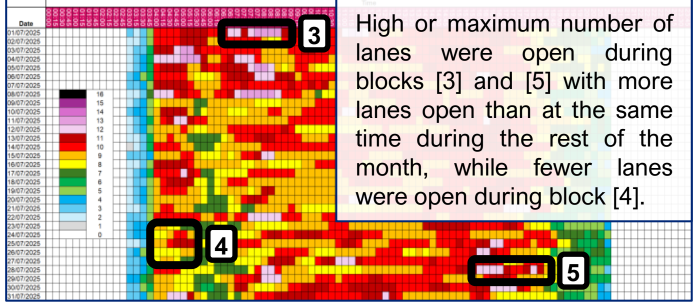
Block [4] generally over forecast demand, while blocks [3] and [5] generally under planned demand.

Scheduled staff



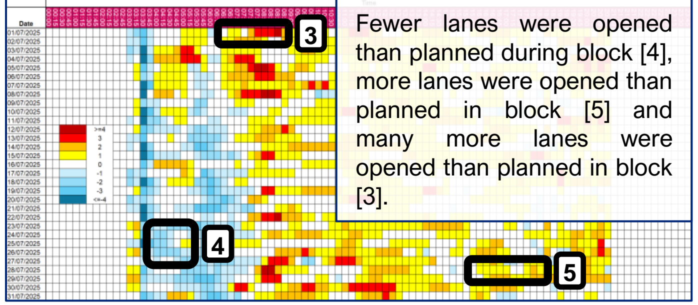
Blocks [4] and [5] occurred during lower levels of scheduled staffing, while block [3] occurred at higher levels.

Lanes open



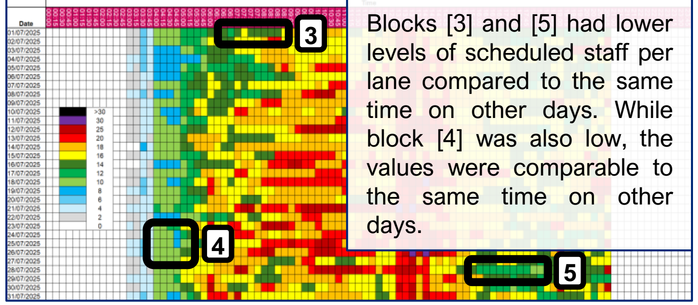
High or maximum number of lanes were open during blocks [3] and [5] with more lanes open than at the same time during the rest of the month, while fewer lanes were open during block [4].

Delta lanes open, actual vs plan



Fewer lanes were opened than planned during block [4], more lanes were opened than planned in block [5] and many more lanes were opened than planned in block [3].

Scheduled staff per lane



Blocks [3] and [5] had lower levels of scheduled staff per lane compared to the same time on other days. While block [4] was also low, the values were comparable to the same time on other days.

Heatmap analysis of Terminal 1 suggests that queue management was most efficient during early morning passenger peaks

High maximum queues were frequently observed between 07:00 and 09:00 across Terminal 1

- As seen in the radar graphs, high periods of maximum queues frequently occurred between 07:00 and 09:00. In February this can be seen in block [1] and in July in block [3].
- Outside of this period, other high queueing times were spread throughout the day with no clear trends in times.

Inaccurate forecasting can result in more lanes being opened than planned, which can be inefficient

- Actual passenger demand varied from the forecast throughout all times of the day.
- This variability likely explains why more lanes were opened than forecast, perhaps driven by staff levels being higher than necessary meaning staff are placed in lanes.
- Additionally, in July passenger demand was consistently underestimated between 03:00 and 04:00, often resulting in fewer lanes being open than planned at this time.
- This highlighting the importance of accurate forecasting, with both over and under forecasting leading to inefficiencies.

Peaks in maximum queues generally occurred outside of the morning peak passenger arrival periods

- Peak demand occurred between 04:00 and 05:00.
- Across February and July, the only high queueing period noted in this timeframe is block [4]. So most peaks in maximum queues in both months occurred outside this peak demand period.
- This could suggest that the terminal can handle the passenger demand levels seen, but high queueing periods occur when demand is not able to be properly planned for or managed.

Inability to open all lanes as planned, possibly due to staff limitations, could drive high maximum queues

- The period of high maximum queues seen in block [4] coincides with a period where fewer lanes were open compared to that time for the rest of the month.
- For this period, the number of lanes open was also lower than planned, suggesting that the unplanned, reduced capacity was the primary driver of high maximum queues within block [4].
- This could suggest that lanes couldn’t be opened, possible due to lack of staff.

Additional queuing influences for Terminal 1 have been suggested, but cannot be verified due to data limitations

The number of lanes open and staffing levels could theoretically suggest that opening fewer lanes but deploying additional staff per lane may provide better throughput

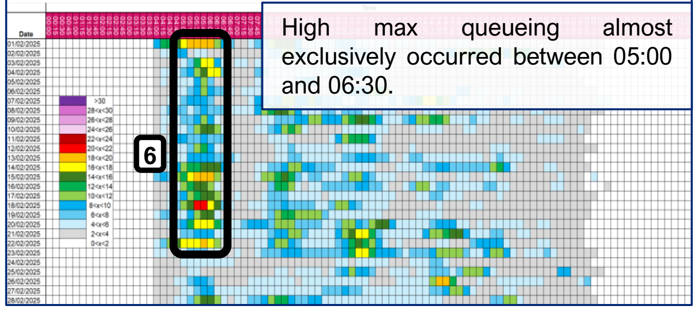
- Blocks [1], [2], [3] and [5] all coincided with periods when a high to maximum number of lanes were open, yet significant queues were still observed, indicating that lane availability alone did not prevent high maximum queues from forming.
- Across all blocks, high maximum queues also occurred during periods when scheduled staffing levels were lower than the norm.
- Consequently, high maximum queue periods aligned with times when the scheduled number of staff per lane was low. This suggests that although many lanes were open, they may not have been fully staffed.
- If high maximum queueing occurs when a high number of lanes are not fully staffed, this could suggest that high queueing is occurring because lanes are not operating at full efficiency.
- This could suggest that opening fewer lanes but staffing them more optimally may provide better overall throughput, although this cannot be confirmed without passenger throughput data.

Data limitations hinder the ability to draw definitive conclusions

- Without throughput data at a 15-minute interval, among other potential insights, it is difficult to robustly assess whether the level of staffing per lane contributes to the observed queues.
- Additionally, the staffing data used represents scheduled staffing only, reflecting predicted rather than actual staff attendance.
- These figures also do not account for staff on breaks, further limiting the accuracy of conclusions regarding staffing efficiency.

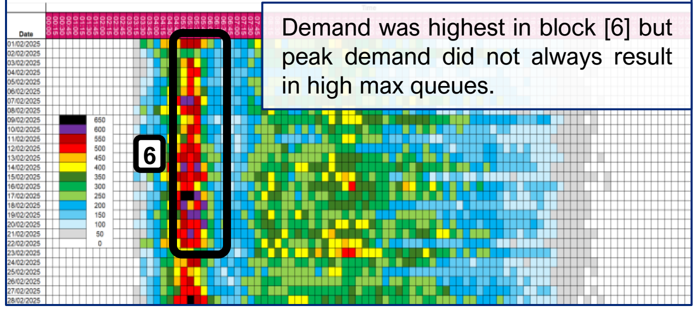
Terminal 2 in February 2025 mostly saw high max queueing in the morning

Maximum queue length



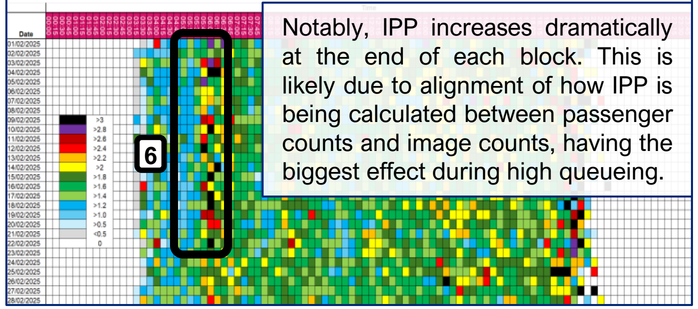
High max queueing almost exclusively occurred between 05:00 and 06:30.

Demand



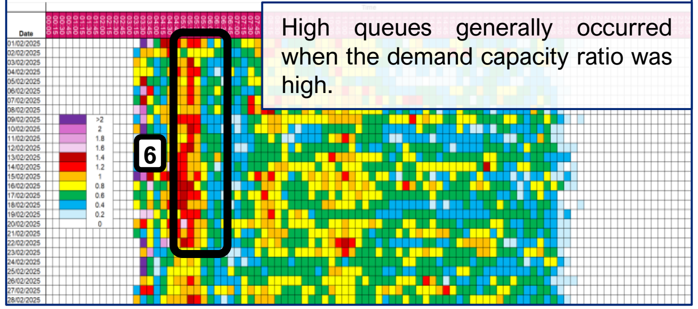
Demand was highest in block [6] but peak demand did not always result in high max queues.

IPP



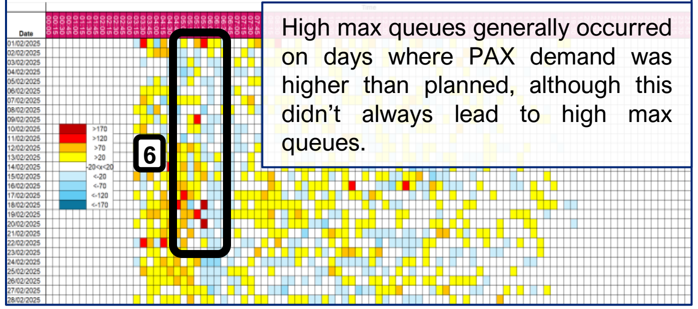
Notably, IPP increases dramatically at the end of each block. This is likely due to alignment of how IPP is being calculated between passenger counts and image counts, having the biggest effect during high queueing.

Demand capacity ratio



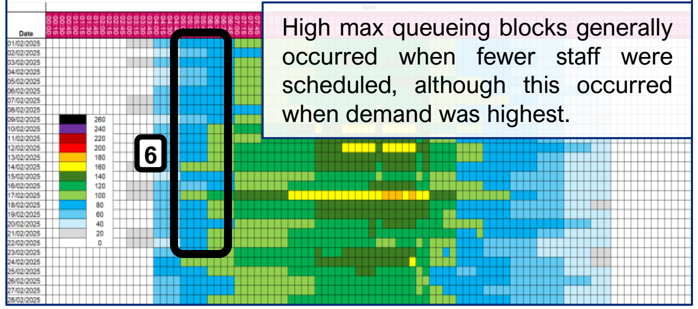
High queues generally occurred when the demand capacity ratio was high.

Delta demand, actual vs plan



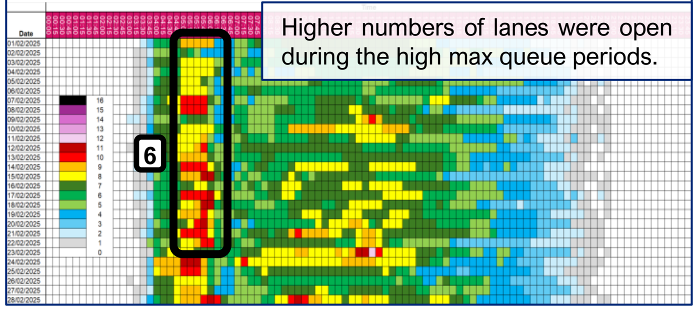
High max queues generally occurred on days where PAX demand was higher than planned, although this didn't always lead to high max queues.

Scheduled staff



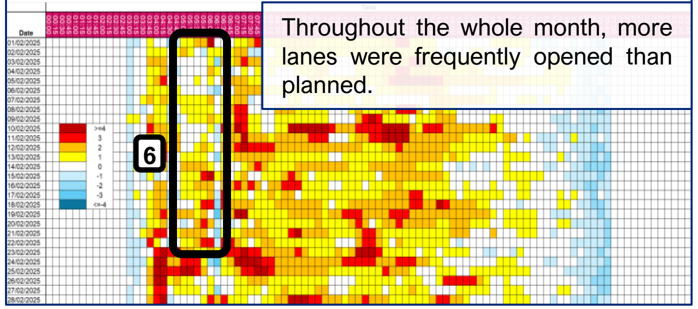
High max queueing blocks generally occurred when fewer staff were scheduled, although this occurred when demand was highest.

Lanes open



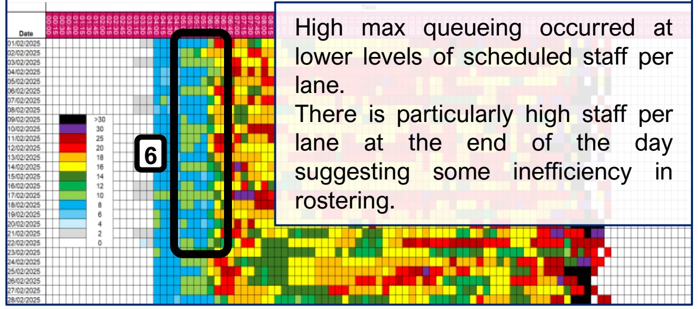
Higher numbers of lanes were open during the high max queue periods.

Delta lanes open, actual vs plan



Throughout the whole month, more lanes were frequently opened than planned.

Scheduled staff per lane

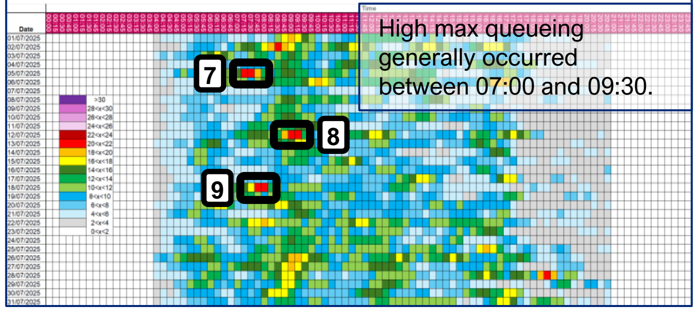


High max queueing occurred at lower levels of scheduled staff per lane.

There is particularly high staff per lane at the end of the day suggesting some inefficiency in rostering.

