

C140 WHITECHAPEL STATION

PEDESTRIAN MODELLING ANALYSIS – Stage E

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Contents

- 1 Executive Summary4**
 - 1.1 Aims and Objectives 4
 - 1.2 Method 4
 - 1.3 Summary and Conclusions 4
- 2 Introduction5**
 - 2.1 Background and Proposed Layout 5
 - 2.2 Purpose..... 5
 - 2.3 Method and Report Structure 5
- 3 Passenger Demand Forecasts6**
 - 3.1 Demand Matrices..... 6
- 4 LEGION Simulation Modelling – Model Development8**
 - 4.1 Source LEGION Models 8
 - 4.2 Stage E Model Development..... 8
 - 4.3 LEGION Model Files 8
 - 4.4 Passenger Routeing Assumptions – Normal Operation..... 8
 - 4.5 Boarding Distributions..... 10
 - 4.6 Alighting Distributions 13
 - 4.7 Entity Types and Percentages..... 17
 - 4.8 Train Dwell Time 17
 - 4.9 Train Arrival Profiles 17
 - 4.10 Whitechapel Station Ticket Office 18
 - 4.11 Unpaid Walkway 18
 - 4.12 Crossrail Cancelled Train 18
 - 4.13 Stage E Model Checks 18
 - 4.14 CRL/LUL Model Audit..... 19
- 5 LEGION Modelling Overview – 2026 Normal Operation Results20**
 - 5.1 Introduction 20
 - 5.2 Outputs and Analysis..... 20
 - 5.3 Fruin Levels of Service (LOS)..... 20
 - 5.4 2026 Normal Operation Results – Station Entrance & Upper Concourse..... 22
 - 5.5 Hammersmith & City and District Line Platforms 27
 - 5.6 East London Line Platforms 30
 - 5.7 East London Line Stairs..... 32
 - 5.8 Crossrail Platforms 34
 - 5.9 Summary of 2026 Modelling Results..... 36
- 6 LEGION Modelling – 2026 +28% Normal Operation Results37**
 - 6.1 Introduction 37

6.2	Station Entrance and Upper Concourse Bridge	37
6.3	Hammersmith & City and District Line Platforms	42
6.4	East London Line Platforms	43
6.5	East London Line Stairs.....	46
6.6	Crossrail Platforms	49
6.7	Summary of 2026 +28% Modelling Results	51
7	LEGION Modelling – 2026 +28% PM Mitigation Results.....	52
7.1	Introduction	52
7.2	East London Line Southbound Board the Next Train (PM Only).....	52
7.3	East London Line Southbound One-way (PM Only).....	54
7.4	Passenger Routeing Assumptions – One-Way (2026 +28% PM only).....	54
7.5	Summary of 2026 +28% PM Mitigation Modelling Results.....	57
8	Summary & Conclusions	58
9	Appendices	59
9.1	Appendix A - Station Layout Plans	59
9.2	Appendix B - 2026 Demand Matrices	60
9.3	Appendix C - LEGION Model Files and Assumption Cover Sheets	61
9.4	Appendix D - 2026 Normal Operation Cumulative Mean/Max Density Plots	62
9.5	Appendix E - 2026 +28% Cumulative Mean/Max Density Plots	63
9.6	Appendix F - 2026 +28% PM Mitigation Cumulative Mean/Max Density Plots....	64
9.7	Appendix G - 2026 +28% Cumulative High Density Maps.....	65
9.8	Appendix H - London Underground Limited Model Audit Action List	66

1 Executive Summary

1.1 Aims and Objectives

- 1.1.1 As the Framework Design Consultants for Whitechapel Station, this report has been prepared to evaluate the performance of the preferred Stage E layout option for Whitechapel Station, an interchange station between Hammersmith & City and District lines, East London Line and Crossrail.
- 1.1.2 The main objective of the analysis is to assess the adequacy of the station design during the busiest AM and PM peak periods for 2026 and 2026+28% passenger demands.

