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# Euston Station - Aspirant Track Access Applications

Concourse Capacity Assessment

[redacted]

31/01/2025

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# Document Version Control

| Prepared by: | | |
|---|---|---|
| | **Name** | [redacted] |
| | **Position** | Station Capacity Planner |
| | **Date** | 30/01/2025 |
| **Reviewed by:** | | |
| | **Name** | [redacted] |
| | **Position** | Senior Station Capacity Planner |
| | **Date** | 31/01/2025 |

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| **Version** | Date | Comments |
| **0.1** | 07/11/2024 | Draft |
| **1.0** | 08/11/2024 | Draft issued for comments |
| **1.1** | 18/12/2024 | Revision incorporating internal feedback |
| **2.0** | 31/01/2025 | Final version |

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## Background

The Network Rail (NR) Passenger and Station Analysis Team (PSAT) was asked to assist with understanding the impact of additional train services, and associated passenger demand, at Euston station resulting from the aspirant track access applications.

In particular, the analysis focuses on deriving comparative concourse sizes suitable for accommodating the current train service and additional passenger demand as a result of more services.

It should be noted that the analysis presented in this document is for a theoretical concourse size. The results are intended to be used to compare the concourse size requirements for each of the timetable options as a proxy for comparing likely performance. These findings should not be used to determine design requirements for the station.

Although this report refers to an 'Open Access Scenario', it should be noted that this scenario is indicative of the additional quantum of services that could be accommodated on the network, as opposed to specific open access services.

This work was conducted in Summer-Autumn 2024.

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## Methodology - Overview

- The methodology applied in the concourse assessment of Euston station draws on the Station Capacity Planning Design Manual (NR/GN/CIV/100/03) for calculating concourse size and spatial provisions during normal operations.
- This approach assumes all passengers gather in the same space. In reality, under normal operations, we expect some of that demand would disperse to the station retail, toilets etc. During disruptions passengers are more likely to congregate closer to the platforms, which at Euston station is in the designated concourse area.
- The assessment is a static calculation of concourse accumulation in 15-minute buckets over the three-hour PM peak period.
- The methodology considers train service call to board and departure time. As such, it can test the impact of the common cause variance (e.g., minor dwell overruns, running time variances) and disruptions, on concourse accumulation. This can be compared to the baseline timetable (TT) and 'typical' platform announcement times.

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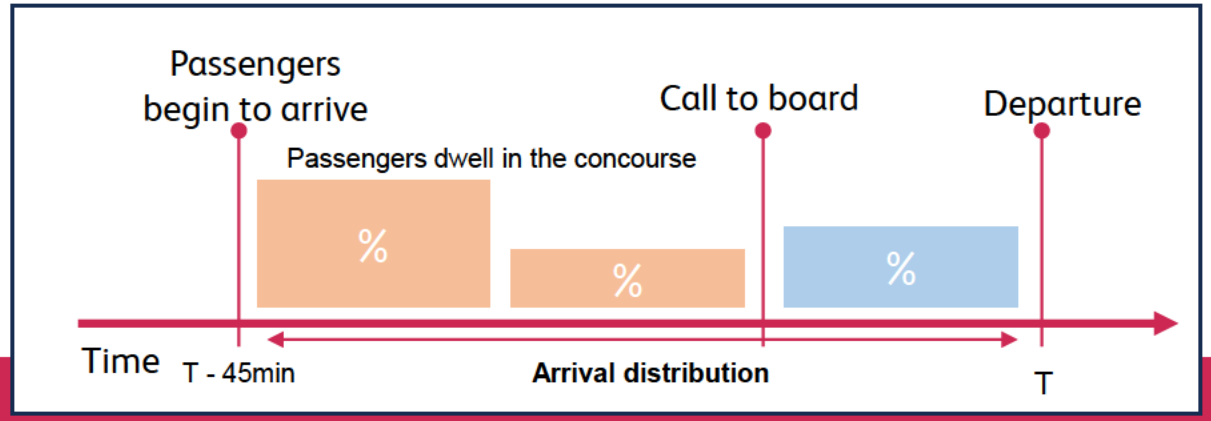
## Methodology – Boarding Passengers