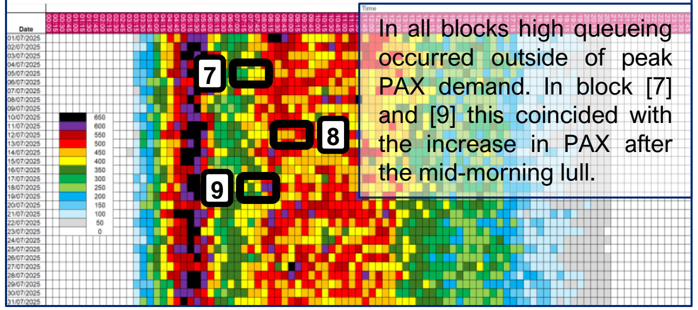
Terminal 2 in February 2025 saw high max queueing as passenger demand started to increase after the quiet mid-morning period

Maximum queue length



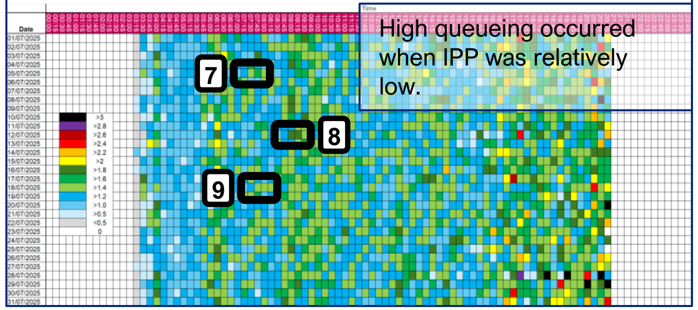
High max queueing generally occurred between 07:00 and 09:30.

Demand



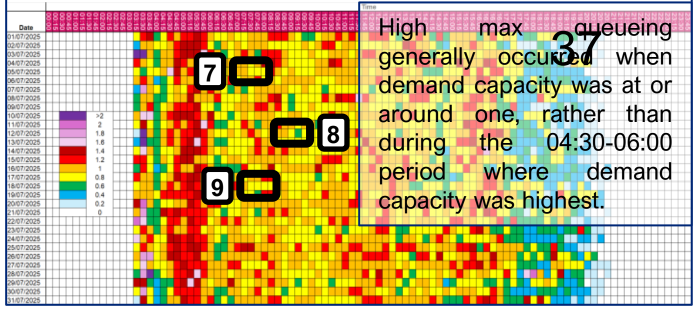
In all blocks high queueing occurred outside of peak PAX demand. In block [7] and [9] this coincided with the increase in PAX after the mid-morning lull.

IPP



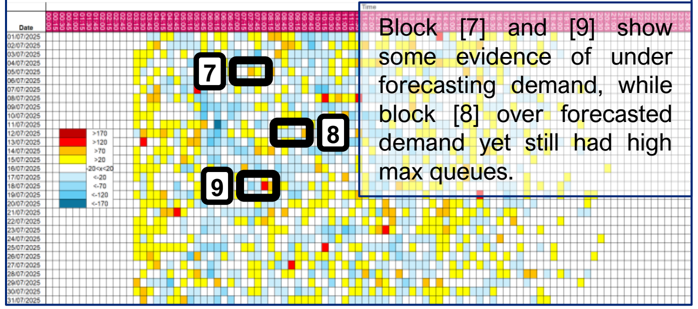
High queueing occurred when IPP was relatively low.

Demand capacity ratio



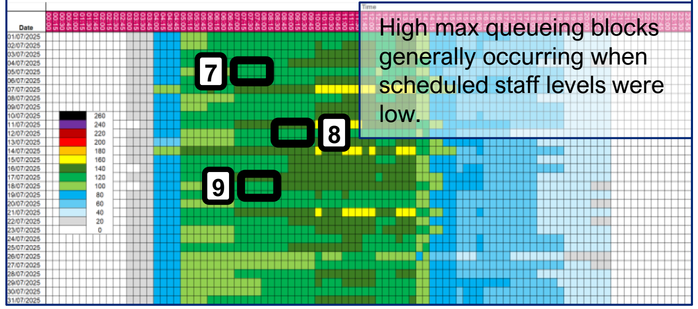
High max queueing generally occurred when demand capacity was at or around one, rather than during the 04:30-06:00 period where demand capacity was highest.

Delta demand, actual vs plan



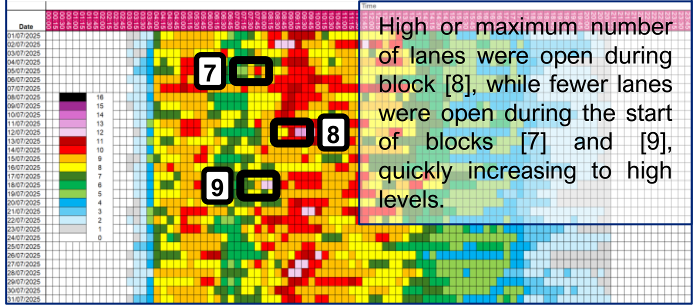
Block [7] and [9] show some evidence of under forecasting demand, while block [8] over forecasted demand yet still had high max queues.

Scheduled staff



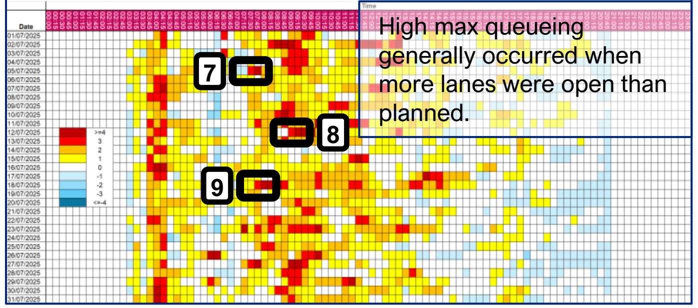
High max queueing blocks generally occurring when scheduled staff levels were low.

Lanes open



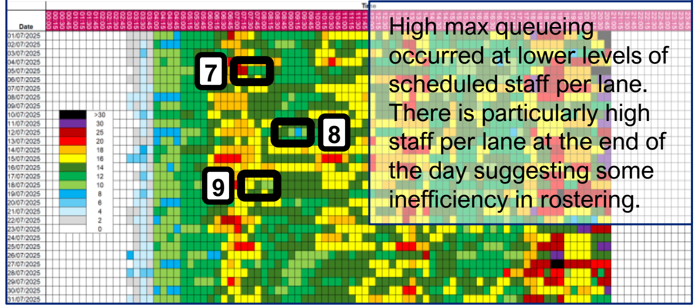
High or maximum number of lanes were open during block [8], while fewer lanes were open during the start of blocks [7] and [9], quickly increasing to high levels.

Delta lanes open, actual vs plan



High max queueing generally occurred when more lanes were open than planned.

Scheduled staff per lane



High max queueing occurred at lower levels of scheduled staff per lane. There is particularly high staff per lane at the end of the day suggesting some inefficiency in rostering.

Heatmap analysis of Terminal 2 highlights different potential causes of high queues across both months

High queueing in Terminal 2 appears to result from a range of factors, with no consistent cause across all instances

- In February, passenger demand peaked between 05:00 and 05:30, with maximum queues occurring shortly after, between 05:30 and 06:00. This suggests queues formed directly in response to peak demand.
- In July, demand peaked between 05:00 and 06:00, with maximum queues appearing between 07:00 and 09:00. This instead suggests that high queues were not aligned with peak passenger demand.
- In July, many lanes were open during the entirety of block [8], while fewer lanes were open at the start of blocks [7] and [9], with lane availability increasing rapidly by the end of the blocks. This ramp-up in lane availability coincided with an increase in passenger volumes following the mid-morning lull.
- This pattern suggests that lanes were being opened reactively to the increased demand, with queues then forming due to additional lanes not being opened early enough.
- Opening additional lanes earlier in blocks [7] and [9] may have helped in managing the increase in passengers more effectively and potentially prevented the queues exceeding 20 minutes.

Accuracy of forecasting is again highlighted as being particularly important for ensuring the efficiency of operations

- Over both months actual passenger demand varied from the plan at all times of the day.
- In February, under forecasting appears to be most prevalent, whereas in July there is more of a balance between over forecasting and under forecasting.
- Under forecasting likely explains why more lanes were opened than planned for large sections of the day for both months.
- With these cases being so frequent, it seems likely that many staff are kept as a buffer, which could be reduced if planning was more accurate.
- In both months there were large periods where more than three lanes were being opened compared to the plan.
- In July in particular, more lanes were being opened than planned between 03:30 and 04:30 on most days.
- This mismatch could be driving inefficiencies in both terminals, highlighting the importance of accurate forecasting.

Data was provided across multiple data requests, but there were issues with missing key drivers and inconsistency across sources

Dublin Airport could not provide data on several fundamental drivers for the required timeframe and time interval, limiting the analysis

- In particular, the actual lane passenger throughput was not provided.
- The rate of tray processing by x-ray machines has been provided, but not in enough granularity to be useful in analysis.
- As the passenger processing rate is a key driver, the lack of this data this has limited our ability to model queue performance.
- This also raised a question of how are planning and performance assessments occurring without lane throughput data available.

Multiple datasets provided by Dublin Airport included identical variables, but the data could not be aligned between sources, limiting confidence in the data

- For example, there are discrepancies in the number of lanes open between the different sources provided by Dublin Airport.
- There are also discrepancies between the recorded number of lanes open, with more lanes open than understood to be available in the terminal at that time.
- Although this may be explained by the transition from conventional x-ray lanes to CT scanners, it is not clear from the data if this is the cause.

Data provided by Dublin Airport could not be reconciled with IAA provided data, further limiting confidence in the data

- We have two sources of queue length; one provided by Dublin Airport and one by the IAA.
- We have assumed that Dublin Airport define queue length as the maximum queue during the 15-minute time window, provided in 15-minute increments.
- The IAA data is defined as the median value of the filtered individual queueing times observed over the preceding 15-minute interval, provided in 1-minute increments.
- Although the trends in the two data sets are the same, we are unable to reconcile the two sources exactly, with the Dublin Airport dataset often reporting higher queues.
- This reduces our confidence in the analysis results as it makes it harder to judge the queue length influences when the values cannot be confirmed necessarily accurate.

Our analysis process has led to several recommendations on how Dublin Airport measures security queueing and data

Queue length definition and calculation should be consistent across Dublin Airport and the IAA

- This would enable reporting on queue performance between organisations to be consistent and easily understandable.

Available technology should be used to record outlined queue parameters

- Variables such as lane throughput are key to security performance analysis, although we understand this is planned to be measured by Dublin Airport in the near future.
- Recording of data should be aligned with what is being measured at other airports.

Measuring queue performance data should be completed at a sufficient time resolution, e.g one-minute intervals.

- Increased granularity of data would allow detailed statistical analysis in support of continuous performance improvement.
- While high resolution data is likely to be 'noisy', robust analysis can deliver insights that are not available from data that is average/smoothed over longer time periods.

A system for recording, storing and retrieving high resolution queue performance data should be implemented

- Currently, data storing is limited, with retrieval of data appearing to be an effort intensive task.
- A new system would enable "rapid ex-post analysis", tactically in response to performance events and more strategically to evidence the impact of queue drivers and support continuous performance improvement.

Reviewing of data collection methods should be completed to ensure consistency of outputs across multiple data sources

- Some data sources were inconsistent with other provided sources of the same data.
- Additionally, sources provided at an increased granularity were sometimes not reconcilable with the original data.

A system should be implemented to record the specific lanes open at each time-period

- A clearer understanding of which lanes were open, and when, would enable analysis of individual lane performance and the impact of different lane configurations.

Analysing lane opening and lane closing sequences

The purpose of this analysis is to understand how well lane opening decisions match the profile of passenger volumes

We have developed a simple queueing model to answer the following question:

How well do the number of lanes open match the show-up profile of passengers, given planned and actual throughput performance?

Our model aims to identify whether, over the period analysed, the total number of lanes open broadly match what ought to be expected given passenger volumes, are too few (risking queues), or are too many (potentially indicating inefficiency).

Our queuing model estimates the minimum number of lanes that need to be open to process passengers within 5 minutes of arrival given outturn data on the number of images generated per passenger, and planned and actual tray throughput performance.

Our analysis, therefore, implicitly assumes the following:

- Passengers are processed within 5 minutes of arrival unless our analysis indicates that more lanes are required to be open that is physically available. This is less than the 10-minute service quality target.
- Lanes can be opened and closed every 5 minutes. In practice, this is unrealistic – and so we apply a 10% inefficiency factor by increasing trays per 5-minute period by 10% to derive a higher lane requirement to account for this.
- Tray processing capacity is the main driver of passenger throughput, rather than passenger processing capacity through body screeners.

Our analysis allows for:

- Comparison between actual lanes open and the modelled lane requirement for each terminal-year pair combination.
- Comparison between 2024 and 2025, to assess whether change in technology and other factors have led to better lane planning.
- Analysis of the consequent effect on staff needed.

Publication note: This lane opening model has been developed further since this original study as part of our development of a draft opex forecast for the 2026 Determination. Further details on the model are provided in the appendix of the main opex report.

Our methodology for estimating how well lane opening and closing sequences match the profile of passenger volumes

The charts on the following slides compare the actual number of lanes open with the number of lanes needed.

Dublin Airport provides actual lanes open data in 15-minute increments. We convert this data into 5-minute periods by assuming the same number of lanes remain open across each set of three 5-minute intervals within a 15-minute block.

We conduct the analysis using 5-minute intervals covering May–July 2024 and February–July 2025 for Terminals 1 and 2.

We calculate lanes required using the following steps:

- We calculate total throughput (TP) using actual passenger volumes and actual images per passenger (IPP).
- When the calculated number of trays exceeds the maximum number that scanners can process, we carry the excess forward to the next available period. This approach smooths the lane-opening profile and, in turn, staffing requirements.
- We determine the number of lanes required using the lane-opening sequence and the throughput associated with each lane. This step relies on Dublin Airport data on planned throughput per lane and the lane sequencing. For example, if 30 trays require processing in a period and the planned lane throughputs are 15, 10, 10, 10, we require three lanes.
- We apply a 10% inefficiency factor by increasing trays per 5-minute period by 10% to derive a higher lane requirement. This is to account for the fact that in practice, lanes cannot be opened and closed at five-minute intervals.
- Finally, we repeat the analysis using the average actual throughput for Terminals 1 and 2 in 2025. This data was provided by Dublin Airport at the end of October 2025 and is calculated using the average over the last 30 days, we assume this 30-day period covers Sept-Oct 2025.