1.2 Method

- 1.2.1 The modelling exercise has been undertaken using LEGION Studio 2006 for 'Normal' operation. Emergency evacuation analysis has been undertaken and reported separately.
- 1.2.2 The modelling method has been agreed at the study outset with both Crossrail Limited and London Underground Limited, building upon earlier LEGION modelling work, and agreeing key assumptions including:
- Passenger Demands;
 - Timetables/Trains per hour;
 - Passenger Routeing;
 - Boarding/Alighting Profiles;
 - Entity Types and Percentages;
 - Train Dwell Times; and
 - Train Arrival Profiles.

1.3 Summary and Conclusions

- 1.3.1 In summary, the LEGION modelling exercise has demonstrated (Chapter 5) that the geometry of the Stage E layout design under Normal Operation would accommodate the 2026 AM and PM peak passenger demands, and would operate within capacity in accordance with the 'acceptable' limits for operation (Section 5.3.3). This includes all station areas, ticket hall, stairs, escalators, passageways and platforms.
- 1.3.2 Additionally, the modelling exercise has demonstrated (Chapter 6) that the geometry of the Stage E layout designs would satisfy the 'acceptable' limits for operation (Section 5.3.3) for the AM and PM 2026 +28% demands.
- 1.3.3 Due to the high volume of boarding passengers during the PM peak on the East London Line southbound platform the LEGION modelling results have shown that small sections of the platform would be approaching/at capacity in the 2026 +28% scenario. In discussions with Crossrail Limited and London Underground Limited a number of potential operational mitigation measures have been discussed, agreed and tested (see Chapter 7). The results show that these mitigation measures would provide significant improvements, and result in acceptable Levels of Service for passengers on the East London Line southbound platform, should it be necessary to introduce these mitigation measures in the future.

2 Introduction

2.1 Background and Proposed Layout

- 2.1.1 Following appointment as Framework Design Consultants for Whitechapel Station, the design team have developed a preferred Stage E layout option for Whitechapel Station, an interchange station between Hammersmith & City and District lines, East London Line and Crossrail. Plans showing the proposed layouts at each level are provided in **Appendix A**.
- 2.1.2 The preferred layout design provides a simple, direct interchange layout for passenger convenience.

2.2 Purpose

- 2.2.1 The purpose of the analysis is to assess the adequacy of the station design to accommodate future passenger demands, during the busiest AM and PM peak periods.

2.3 Method and Report Structure

- 2.3.1 The analysis has been undertaken based on dynamic simulation modelling using LEGION Studio for 'Normal' operation. Emergency evacuation analysis has been undertaken and reported separately.
- 2.3.2 The report follows the following format:
- Chapter 3 summarises the passenger demands, and growth assumptions used in this study;
 - The modelling assumptions and LEGION model development is summarised in Chapter 4 and the modelling results are provided in Chapters 5, 6 and 7.
 - Overall conclusions and recommendations are provided in Chapter 8.

3 Passenger Demand Forecasts

3.1 Demand Matrices

3.1.1 2026 'with Crossrail' AM and PM demand matrices were provided to the modelling team within the Assumption Cover Sheets (ACS) for the LEGION modelling exercise. These are provided in **Appendix B** with the Assumption Cover Sheets in **Appendix C**.

It should be noted that the analysis undertaken has been based on the version 1.8 forecasts as instructed by Crossrail Limited (CRL) and London Underground Limited (LUL).

Figures 3.1 and **3.2** below illustrate the entry/exit passenger volumes for the AM and PM 2026 forecasts.