- For boarding passengers, the dwell time in the concourse is estimated based on pre-departure arrival distribution, the time between the platform announcement (call to board) and the train departure.
- The pre-departure arrival distribution assumptions are based on a passenger questionnaire conducted as part of a passenger survey at Euston station in May 2024.
- Except for London Overground, boarding passengers for each service are assumed to accumulate in the concourse for 30 minutes prior to the departure (two 15-min buckets). Under the working timetable (WTT) scenario, all passenger expected to arrive in the 15-min period before their departure are assumed not to dwell in the concourse and travel straight to the platform. For all other scenarios, passengers are assumed to dwell in the concourse until their platform is announced. (Tested scenarios are defined on Slides 9 and 10).
- London Overground passengers are assumed to travel directly to the platform and are accounted for as moving passenger demand. These passengers are expected to wait on or near the platform, and any delay in the model is not reflected as additional accumulation on the concourse.



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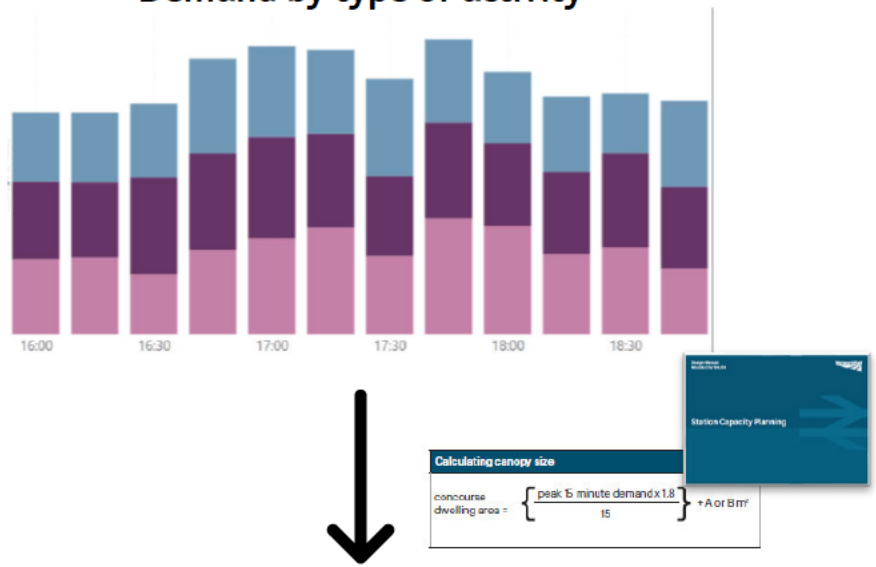
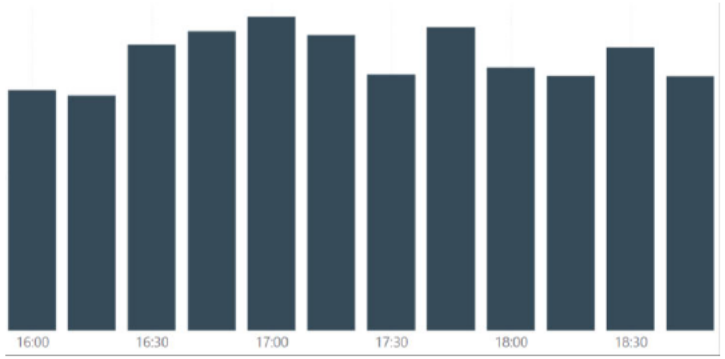
## Methodology – Concourse size

- The assessment considers boarding and alighting loads and assigns an appropriate Fruin Level of Service to the corresponding activity (an occupancy rate for dwelling and a rate of movement for circulation). The initial input is a timetable with assigned boarding and alighting loads. To estimate the impact of new services, the static model was updated with the forecast supplied by NR's Economic Analysis Team.
- The methodology considers train service call to board and departure time. As such, it can test the impact of the common cause variance (e.g., minor dwell overruns, running time variances) and disruptions, on concourse accumulation. This can be compared to the baseline TT and typical platform announcement times.
- It should be noted that the analysis presented in this document is for a theoretical concourse size. The results are intended to be used to compare the concourse size requirements for each of the timetable options as a proxy for comparing likely performance. These findings should not be used to determine design requirements for the station.