Our analysis estimates a plausible **minimum** number of lanes required because we (1) use planned throughput values and (2) assume no operational inefficiencies. We also assume that operators can open and close lanes in 5-minute increments.

Key insights from our analysis of lane opening

We have derived the following key insights from our analysis:

- Based on actual passenger volumes, the analysis indicates that the number of lanes open generally exceeds the estimated operational requirement, with the difference being more pronounced during the summer months.
- In Terminal 1, the peak number of lanes required is slightly lower in 2025 (12 out of 14) compared with 2024 (14 out of 15). This reflects the upgrade of all lanes to C3, which increases planned throughput per lane, by an average of approximately 10%. Therefore, assuming no change in passenger volumes, there is a reduction in the overall lane requirement.
- In Terminal 2, the peak lane requirement in 2025 is higher than in 2024. This reflects the fact that planned throughput assumptions remain unchanged from 2024, despite lane upgrades.
- When the analysis allows for a 10% throughput inefficiency, the difference between lanes open and lanes required reduces substantially.
- Using actual throughput data for 2025 brings the estimated lane requirements more closely in line with the number of lanes open. In some periods, the calculated requirement exceeds the number of lanes open. This suggests that further examination of the differences between planned and actual average throughput would help to better understand these outcomes.

Terminal 1 – 2024 (CEPA analysis based on planned throughput)

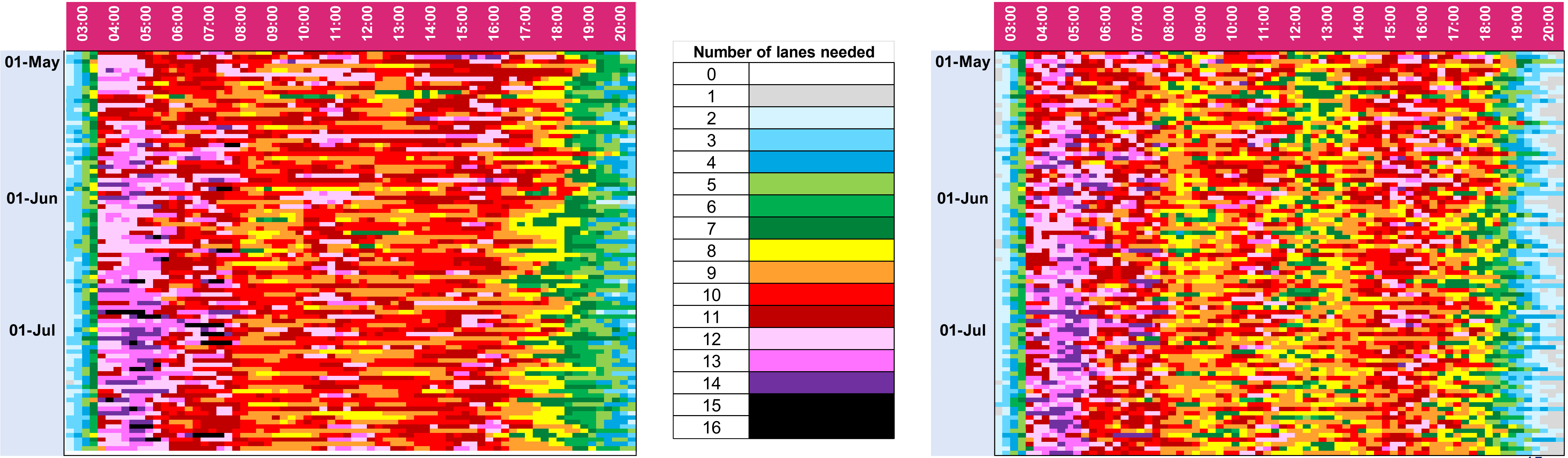
The charts on the next four slides summarise our analysis. The charts on the left show the number of lanes open as reported by Dublin Airport. The charts on the right present our estimated lane requirements, based on planned throughput and incorporating a 10% inefficiency factor.

Data for 2024 is limited, and as a result we present May-July 2024 for Terminal 1 and Terminal 2.

Based on observed passenger volumes and presentation profiles, our analysis indicates that, at certain times (generally around noon and 18:00h-20:00h) the estimated lane requirement is lower than the number of lanes recorded as open by Dublin Airport during the period May–July 2024 for Terminal 1.

2024 T1 – actual lane opening

2024 T1 – lane opening based on CEPA analysis (10% inefficiency)

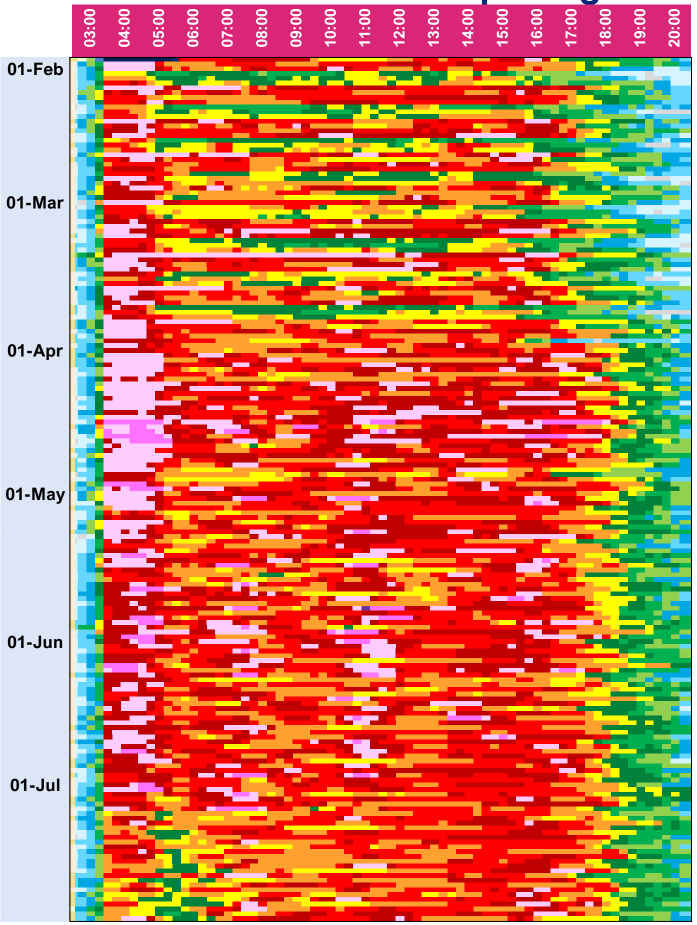


Terminal 1 – 2025 (CEPA analysis based on planned throughput)

Based on observed passenger volumes and presentation profiles, our analysis indicates that, at certain times (generally around 12:00h-13:00h) the estimated lane requirement is lower than the number of lanes recorded as open by Dublin Airport during the period February–July 2024 for Terminal 1. The impact seen here is more significant than in 2024, despite Dublin Airport reporting lower numbers of lanes open.

We observe that the modelled lane requirement reflects less seasonality, appearing to support Dublin Airport's decision to have less deployment of seasonal staff.

2025 T1 – actual lane opening



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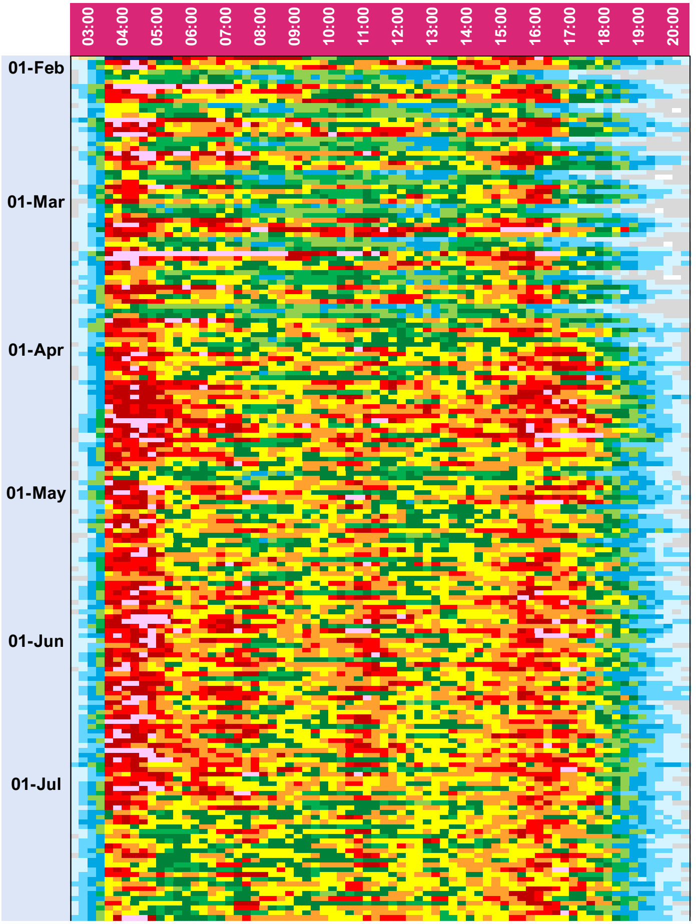
2025 T1 – lane opening based on CEPA analysis (10% inefficiency)

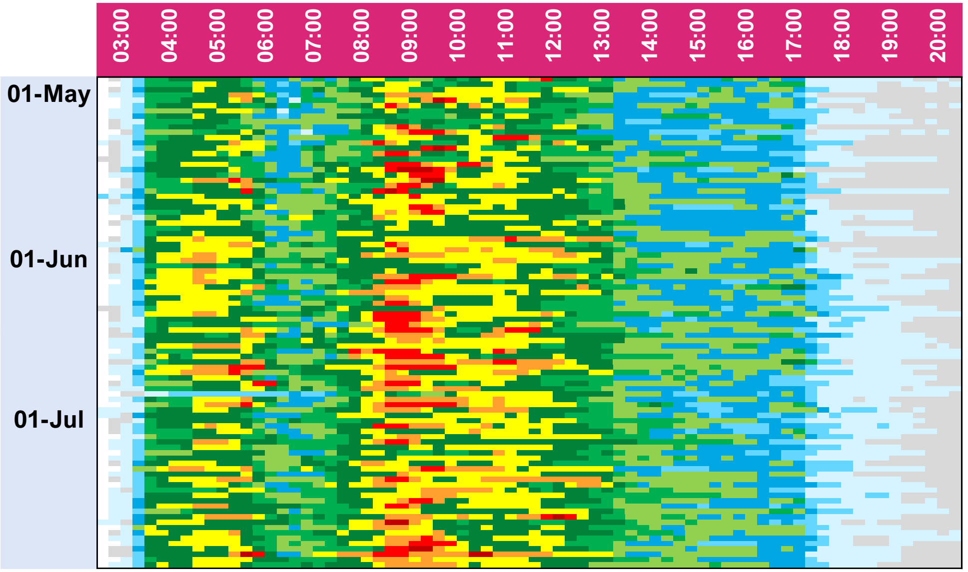


Terminal 2 – 2024 (CEPA analysis based on planned throughput)

Based on observed passenger volumes and presentation profiles, our analysis indicates that, at certain times the estimated lane requirement is lower than the number of lanes recorded as open by Dublin Airport during the period May–July 2024 for Terminal 2.

The discrepancy seen here is lower than what was observed in Terminal 1.

2024 T2 – actual lane opening



Number of lanes needed
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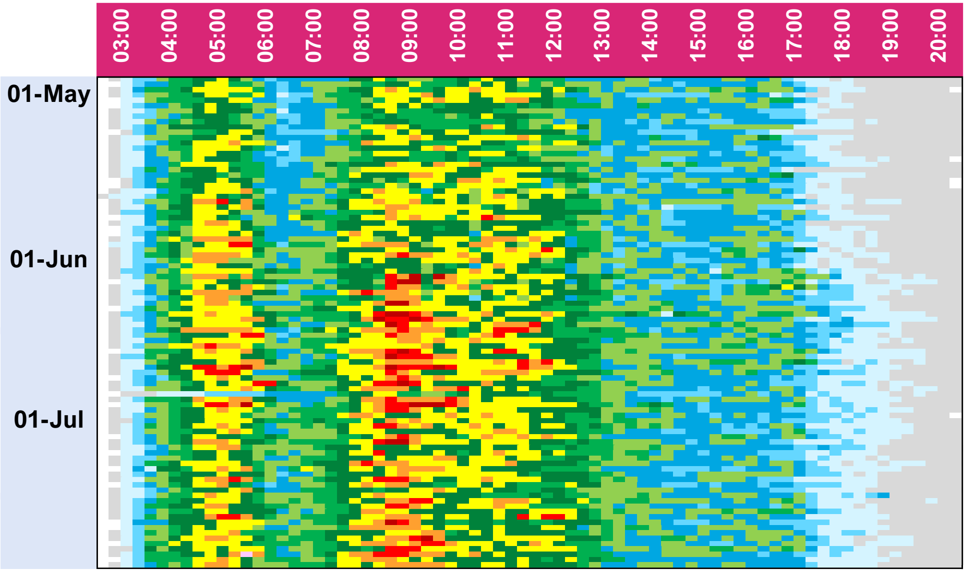
2024 T2 – lane opening based on CEPA analysis (10% inefficiency)

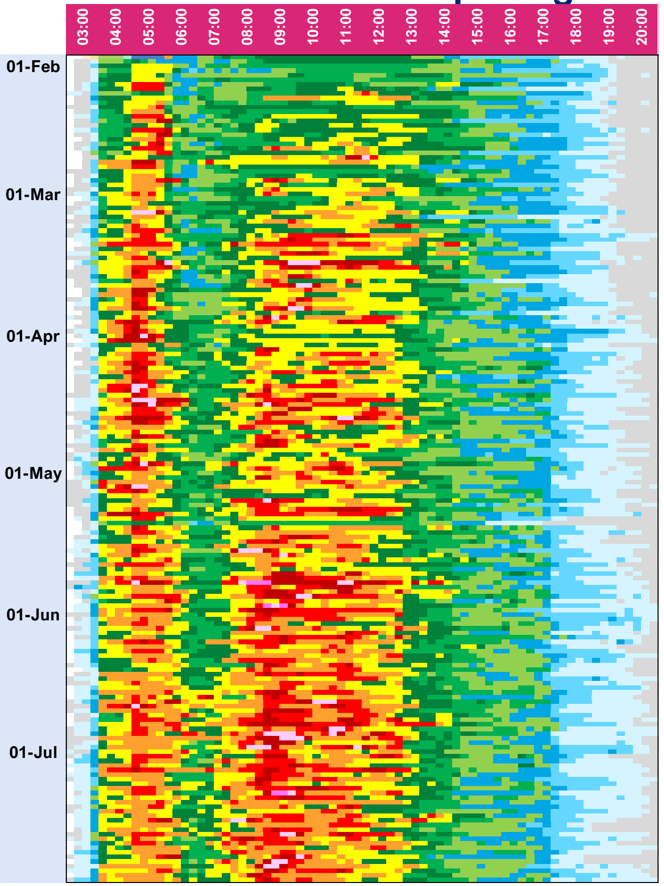


Terminal 2 – 2025 (CEPA analysis based on planned throughput)

Based on observed passenger volumes and presentation profiles, our analysis indicates that, at certain times the estimated lane requirement is lower than the number of lanes recorded as open by Dublin Airport during the period May–July 2025 for Terminal 2. The discrepancy seen here is lower than what was observed in Terminal 1.