Figure 3.1 – 2026 AM Peak 3-hour Passenger Volumes

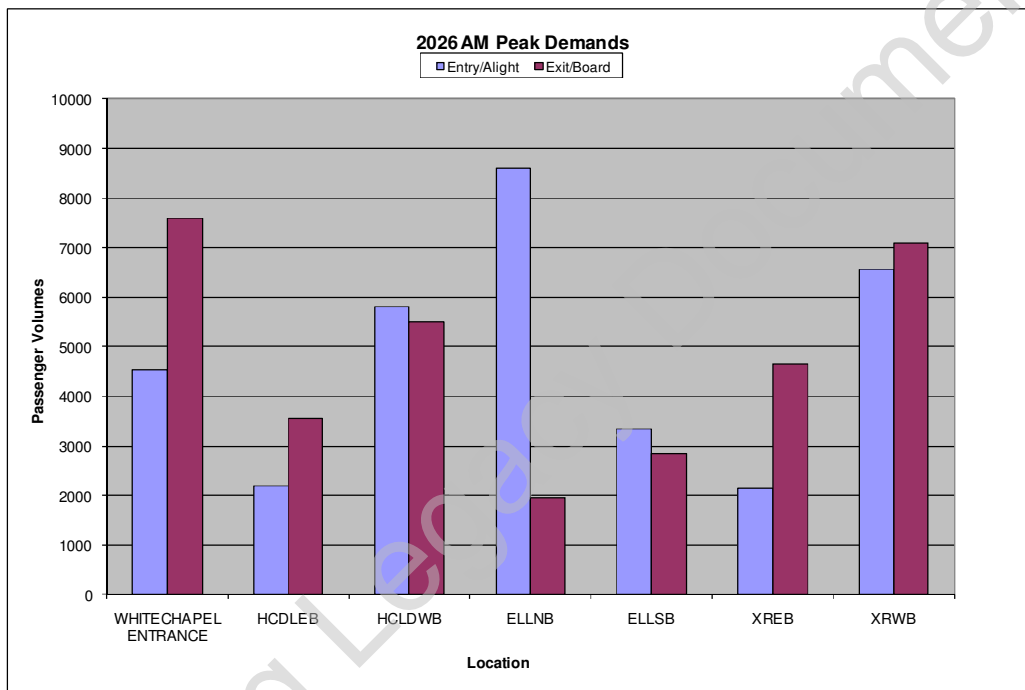
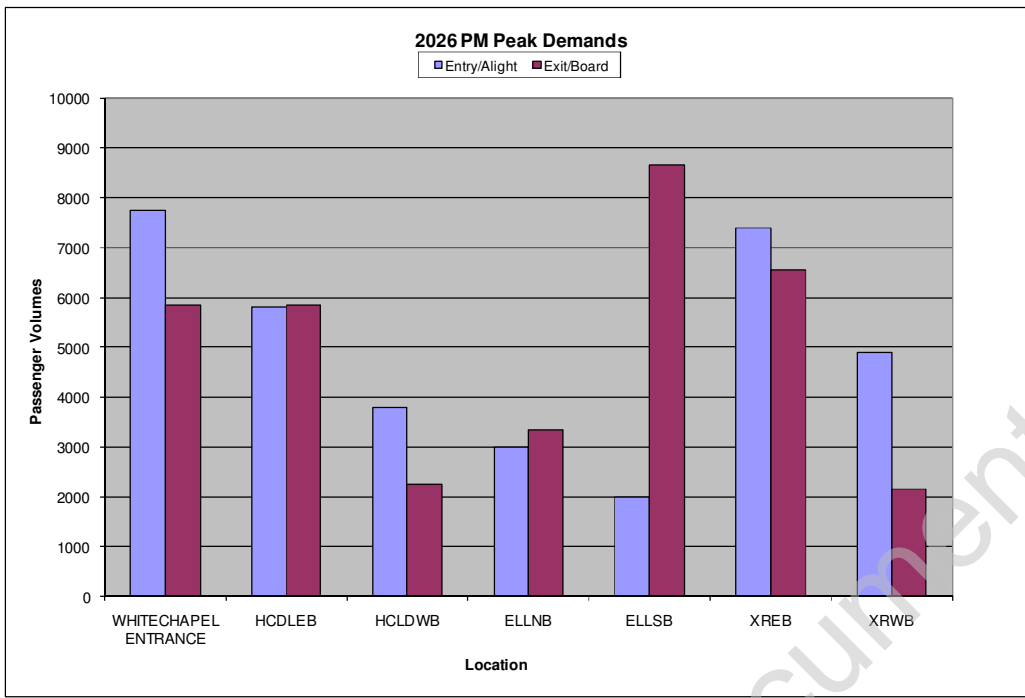