**Demand by type of activity**




**Equivalent concourse size**



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## Demand scenarios

The Existing TT scenario represents the timetable and demand observed during the passenger survey conducted in May 2024.

Demand forecasts were supplied by NR's Economic Analysis Team, derived from MOIRA2, and include additional services to indicate demand in the following scenarios:

- Open Access 2024 – This scenario is indicative of the number of additional services that can be accommodated on the network. This is based upon the December 22 Concept TT, which includes five additional services in the PM peak compared to the existing timetable (more detail on the next slide), under 2024 levels of demand.
- Open Access 2042 - represents 2042 demand with these additional services

| Demand Scenario | Departing services (PM Peak) | Boarders | Boarding pax/service (avg) | Alighters |
|---|---|---|---|---|
| *Existing TT (May 2024)* | 67 | 21,981 | 328 | 14,581 |
| *Open Access 2024** | 72 (incl. GUT) | 21,978 | 309 | 14,536 |
| *Open Access 2042** | 72 (incl. GUT) | 29,980 | 416 | 16,009 |

* Note the demand forecast did not specifically look at open access services, but the additional quantum of services that could be accommodated on the network

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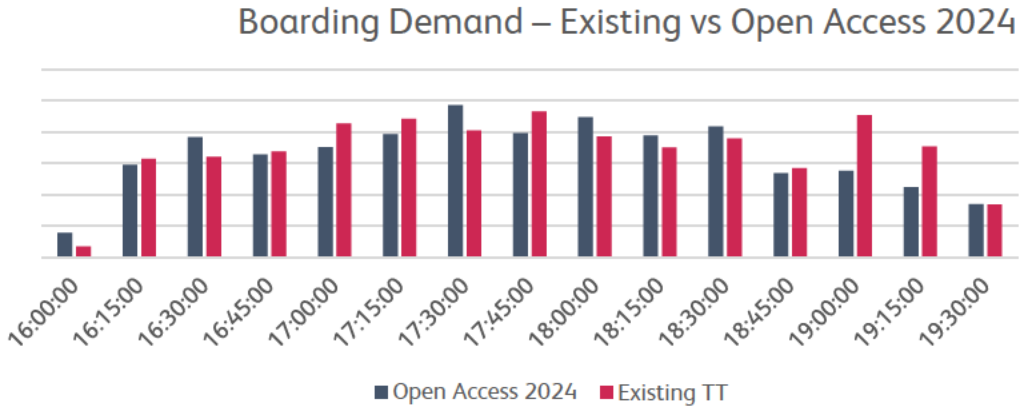
# Changes in Timetable/Demand – 2024

## Additional services assumed as part of Open Access 2024 Scenario

(Services included in Dec' 22 Concept TT and not in the existing TT)

| Destination | Departure | Arrival at Destination | TOC |
|---|---|---|---|
| Stirling | 16:20:00 | 22:14:00 | Grand Union Trains |
| Liverpool Lime Street | 16:30:00 | 18:43:00 | Avanti West Coast |
| Liverpool Lime Street | 17:30:00 | 19:43:00 | Avanti West Coast |
| Blackpool North | 17:36:00 | 20:29:00 | Avanti West Coast |
| Liverpool Lime Street | 18:30:00 | 20:43:00 | Avanti West Coast |

Open Access 2024 scenario changes the profile of the demand at the station creating a more sustained period of high boarding demand.




Note although referred to as the Open Access Scenario in this analysis, the demand forecast did not specifically look at open access services, but the additional quantum of services that could be accommodated on the network.

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## Tested Scenarios

This static model is designed to measure passenger aggregation in the concourse – train performance and calls to board are essential factors influencing the number of passengers waiting in the concourse.

Passenger rail performance data indicates that all three operators serving Euston station struggle to meet the performance targets, with Avanti West Coast receiving scores among the lowest in the country.