In general, fewer lanes are needed in 2025, when compared to 2024 reflecting an increase in planned throughput per lane.

2025 T2 – actual lane opening



Number of lanes needed	
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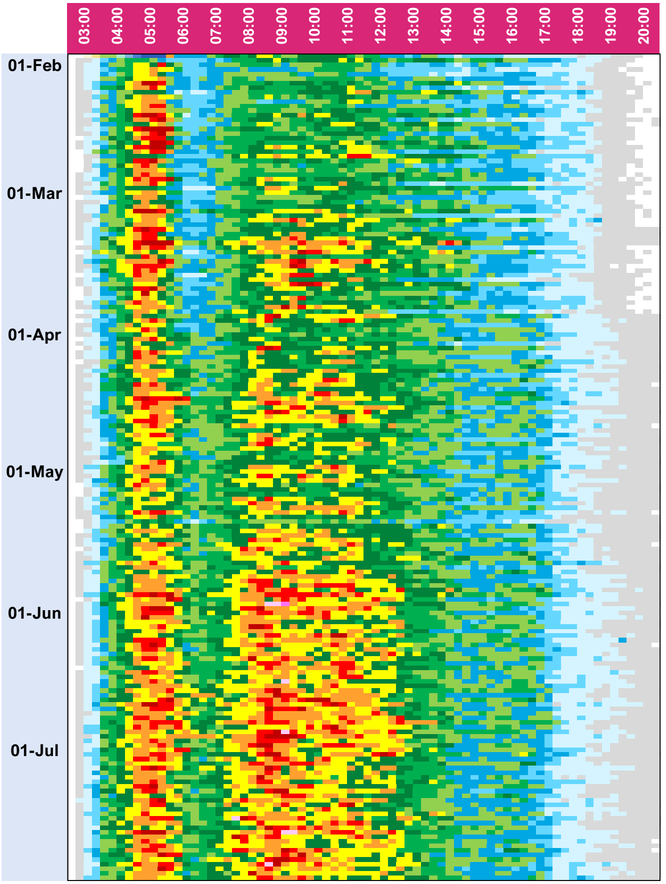
2025 T2 – lane opening based on CEPA analysis (10% inefficiency)

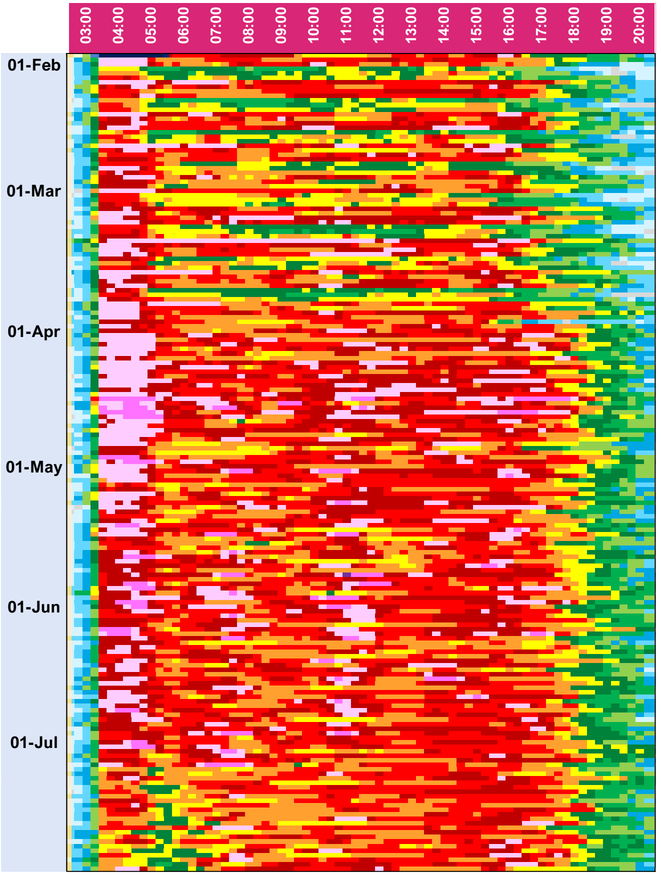


Terminal 1 – 2025 (based on actual throughput)

We updated our analysis to consider the lane requirement based on **an estimate of actual throughput based on 30 days worth of data**. This is presented in the next two slides.

Based on observed passenger volumes and presentation profiles, when we base our analysis on actual throughput, the lane requirement increases however our analysis continues to indicate that, at certain times the estimated lane requirement is lower than the number of lanes recorded as open by Dublin Airport during the period Feb–July 2025 for Terminal 1. We observe less seasonal variation in 2025.

2025 T1 – actual lane opening



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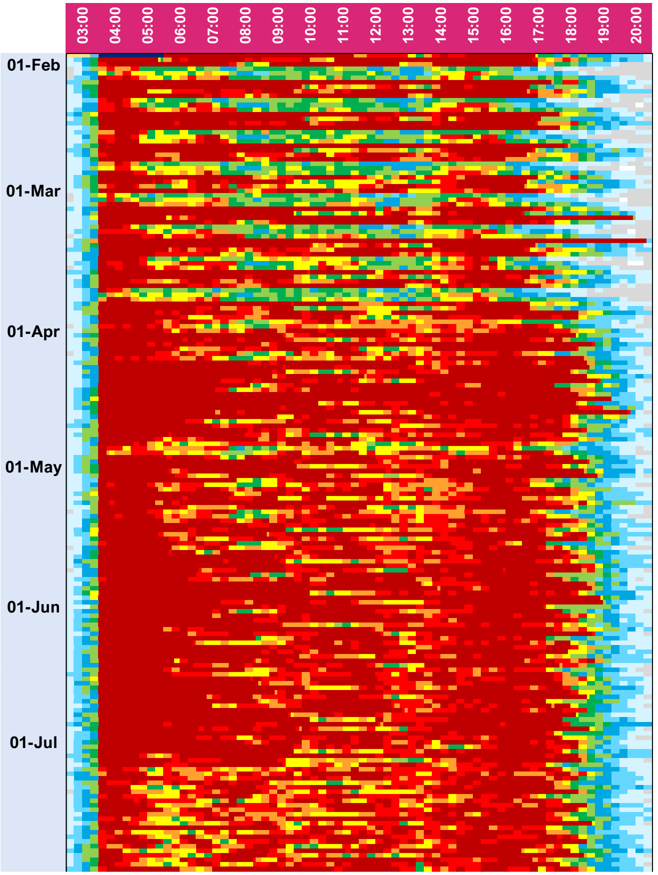
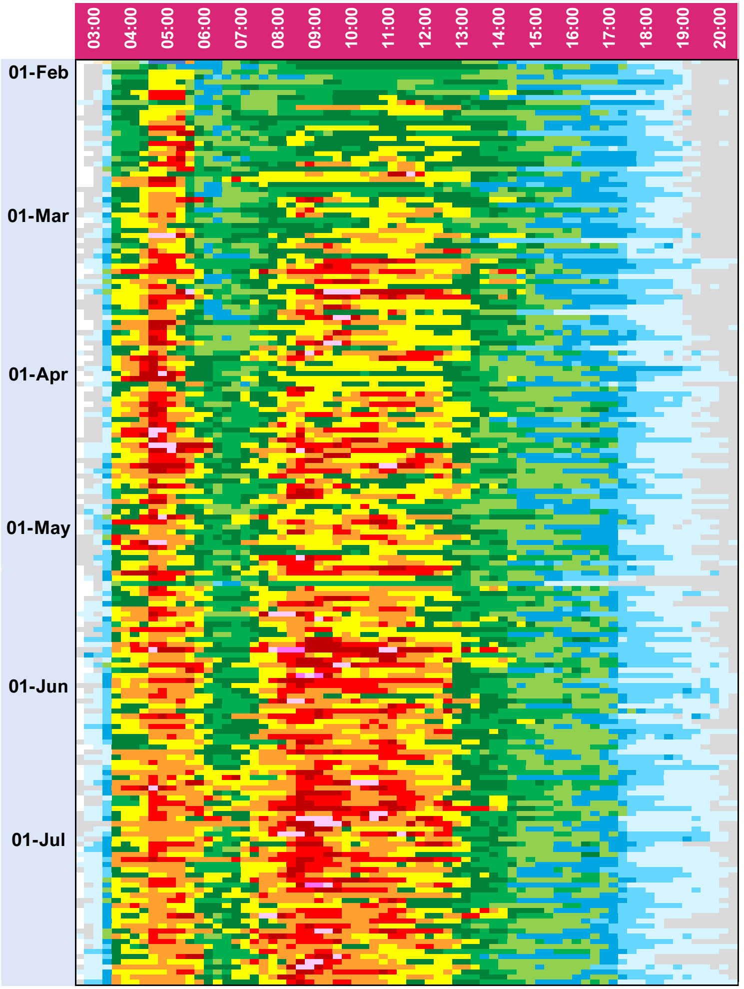
2025 T1 – lanes needed (actual throughput)



Terminal 2 – 2025 (based on actual throughput)

Based on observed passenger volumes and presentation profiles, using actual throughput increases the estimated lane requirement. However, the analysis still indicates that, at certain times, the estimated lane requirement remains lower than the number of lanes recorded as open by Dublin Airport during Feb–July 2025 for Terminal 2. The magnitude of this difference is smaller for Terminal 2.

2025 T2 – actual lane opening



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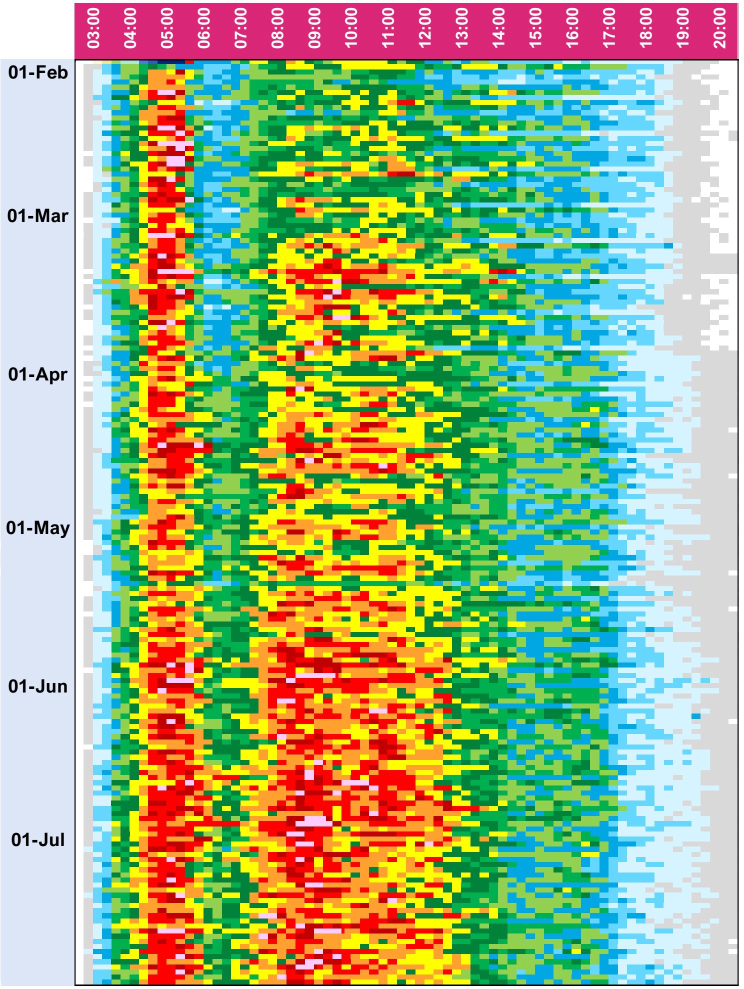
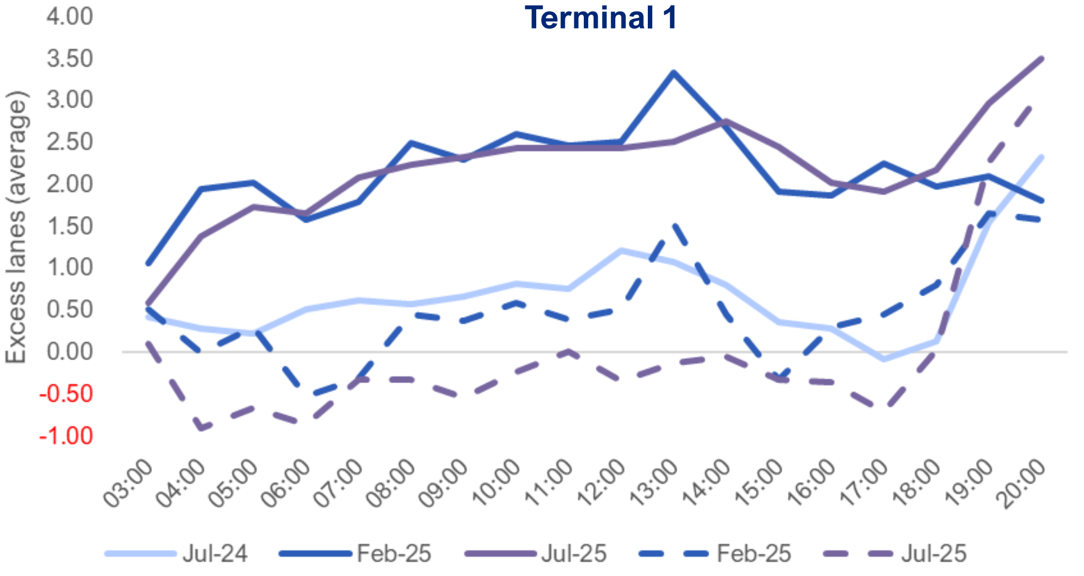
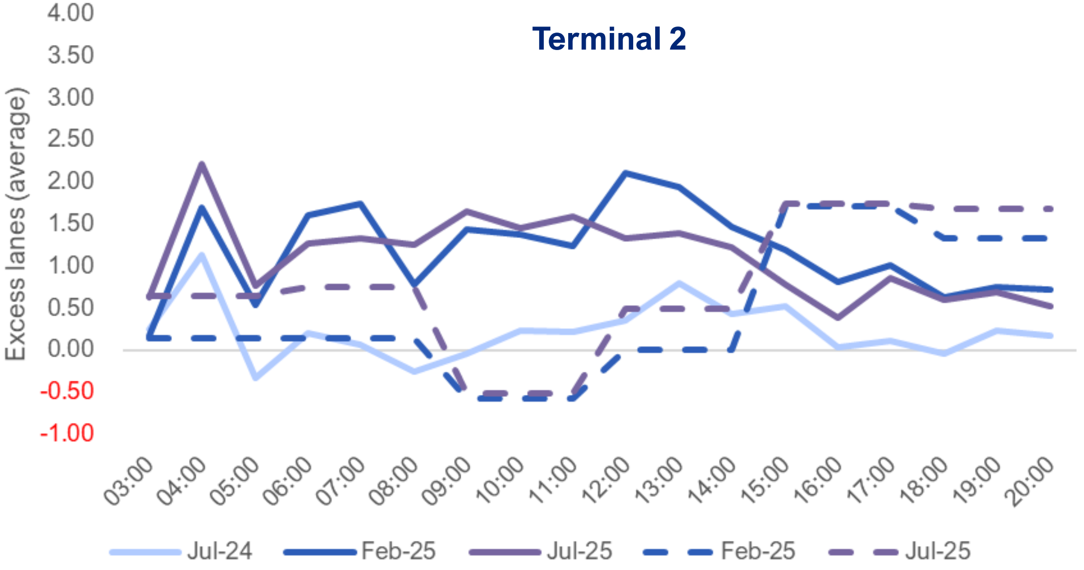
2025 T2 – lanes needed (actual throughput)