Figure 3.2 – 2026 PM Peak 3-hour Passenger Volumes



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4 LEGION Simulation Modelling – Model Development

4.1 Source LEGION Models

4.1.1 The modelling team received, from CRL, the earlier MDC scheme models for the AM and PM peaks. The model files received were:

- WHI_AM_135%_v4.lgm
- WHI_PM_135%_v2.lgm

4.1.2 These models were used as a base to develop the Stage D models that were subsequently audited by LUL and have been reported on separately (Reference: C140-HYD-T3_XTC-D061-00347).

4.1.3 The Stage E models and results as summarised in this report have therefore been based on the Stage D models.

4.2 Stage E Model Development

4.2.1 The Stage E model development included the updated CAD which reflects the internal station geometry based on the Stage E design.

4.2.2 The Assumption Cover Sheets set out a number of assumptions to be incorporated in the modelling exercise, including:

- Passenger Demands;
- Timetables/Trains per hour;
- Passenger Routeing;
- Boarding/Alighting Profiles;
- Entity Types and Percentages;
- Train Dwell Time; and
- Train Arrival Profiles.

4.3 LEGION Model Files

4.3.1 All LEGION models and the corresponding ACS referred to within this report have been saved to disc and are attached as **Appendix C**. The remainder of this Chapter details some of the key assumptions as set out in the ACS.

4.4 Passenger Routeing Assumptions – Normal Operation

4.4.1 District, Hammersmith & City

- HCDL - ELLNB passengers would use western staircase that connects directly to the ELLNB platform;
- HCDL - ELLSB passengers would use eastern staircase that connects directly to the ELLSB platform;
- HCDL – Crossrail passengers use the escalators to the Concourse Bridge, then route towards the northern escalators down to Crossrail. The reverse route has been assumed for Crossrail – HCDL passengers.

4.4.2 East London Line

- ELL - HCDL passengers would use the southern staircases located on the East London Line Northbound and Southbound platforms, which connect directly to the HCDL platform;

- ELL – Station Exit passengers would follow the same route as the HCDL passengers using the stairs located at the southern end of the platforms. From here they use the escalators from HCDL up to the Concourse. It was noted that the exiting passengers could potentially route via the northern staircases on the ELL platform and then via the escalator connecting the lower and upper Concourse. The assumptions made in this modelling exercise reflect the ‘worst case’ scenario, whereby all exiting passengers use the southern ends of the platform which are the busiest.
- ELL - Crossrail passengers would use northern staircases located on the East London Line Northbound and Southbound platforms, which connect with the Concourse Bridge. The reverse route has been assumed for Crossrail – ELL passengers.