Euston often sees "surges" of passengers moving towards the platform upon a train announcement. While the empirical evidence is limited, the available survey video footage and Wordline data analysis suggest that boarding windows can vary between 2 and 40 minutes.

Since performance issues are widely recognised as a challenge at Euston Station, PSAT developed additional operational scenarios to test the demand under the common cause variance scenarios.

The operational scenarios tested are as follows:

- Working Timetable (WTT)
- Random Delay to Calls to Board
- Random Delay to Departure
- Random Delay Departure and Calls to Board

Please note, any delays tested were generated at random and don't represent observed train performance.

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## Operational Scenarios

| Operational Scenario | Assumptions | Model runs |
|---|---|---|
| Scenario 1 - Working Timetable (WTT) | Call to Board as 'planned' (14min for Avanti services, 12 for all other TOCs) | 1 |
| Scenario 2 - Random Delay to Calls to Board | Call to Board is delayed by a random number of minutes between 1 and 10/12 (depending on the TOC). Departure time remains unaffected. | 10 |
| Scenario 3 - Random Delay to Departure | All departures are delayed by a random number of minutes between 1 and 20 minutes. Calls to board are adjusted to meet the 'target' of 12 and 14 minutes. | 10 |
| Scenario 4 - Random Delay Departure and Calls to Board | All departures are delayed by a random number of minutes between 1 and 20 minutes. All calls to board are delayed by a random number of minutes between 1 and 10/12 (depending on the TOC). | 10 |

Where the scenario assumes a degree of variance (all except of WTT), the average result is shown based on 10 model runs.

The model doesn't account for cancellations or changes to the journey passengers may make because of delays or cancellations.

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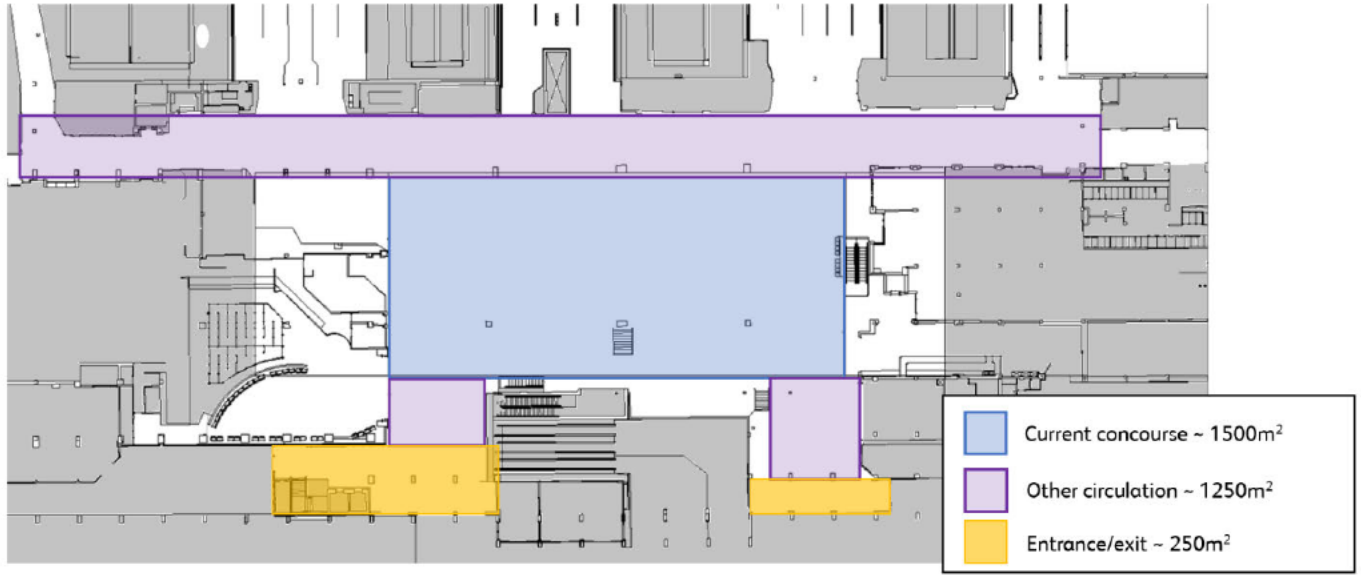
## Concourse Space

The useable concourse area at Euston station is estimated at 1500m$^2$, as indicated by the area shaded in blue.