Lanes open vs lanes needed

- We assess the difference between the number of lanes open and the number of lanes needed (calculated assuming a 10% inefficiency), for both the terminals using the averages over the hour (derived from the 5-min data) and the following months: July 2024, February 2025, and July 2025.
- We find that on average, more lanes are open than needed (peaking at an excess of ~3.5 lanes for T1 and ~2 lanes for T2). In the calculations using the average throughput, the lanes open and calculated have a smaller discrepancy and there are periods where the lanes calculated are higher than lanes needed. (for more discussion on the actual TP, refer to the next slide)
- The difference is more pronounced for Terminal 1 than Terminal 2, and more prominent in 2025 than in 2024.
- There are some periods in the 2024 analysis where the lanes calculated as per the passenger data is slightly higher than the lanes open.
- Note that this analysis is based on averages and therefore, may hide the variation between the different time periods.





Dotted line for 2025 uses actual throughput value for calculation

Planned vs average throughput

The lane queuing analysis relies on the Dublin Airport provided information of planned and actual (average) throughput.

There is a significant difference between the planned and average throughput (from 10% to 42% lower throughput than planned). There are a few possible explanations for this:

1. **Skills and experience.** One potential explanation may be variation in the staff skill experience at different lanes, thereby, explaining the differences in processing trays. This could be due to the variation in training operating the different lane screening technology, years of work experience, or other factors.
2. **Lane and passenger mismatch.** There are more lanes open and not enough passengers (and trays). This means that each lane would process fewer trays and would not meet the target/maximum planned throughput. This can explain the discrepancy, especially in the T1 mezzanine lanes.
3. **The timing of the average throughput calculation.** There could be seasonal variations in the average throughput calculated. Currently, we are assuming that the 30-day average was calculated based on Sept-Oct 2025 data as the information was provided by Dublin Airport at the end of October.

Terminal	Lane	Planned throughput	Average throughput*	Diff	Diff(%)
T1	1	330	226	-104	-32%
	2	350	262	-88	-25%
	3	430	344	-86	-20%
	4	400	375	-25	-6%
	5	400	350	-51	-13%
	6	430	340	-90	-21%
	7	430	346	-84	-19%
	8	430	353	-77	-18%
	Mezz 1	380	290	-90	-24%
	Mezz 2	380	312	-68	-18%
	Mezz 3	380	219	-161	-42%
T2	1	350	254	-96	-27%
	2	350	295	-55	-16%
	3	350	314	-36	-10%
	4	350	309	-41	-12%
	5	350	276	-74	-21%
	6	350	242	-108	-31%
	7	350	277	-73	-21%
	8	350	304	-46	-13%
	9	350	311	-39	-11%
	10	350	316	-34	-10%
	11	350	287	-63	-18%
	12	350	253	-97	-28%

**Average calculated using last 30 days' actual TP*

Rostering analysis

The purpose of this analysis is to understand how well the rostering of security staff aligns with demand

The main question we are trying to answer is:

How well does the number of staff available match the number of staff needed across the two terminals?

- Supply is defined as the number of staff scheduled to be on duty at each time of day, adjusted for assumed breaks.
- Demand is defined as the number of staff needed at each time of day to cover fixed security posts and central search lane positions.

Our analysis matches staff supply against demand across a sample period in 2024 and 2025, assessing rostering inefficiencies through surplus (supply > demand) and shortfall (demand > supply). We selected three representative weeks – 14/07/2024, 01/02/2025, and 14/07/2025 – and mapped staff shifts against required staffing levels for each day of the week across both terminals. The model also aggregates surplus and shortfall to evaluate overall staffing efficiency and to identify recurring mismatch windows across 2024 and 2025.

This also enables comparisons between 2024 and 2025 to assess whether technology changes and other factors have improved roster efficiency. In addition, it allows us to compare planned and actual staffing demand for each terminal–year combination, and to examine trends across the full year to identify recurring patterns of surplus and shortfall in staff rostering.

However, our analysis has several key limitations, which we outline below.

- Rostering is based on a set of simplifying assumptions that may not fully reflect real-world operations. For example, breaks are assumed to be taken at the midpoint of each shift, and overnight shifts are not rolled over into the following day but instead recorded on the same day.
- The demand dataset is limited to the period from 03:00 to 21:00, while the supply data covers the full 24-hour period, which may affect like-for-like comparisons.
- Due to demand-side data gaps between February and April 2024, the 2024 efficiency metric includes data only from May onwards for both terminals.

Our methodology for estimating efficiency through how well staff roster matches to staff needed

The charts in the following slides compare staff supply derived from rosters with staff demand for a number of selected winter and summer weeks.

Staff supply (shown by the blue area) was calculated by mapping staff shifts across each day and adjusting for breaks. Our analysis is based on the following assumptions:

- Overnight shifts are recorded as rolling over onto the same day.
- Breaks are incorporated into the roster using the following rules:
  - Shifts shorter than 4 hours have no breaks.
  - Shifts between 4 and 8 hours include a 30-minute break at the midpoint of the shift.
  - Shifts longer than 8 hours include a 40-minute break 25% of the way into the shift and a 30-minute break 75% of the way through the shift.

Demand is shown by the green and orange line on the charts. This is calculated separately for planned and actual numbers of lanes opened, multiplied by the number of staff required per lane. We have used IAA's lane opening sequence to determine lane demand.

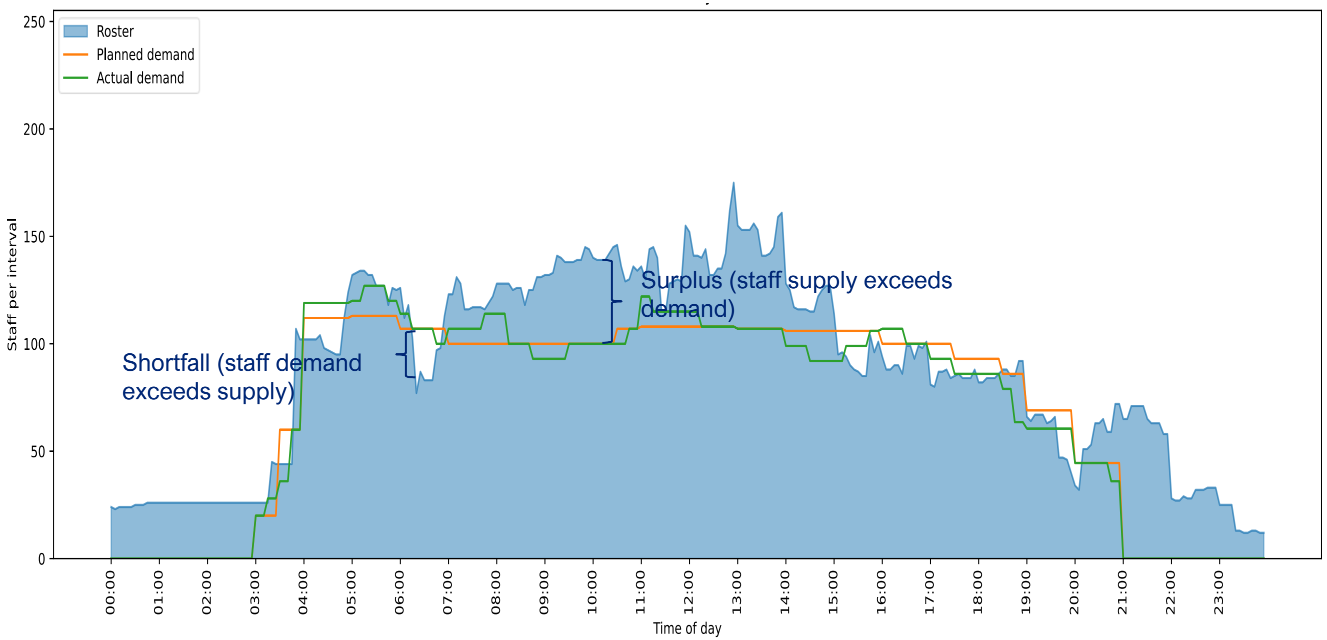
- Total demand is the sum of variable demand (lane openings) driven by passengers presenting at Central Search and the fixed demand profile (static demand) required to staff static security posts across the terminal.
- The variable (Central Search) element of this profile has been derived using Dublin Airport's own passenger presentation profile which is when passengers turn up at security.

The level of efficiency in rostering is measured by the efficiency gap. This is calculated as the difference between rostered supply and demand as a proportion of rostered supply. The positive and negative gaps are calculated separately for each day and mapped across the whole period.

- Due to data limitations in 2024, the efficiency gap is calculated from May to July.
- The chart for 2025 covers the period from February to July.

Roster efficiency: Example chart

- Our analysis produces a graph (see the chart to the right) showing a full working day (00:00–23:55) plotted at 5-minute intervals. This graph is produced for all 7 days for a given week.
- The staff supply (roster) is the blue area in the chart which represents the overall supply of staff in a terminal. This is calculated using staff shift patterns from rosters provided by Dublin Airport.
- Planned and actual demand are shown using the orange and green lines. They capture the number of staff needed in a terminal based on passenger numbers and presentation provided by Dublin Airport.

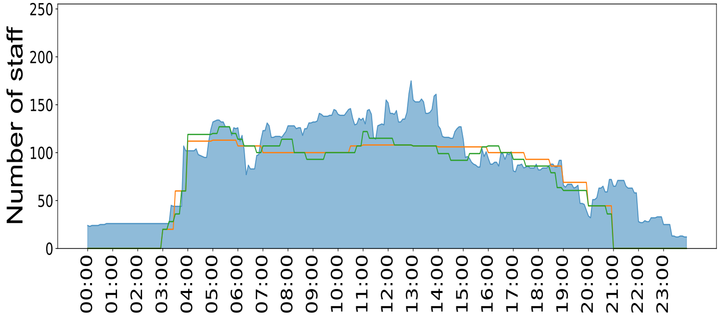


Key insights from our analysis of roster efficiency

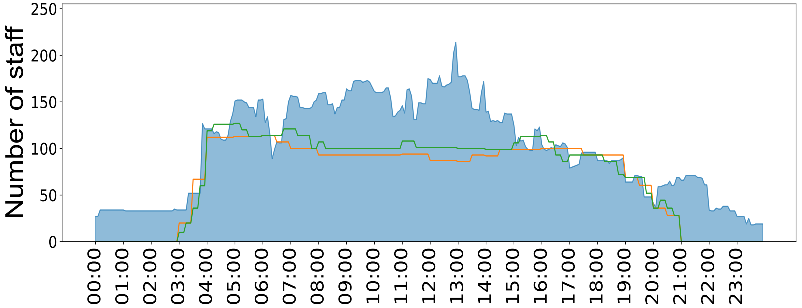
- In both 2024 and 2025, July shows higher staff surplus than February. However, surplus levels are lower in 2025 across both sampled months, which is consistent with the efficiency gap analysis showing an overall reduction in surplus in 2025.
- We see an increase in shortfalls in 2025. This may partially offset the reduction in surplus, resulting in a lower overall efficiency gap (measured as the average of surplus and shortfall) from 2024 to 2025.
- These findings align with the lanes analysis, which indicates that more lanes were open than required, consistent with staff surplus in both years. Improved staffing efficiency in 2025 is reflected in a narrower gap between lanes open and lanes required, alongside some periods where required lanes exceeded lanes open.
- The average efficiency gap in 2024 (February to July) was 20%. Accounting for demand-side data limitations, restricting the 2024 comparison to May–July reduces the average to 14%, which remains higher than the 2025 average (February to July) of 6.5%.
- February shows closer alignment between demand and supply across both terminals, with an average efficiency gap of 5.6% for the month.
- Finally, at a more granular level, supply and demand diverge most in the mid-afternoon: between 12:00 and 14:00, rostering peaks and drives surplus across terminal–year pairs, particularly in July.