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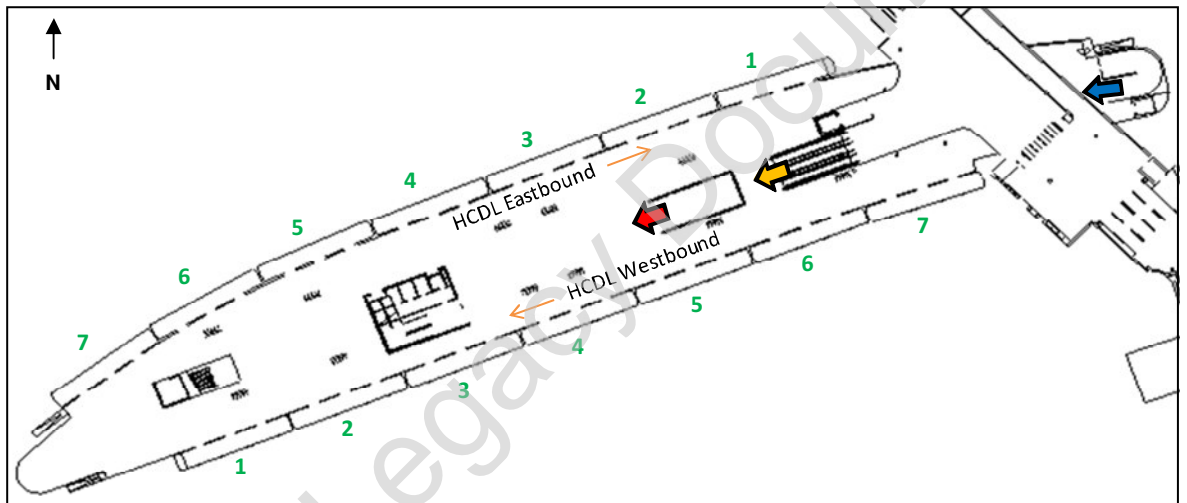
4.5 Boarding Distributions




4.5.1 District, Hammersmith & City

- There are three points of entry onto the HCDL platform and, the platform distributions are as stated within the ACS. **Figure 4.1** below highlights the points of entry to the platform and details the eastbound and westbound boarding distributions from each of the entry points.

Figure 4.1– HCDL Platform Entry Points and Boarding Distributions