When the space is sufficiently sized to accommodate the dwelling and circulating demands, the concourse is expected to operate without conflict offering good passenger experience.

Once demand starts to exceed this capacity we can expect deterioration in passenger experience, conflict between dwelling and circulating passengers (boarders and alighters), and eventually congestion leading to introduction of crowd measures and station closure.

Keeping demand at levels that align with the concourse capacity, under normal operations, is essential to retain resilience in the concourse in the event of disruptions.



# Results

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## Scenario 1 - Working Timetable (WTT)

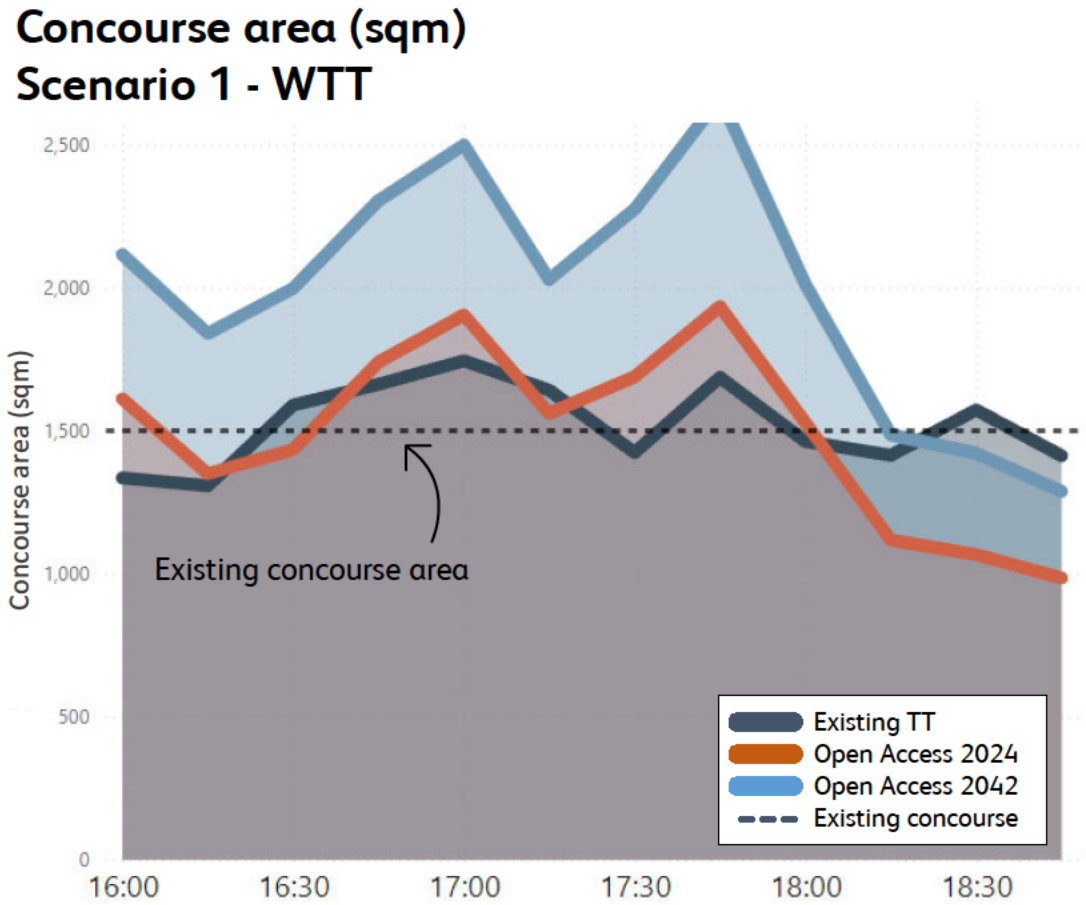
This graph shows the resultant concourse area for each demand scenario, based on the WTT.