July 2024 – Terminal 1

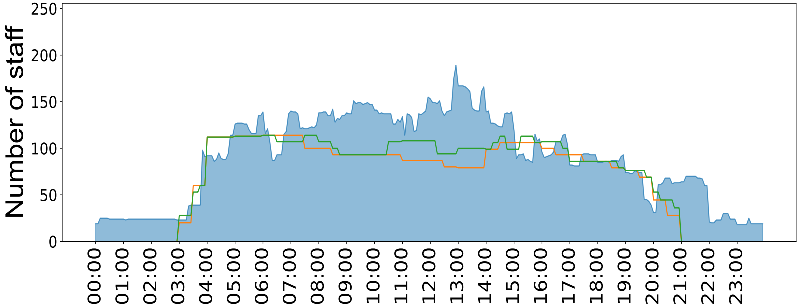
14 Jul 2024 – Terminal 1



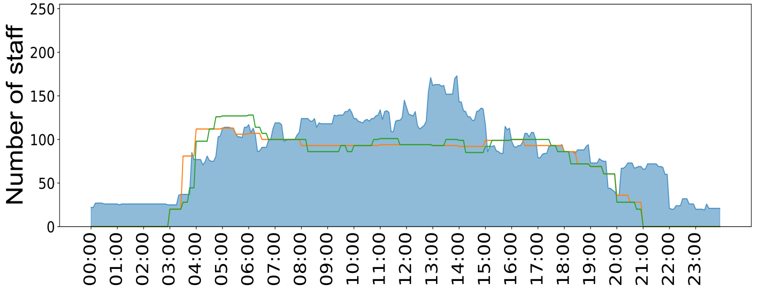
15 Jul 2024 – Terminal 1



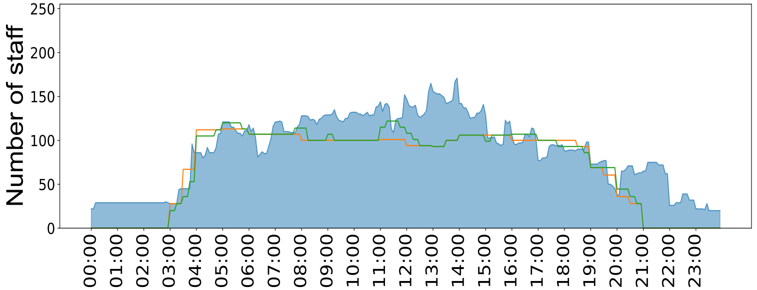
16 Jul 2024 – Terminal 1



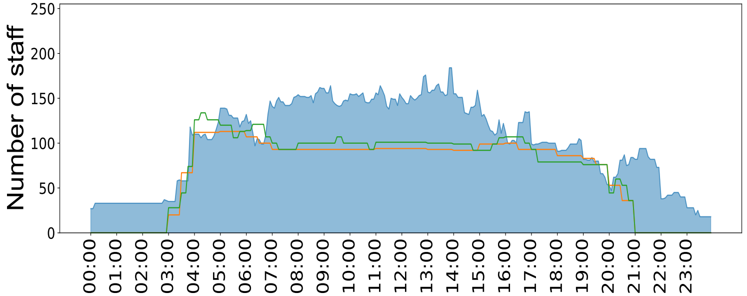
17 Jul 2024 – Terminal 1



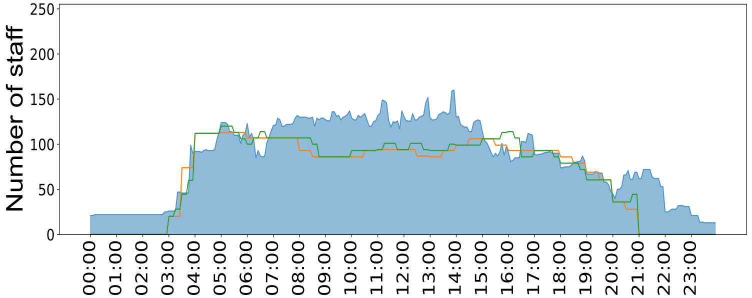
18 Jul 2024 – Terminal 1



19 Jul 2024 – Terminal 1



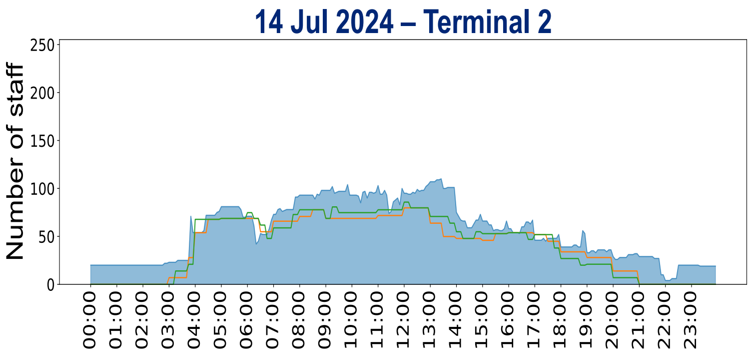
20 Jul 2024 – Terminal 1

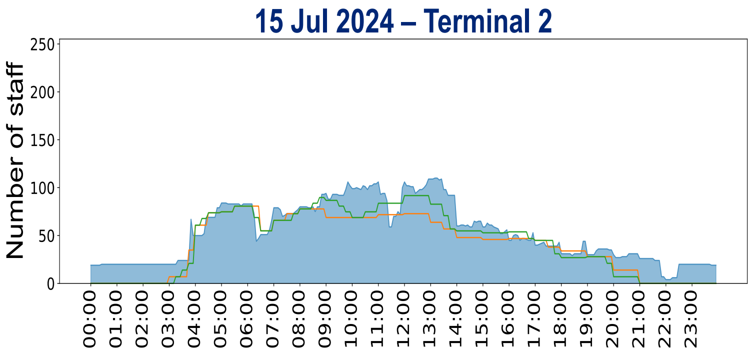


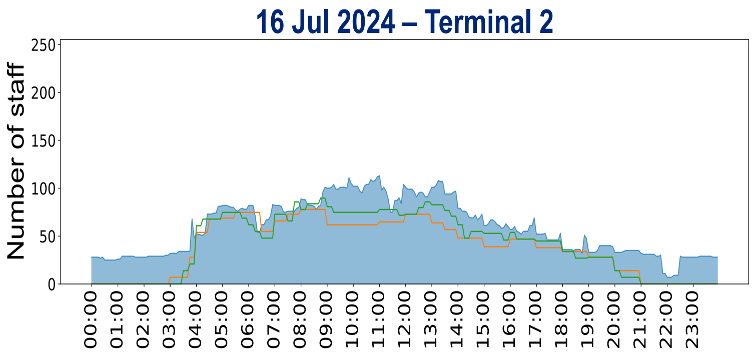
Roster
Planned demand
Actual demand

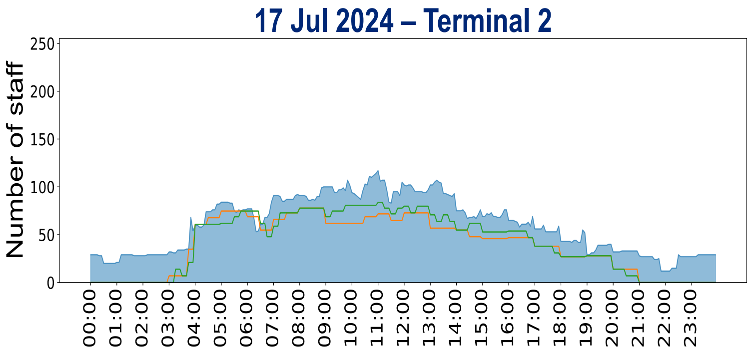
- This slide shows a typical week in July represented by the charts depicting staff roster and staff needed. Each chart represents a single day of the week.
- Across this winter week, we see that supply is most closely aligned to raw demand in the early morning (03:00 to 07:00) and again from 15:00 to 21:00.
- The largest mismatch occurs around midday with supply generally exceeding demand between 07:00 and 14:00.

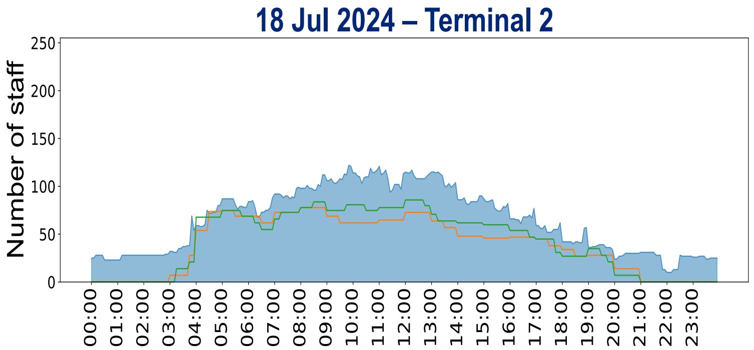
July 2024 – Terminal 2

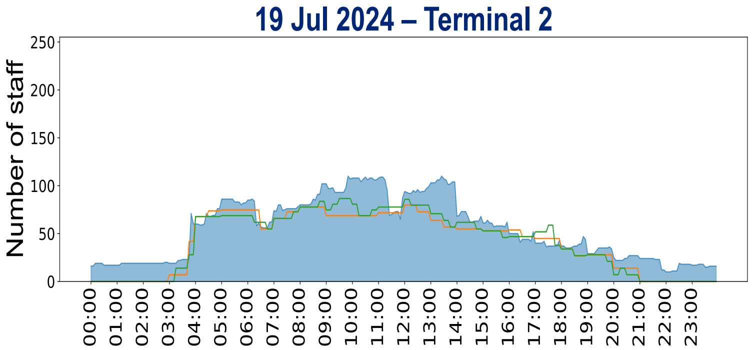


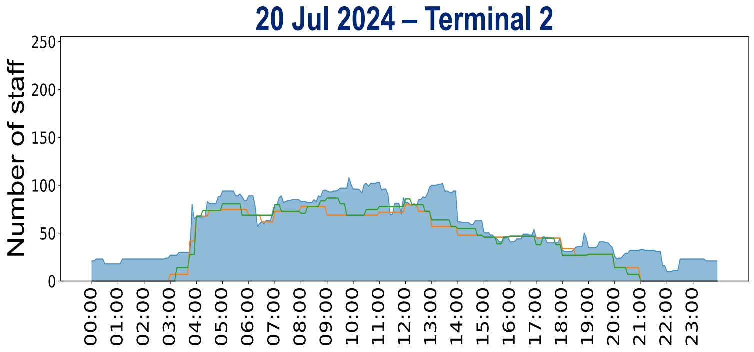


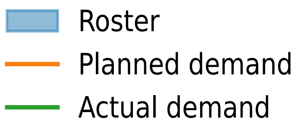






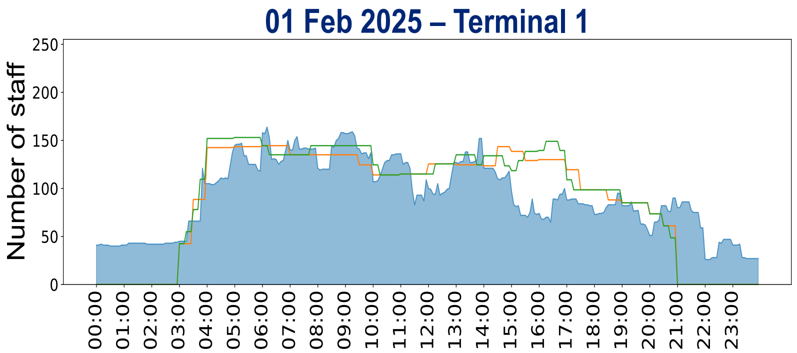


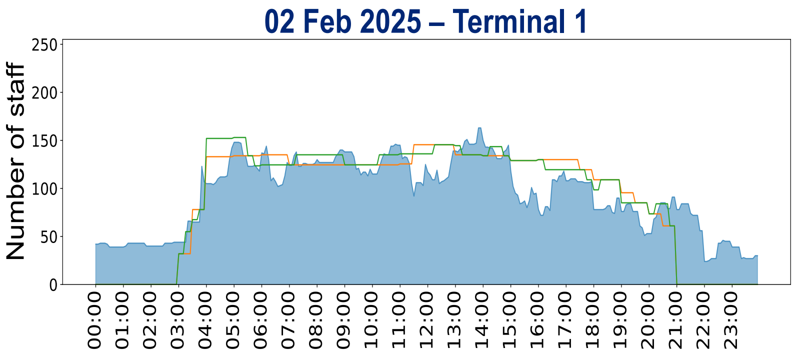


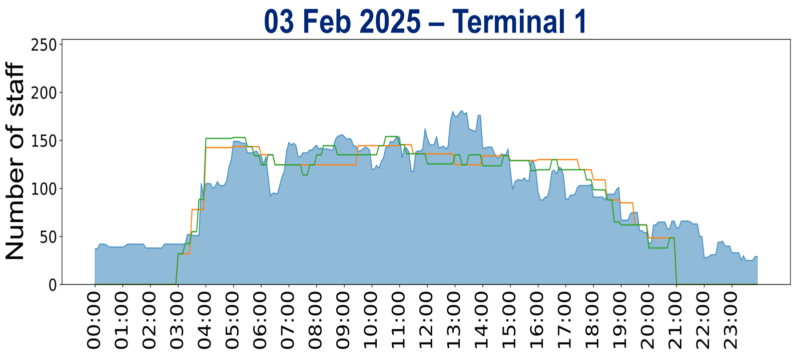


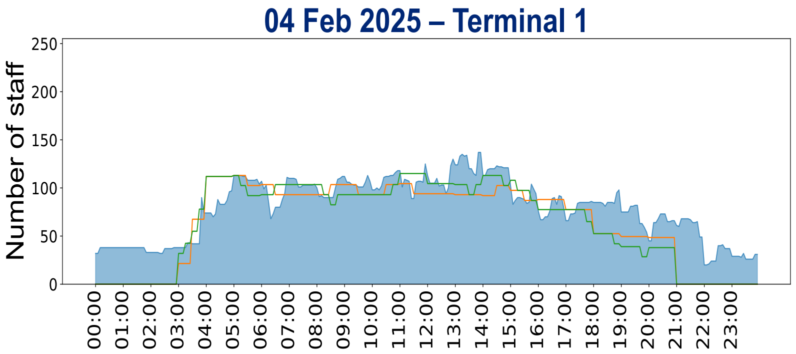
- The charts for Terminal 2 show that supply and demand are generally more aligned than in Terminal 1.
- However, we also see that mid-afternoon periods (10:00 to 14:00) continue to see surplus staff.
- Instances of shortfall are uncommon and usually happen at sharp supply drops, particularly during early mornings.