District, Hammersmith & City – Eastbound Platform								
Entry	Car 7	Car 6	Car 5	Car 4	Car 3	Car 2	Car 1	Total
	5%	10%	15%	22.5%	22.5%	15%	10%	100%
	2.5%	7.5%	12.5%	20%	22.5%	22.5%	12.5%	100%
	0%	2.5%	5%	10%	17.5%	30%	35%	100%



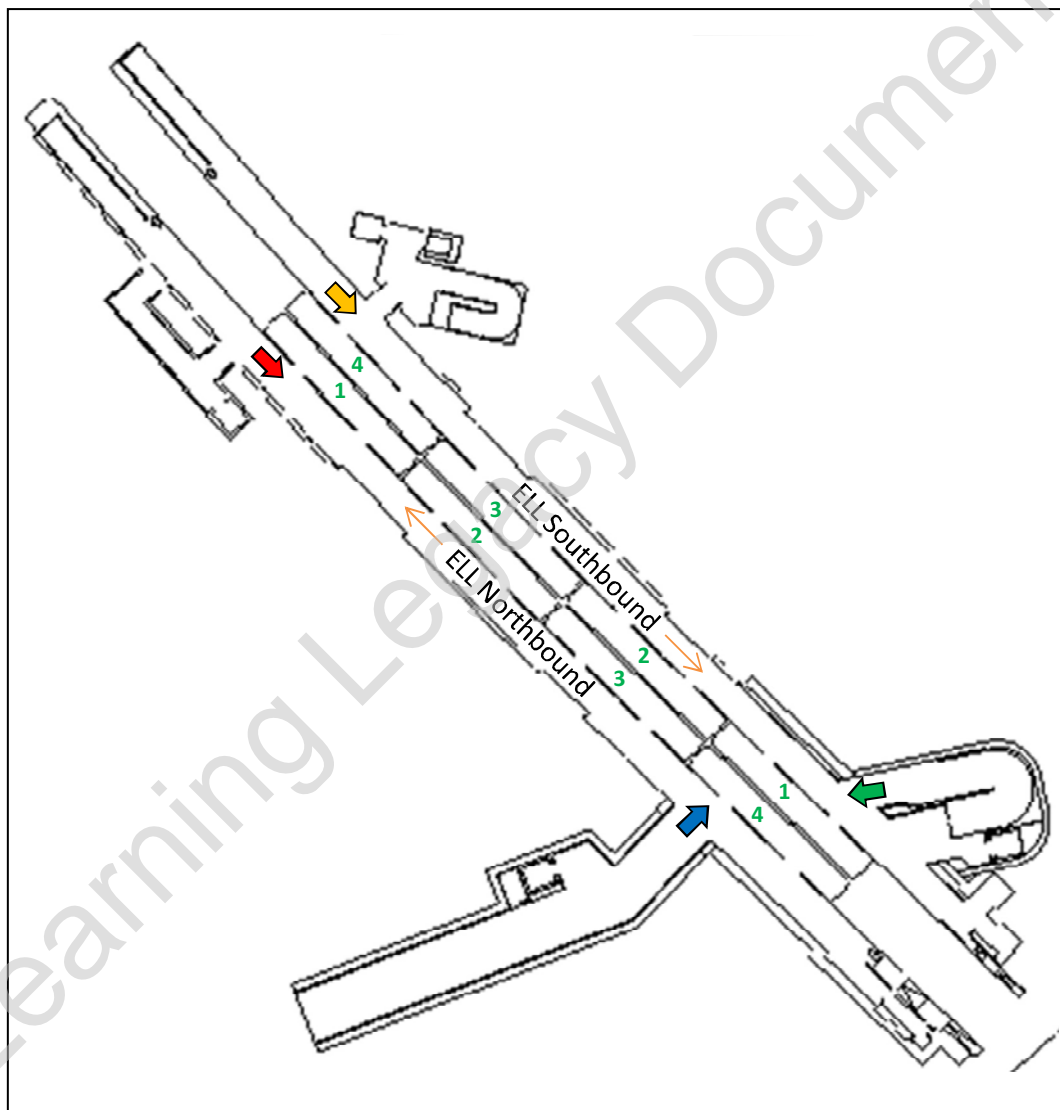
District, Hammersmith & City – Westbound Platform								
Entry	Car 1	Car 2	Car 3	Car 4	Car 5	Car 6	Car 7	Total
	5%	10%	15%	22.5%	22.5%	15%	10%	100%
	2.5%	7.5%	12.5%	20%	22.5%	22.5%	12.5%	100%
	0%	2.5%	5%	10%	17.5%	30%	35%	100%