Under the assumption that all services run on time and all call to board targets are met, the concourse already exceeds its theoretical capacity during the PM peak.

In the Existing TT scenario, the concourse exceeds its theoretical capacity between 16:30 and 18:15 by a maximum of 16 % (at 17:00-17:15).

Under the Open Access 2024 demand scenario, the demand is more concentrated creating two distinctly busier 15-min periods – around 17:00 and 17:45. This is likely to create poorer passenger experience and reduce station resilience during those periods.

Under the Open Access 2042 demand scenario the concourse is expected to exceed its theoretical capacity for most of the PM peak. This would be expected to result in a severely degraded passenger experience and negligible resilience to demand or operational fluctuation.



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## Scenario 2 (Call to Board) vs Scenario 3 (Departure Delay)

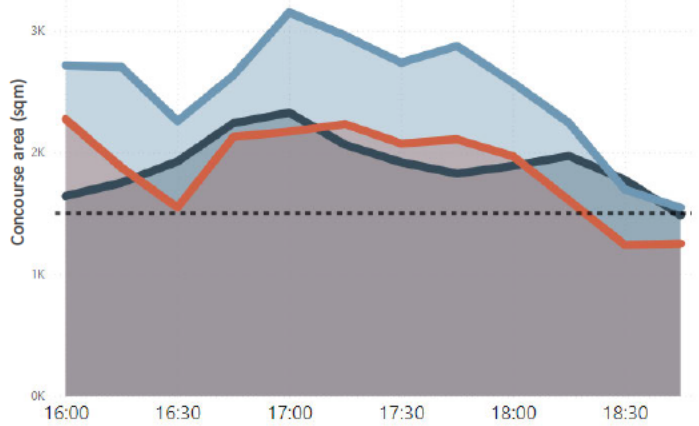
These graphs shows the resultant concourse area for each demand scenario based on the Call to Board & Departure Delay scenarios, respectively.

Delay in departure has a more significant impact than delay of Calls to Board. However, even when services run on time, continuous delay in announcing platforms will lead to noticeable deterioration in passenger experience.

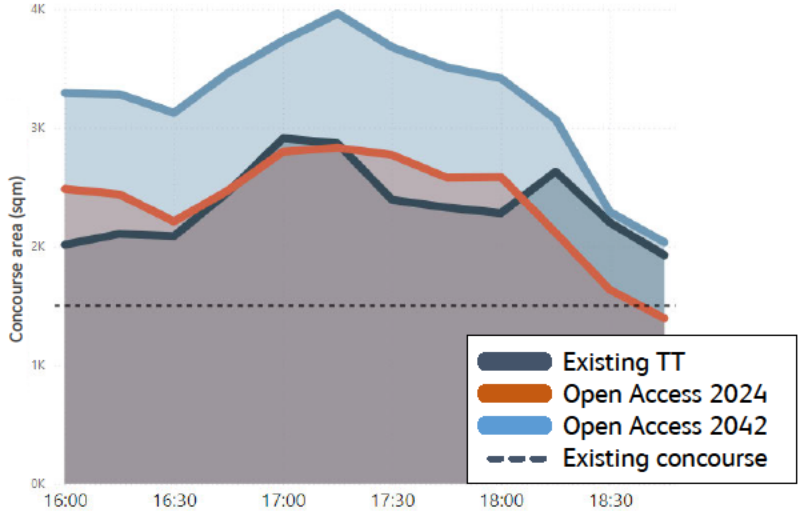
In both operational scenarios, we observe higher peak demand under the Existing TT scenario, however the concourse is expected to be busy for longer periods of time under the Open Access 2024 scenario. This is likely to have an impact on station resilience.

Under the Open Access 2042 scenario, the demand in the concourse is likely to require crowding measures to ensure safety of passengers.