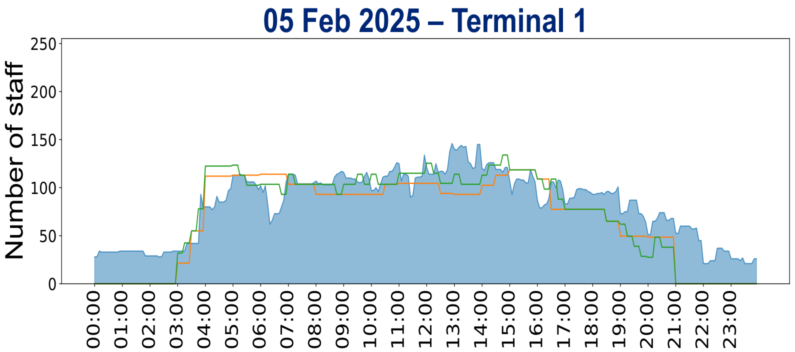
February 2025 – Terminal 1

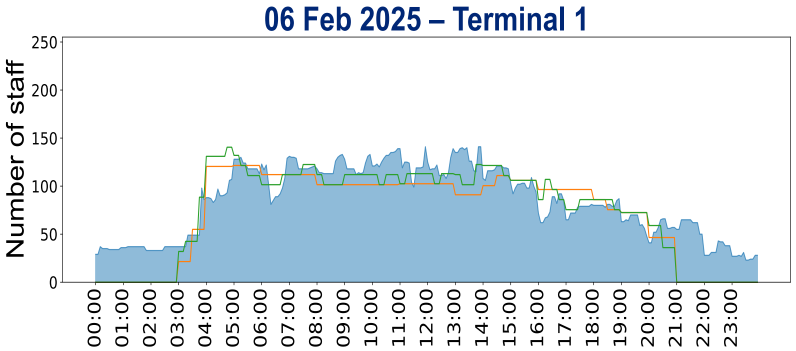


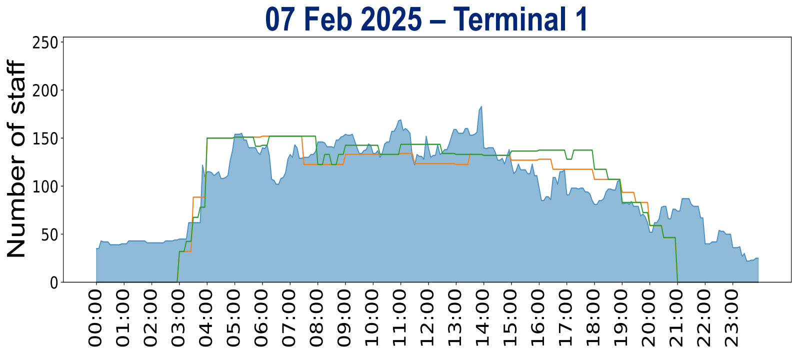










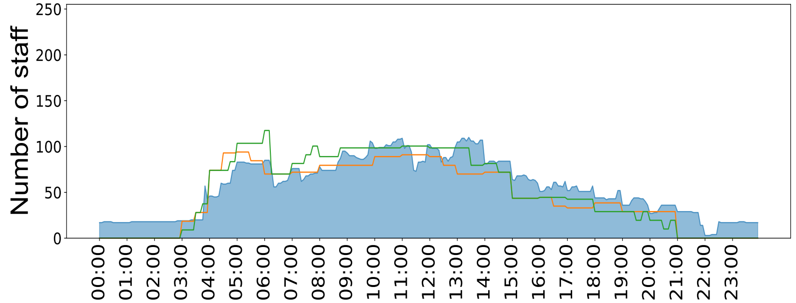


Roster
Planned demand
Actual demand

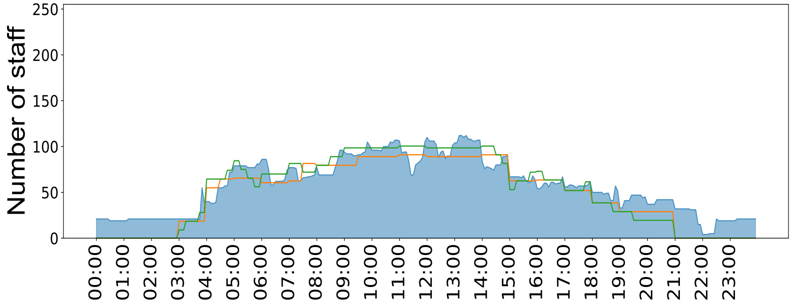
- We observe that this week in February sees more shortfall than July in 2024.
- This shortfall is particularly heightened in early mornings (3:00 to 7:00) and late afternoons (15:00 to 19:00). This is the opposite of the surplus impact seen in July 2024.
- February also appears to be more efficient with greater instances of supply-demand convergence.

February 2025 – Terminal 2

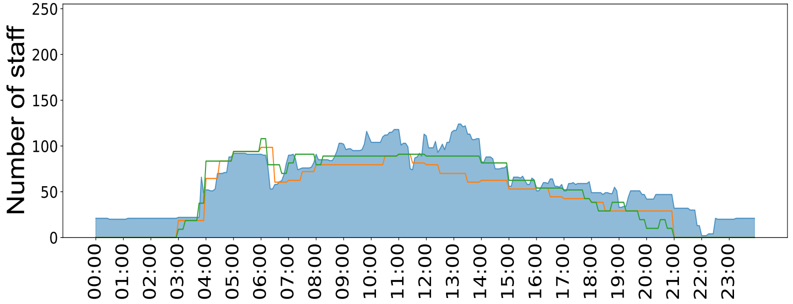
01 Feb 2025 – Terminal 2



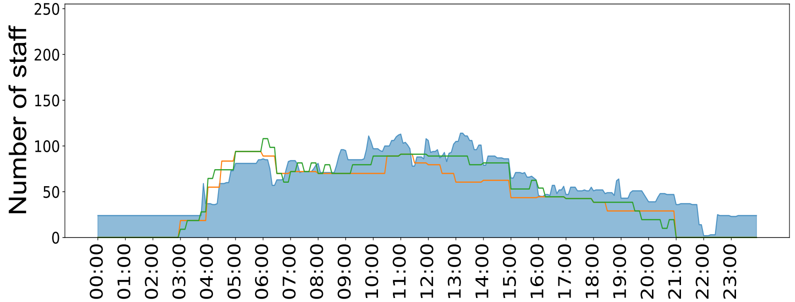
02 Feb 2025 – Terminal 2



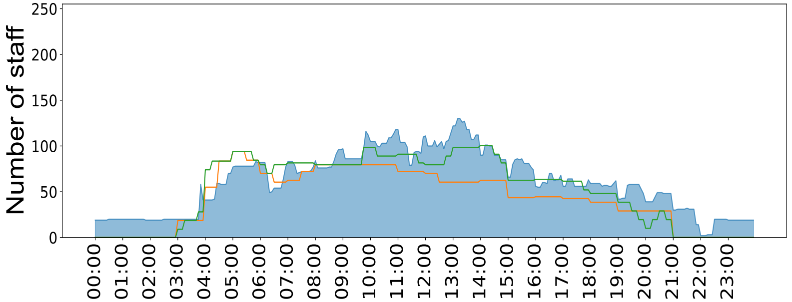
03 Feb 2025 – Terminal 2



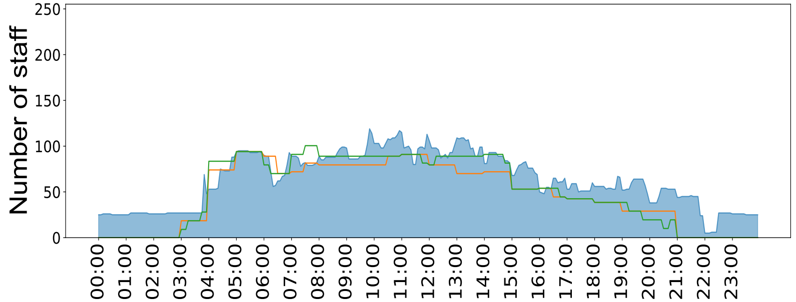
04 Feb 2025 – Terminal 2



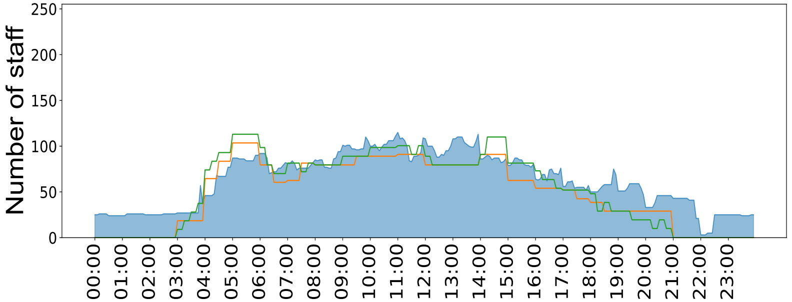
05 Feb 2025 – Terminal 2



06 Feb 2025 – Terminal 2



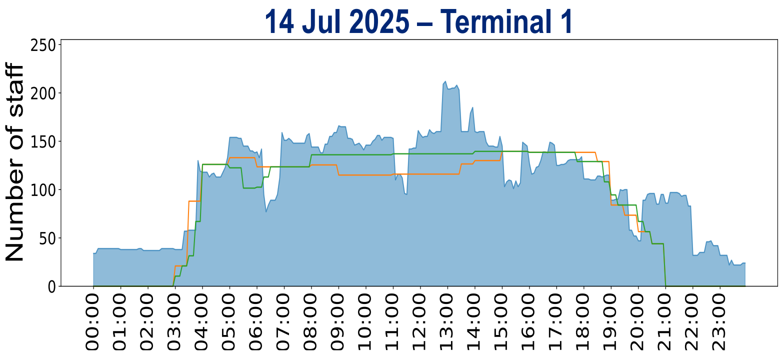
07 Feb 2025 – Terminal 2

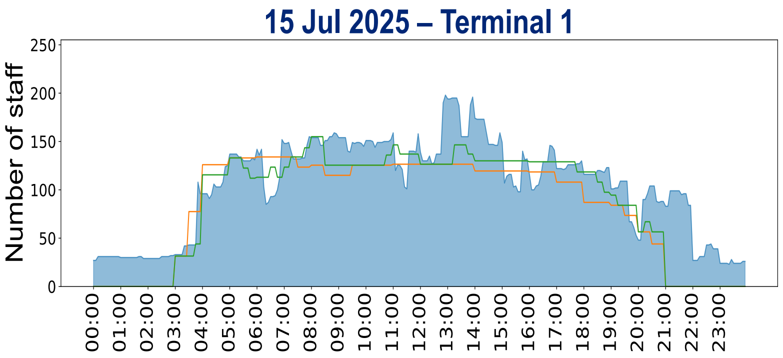


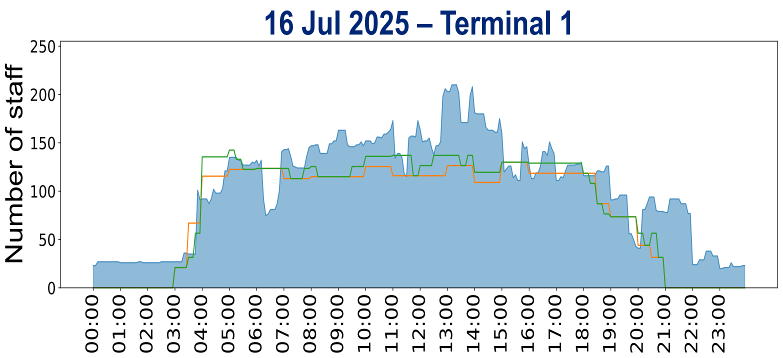
Roster
Planned demand
Actual demand

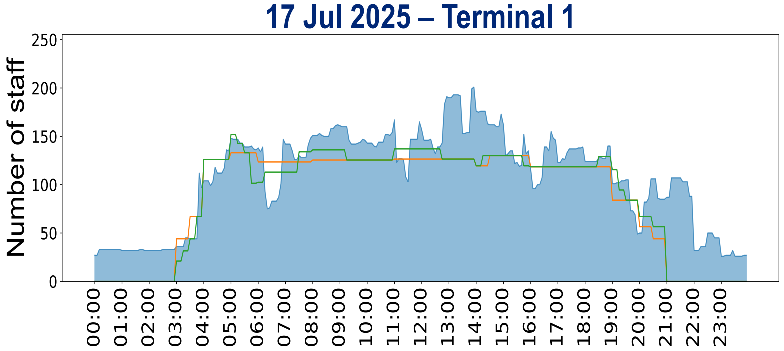
- The charts for Terminal 2 in February indicate less inefficiency than Terminal 1 with a reduction in both surplus and shortfalls.
- Unlike Terminal 1, these shortfalls occur more in early mornings from 03:00 to 07:00.
- We also see that planned and actual demand diverge from 3 Feb to 5 Feb with actual demand following roster patterns closely.