4.5.2 East London Line

- There are four points of entry onto the East London Line platforms. The platform distributions are as stated in the ACS. **Figure 4.2** below highlights the points of entry to the platform and details the northbound and southbound boarding distributions from each entry point.

Figure 4.2 – ELL Platform Entry Points and Boarding Distributions

East London Line Northbound Platform					
Entry	Car 4	Car 3	Car 2	Car 1	Total
←	10%	20%	30%	40%	100%
←	40%	30%	20%	10%	100%

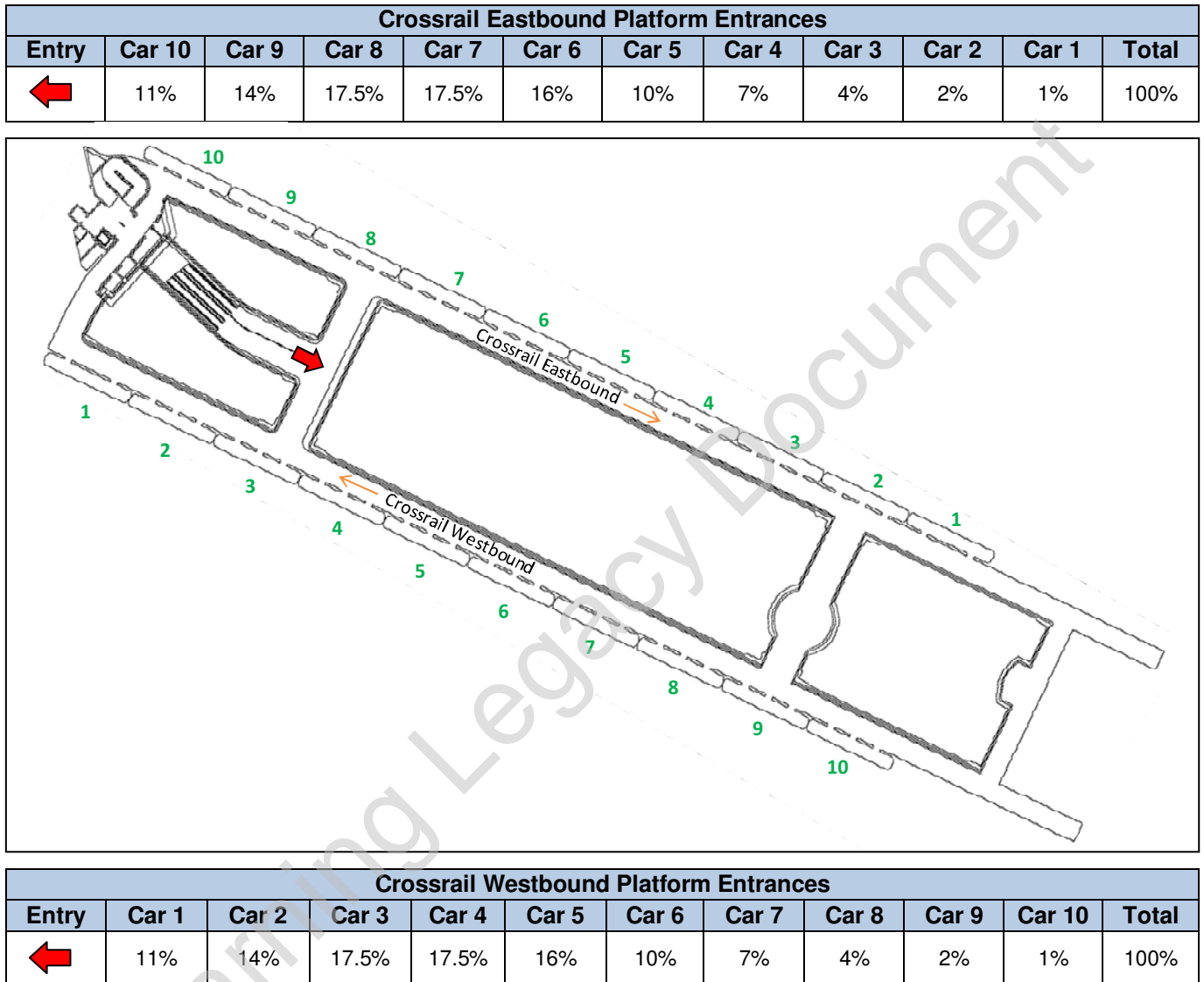


East London Line Southbound Platform					
Entry	Car 1	Car 2	Car 3	Car 4	Total
←	40%	30%	20%	10%	100%
←	10%	20%	30%	40%	100%

4.5.3 Crossrail

- There is one point of entry to the Crossrail platforms and the platform distributions are based on those from the ACS. **Figure 4.3** below highlights the points of entry to the platform and details the eastbound and westbound boarding distributions from the entry point.