**Concourse area (sqm)**
**Scenario 2 - Call to Board Delay**




**Concourse area (sqm)**
**Scenario 3 - Departure Delay**



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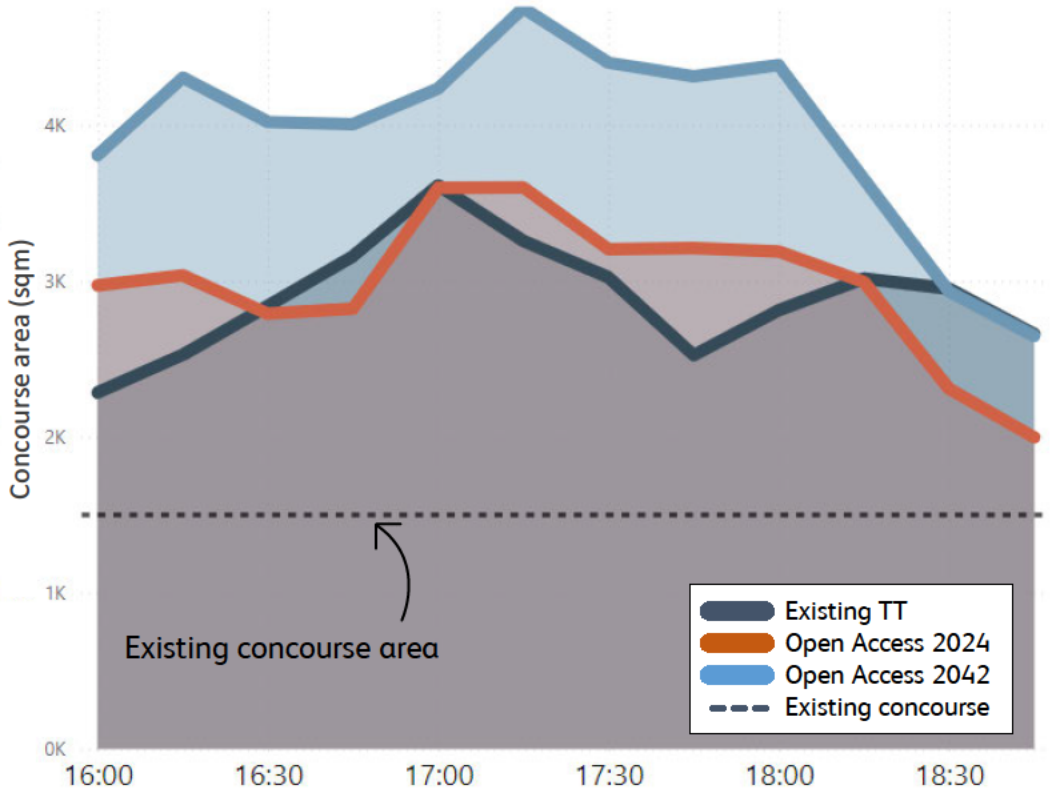
## Scenario 4 - Call to Board and Departure Delay

These graphs shows the resultant concourse area for each demand scenario based on the combined Call to Board & Departure Delay scenario.

In the event of continuing delays in train service (of up to 20 minutes) and delays to platform announcements the concourse is unlikely to cope with the demand.

The concourse is expected to be busier for a longer period of time under the Open Access 2024 scenario. Therefore, the concourse is more likely to recover throughout the peak under the Existing TT scenario. However, the passenger experience is likely to be very poor in all scenarios. Crowd management would be required during the busiest periods.

Under the Open Access 2042 the concourse will experience higher demand for an extended period of time.



# Conclusions

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## Conclusions

As it stands, Euston Station is vulnerable to disruptions associated with delays and cancellations, as well as common cause variance in call to board announcements.

The data suggests that even under existing demand and timetable, the concourse design does not lend itself to accommodating spikes in demand well.

In the short-run, introduction of additional services at London Euston may contribute to poorer passenger experience in the concourse.

Additional services may limit station's ability to cope with common cause variance in train service, such as delays to boarding and departure. This means the station has less resilience to demand or operational fluctuation.

It should be noted that the analysis presented in this document is for a theoretical concourse size. The results are intended to be used to compare the concourse size requirements for each of the timetable options as a proxy for comparing likely performance. These findings should not be used to determine design requirements for the station.