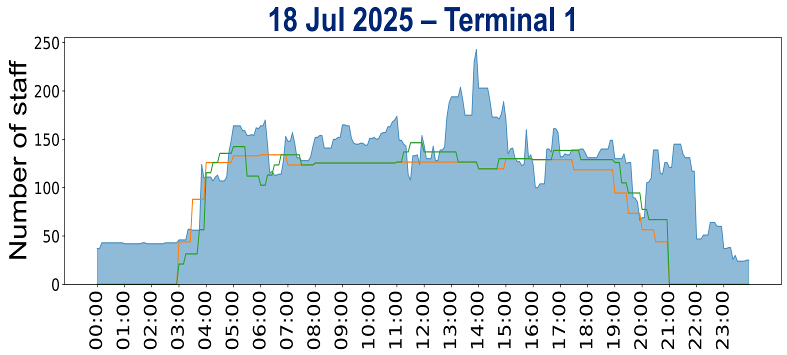
July 2025 – Terminal 1

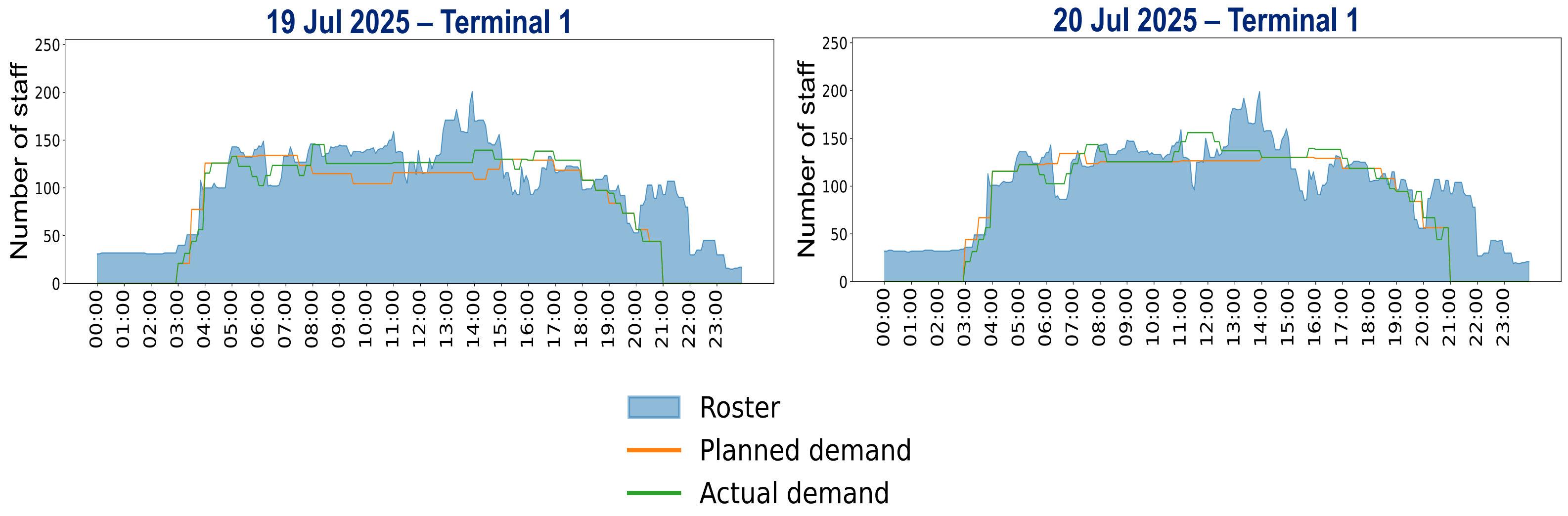






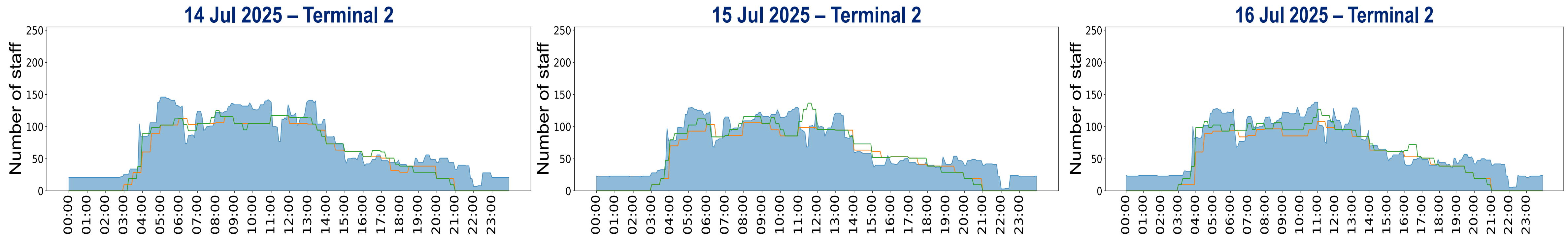


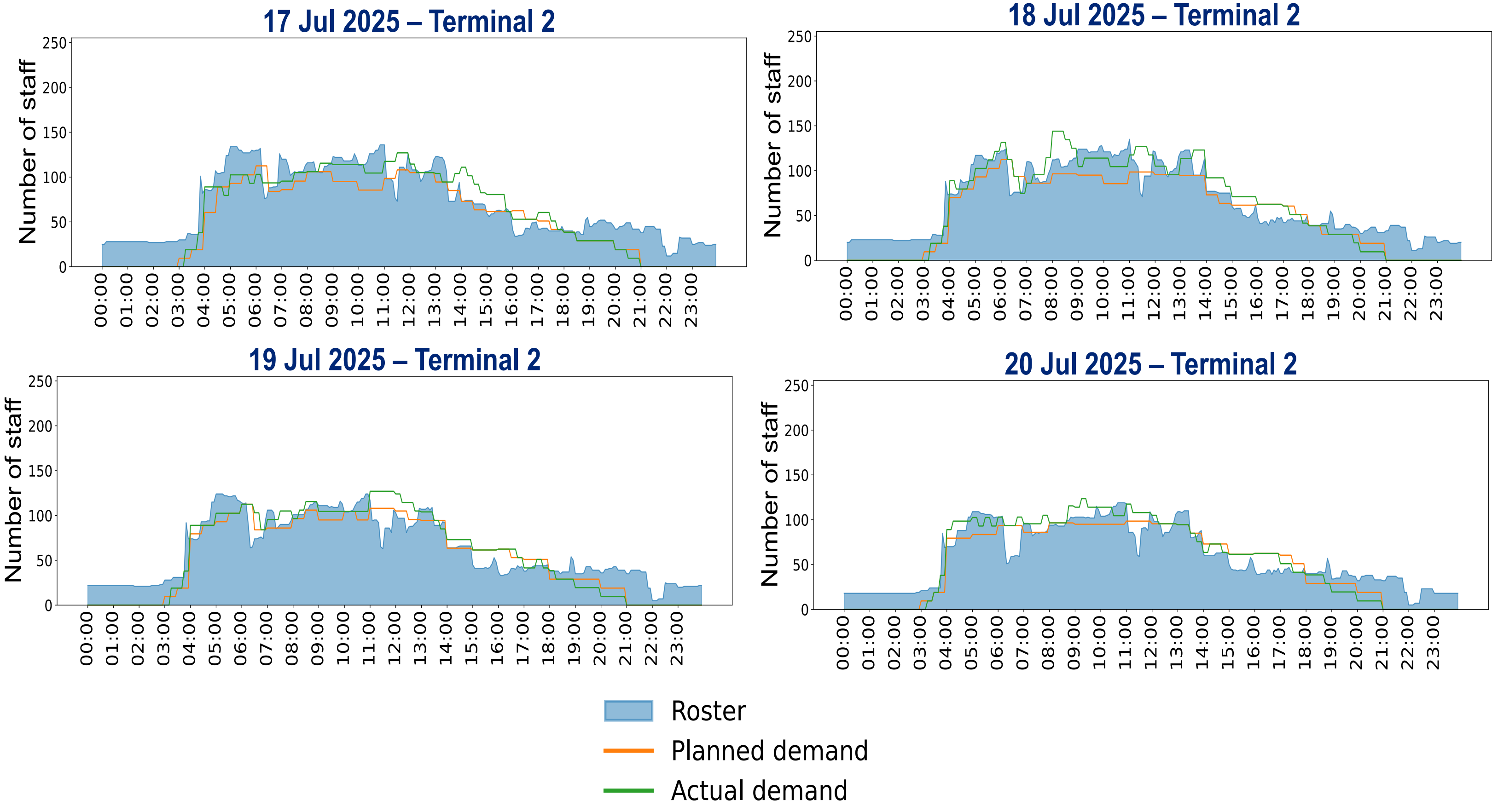




- It can be observed that July 2025 has bigger swings in divergence than Terminal 1 in 2024.
- While the same week in the previous year had one large surplus block, we see that 2025 sees more peaks and troughs (i.e. surplus and shortfall).
- Overall, instances of staff surplus has reduced since the previous year for Terminal 1.

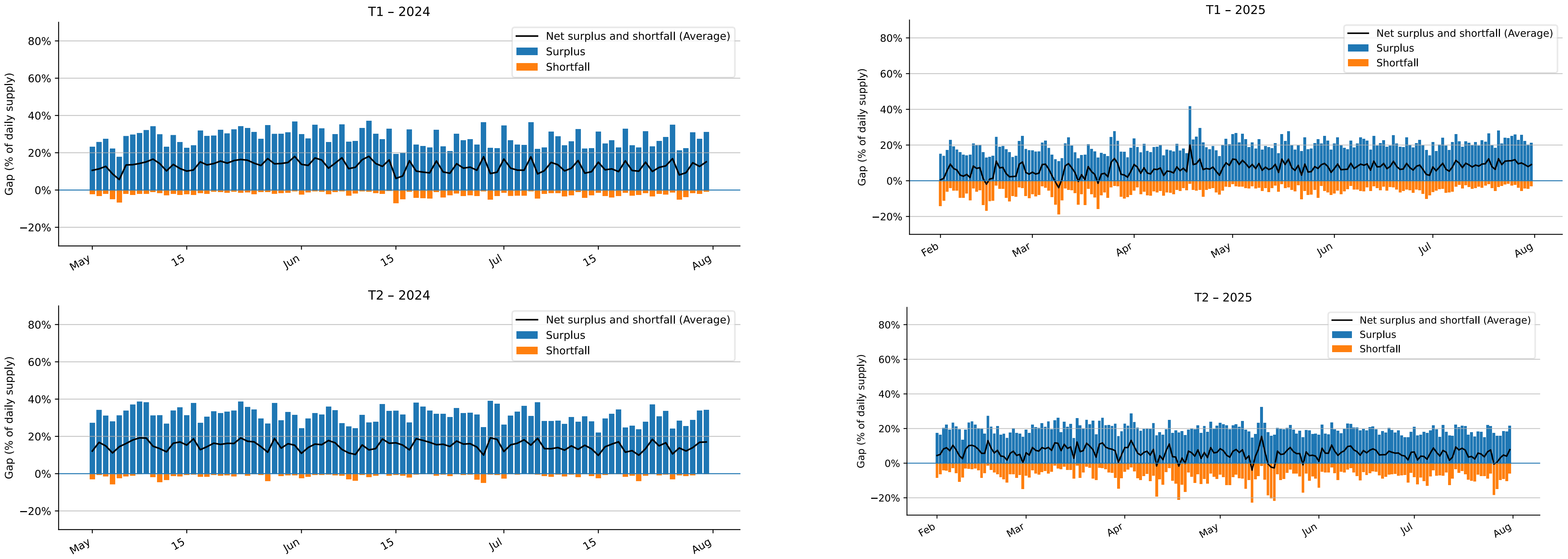
July 2025 – Terminal 2





- A similar pattern to Terminal 1 is observed here as we see greater swings in divergences.
- In contrast to the previous year, Terminal 2 in July 2025 sees more shortfalls and less surplus.
- The charts also indicate greater divergence between planned and actual demand, particularly around noon-time.

Staffing surplus and shortfall across 2024 and 2025



- The charts above aggregates daily surplus (staff available>staff needed) and shortfall (staff available<staff needed) across the period shown.
- The 2025 roster appears more closely aligned to modelled demand overall, but with more frequent shortfall periods. A reasonable level of mismatch between supply of staff through rosters and demand for staff, is 15% – we see that both 2024 (average of 14%) and 2025 (average of 6.5%) are below this level.
- These charts are also consistent with the lanes analysis, which suggests more lanes are open than would be required if actual throughput aligned with planned throughput.

Staffing and workforce considerations

There are a number of staffing and workforce factors that should be taken into consideration.

- Dublin Airport had adapted its security operation so staffing now spans both terminals. Officers are moved around tactically as necessary during the day-to-day operation. This is a change from the previous operation where staff were assigned to a single terminal.
- The Terminal 2 security operation was fully C3-enabled by the start of 2025, whereas the shift in Terminal 1 was fully completed in September 2026.
- **Training**: All security staff are required to complete 6 weeks of annual training, made up of 5 weeks of classroom training plus 1 week in-lane. This covers AvSec in addition to soft skills. All security staff are cross-trained to enable staff to work in different positions.
- **NWOW principles**: Staff are allocated core fixed rosters for a minimum of 12 months with stable shift patterns and 11-hour breaks between shifts.
- There are no longer seasonal staff, and all are now part-certified.
- Dublin Airport expects that this will lead to improvements in attrition and absence rates but is as yet unable to determine this.

There are also a number of constraints that Dublin Airport has to work within when running the security operation.

- **Organisation of Working Time Act (1997)** governs maximum working hours, rest breaks, annual leave, and related entitlements for most employees in Ireland. These rules affect how rosters are organised, overtime managed, and rest periods provided between shifts. Dublin Airport will need to ensure shift patterns comply with these legal maximums and rest requirements.
- Security staff roles at Dublin Airport are represented by **Trade Unions**. Negotiations with these unions shape employment terms such as roster patterns, hours, pay scales, overtime arrangements, and job security. Past disputes have centred on rostering practices (notably flexible rosters with variable hours), advance notice of shifts, and guaranteed minimum hours – highlighting the need for union engagement in rostering/contract changes.
- **Training, contingency, sickness rates and absence** provide another constraint on the operation which is required to be factored into rostering and operational planning.

Conclusions on rostering analysis

- We acknowledge that there are constraints that Dublin Airport has to work within and factor into the operation, and our conclusion on the roster efficiency analysis are set out below.
- **Evolution of periods.** The overall mismatch between staff required and staff available decreases between 2024 and 2025. However, this reduction in surplus staffing is accompanied by a higher incidence of staff shortfalls in 2025.
- **Variation between planned and actual demand.** Planned demand diverges most from actual demand around the midday peak. This divergence is particularly pronounced in Terminal 2 during both winter and summer sample weeks. This pattern suggests that forecasting profiles may be overstating peak demand, mis-timing the peak, or both.
- Actual demand aligns more closely with rostering than planned demand. This indicates that improvements to forecasting and planning assumptions could reduce reliance on surplus staffing during peak periods.
- **Seasonality.** In 2025, February shows a closer alignment between staffing supply and demand across both terminals than July. This may reflect higher expected summer demand leading to more conservative staffing levels.
- Surplus staffing increases in July across both years, suggesting that the uplift applied for summer demand may be higher than required or applied too broadly across the day.

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