Figure 4.3 – Crossrail Platform Entry Points and Boarding Distributions

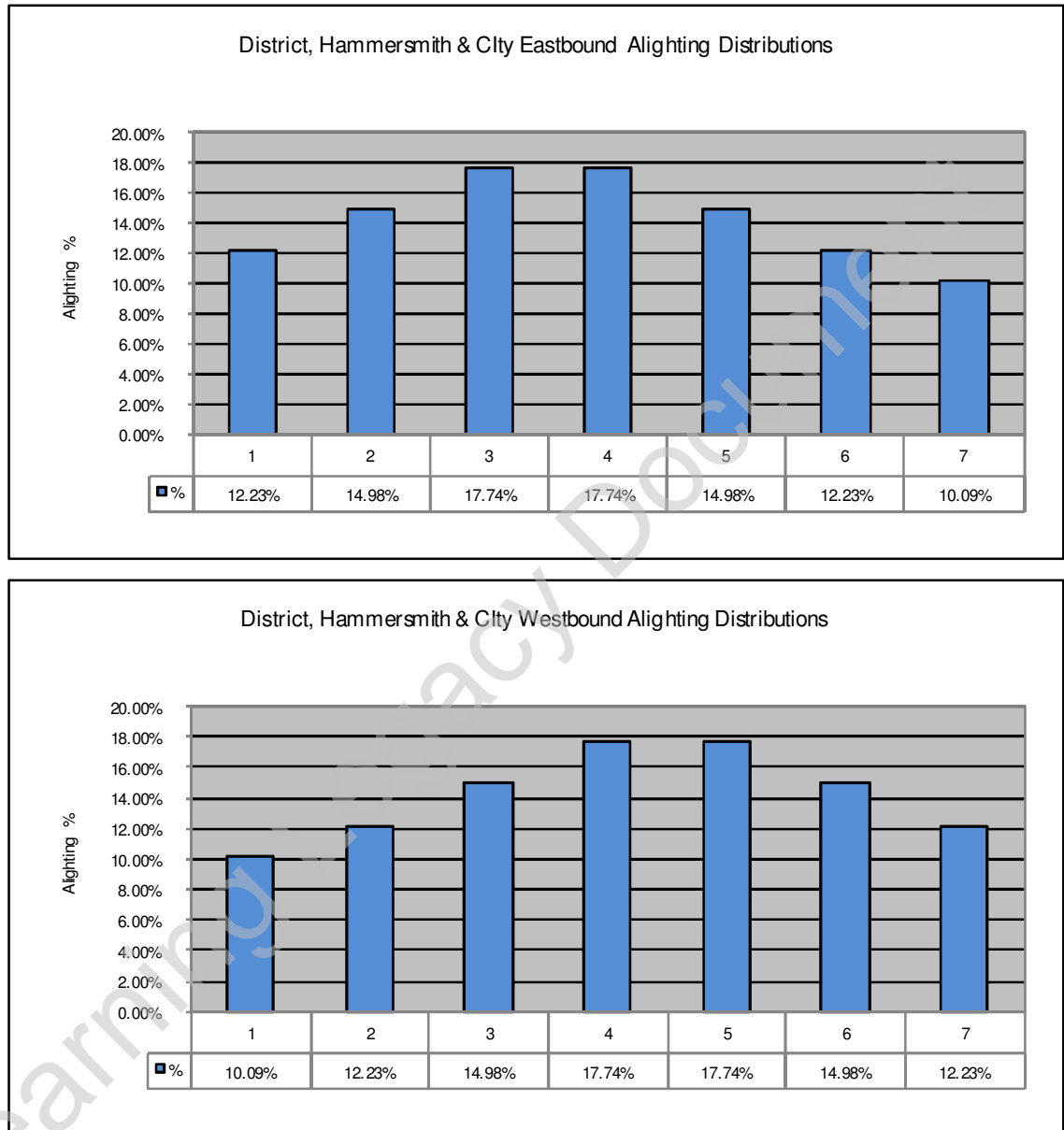


4.6 Alighting Distributions

4.6.1 District, Hammersmith & City – Normal Operation

- The alighting distributions are as stated in the ACS. **Figure 4.4** below highlights the eastbound and westbound alighting distributions.

Figure 4.4 – HCDL Alighting Distributions



4.6.2 East London Line

- The alighting distributions are as stated in the ACS. Separate alighting distributions have been created for Crossrail and HCDL/Exit passengers. It was assumed that frequent passengers would have knowledge of the station and therefore the distributions have assumed that passengers would alight the train at the location nearest their platform exit stairs.
- **Figure 4.5** and **4.6** below highlights the northbound and southbound carriage alighting distributions, it can be seen that the Crossrail passengers are weighted to the northern end of the platform and the HCDL/Exit passengers to the southern end. A plan showing the carriage positions is provided as **Figure 4.2**.

Figure 4.5 – ELLNB Alighting Distributions

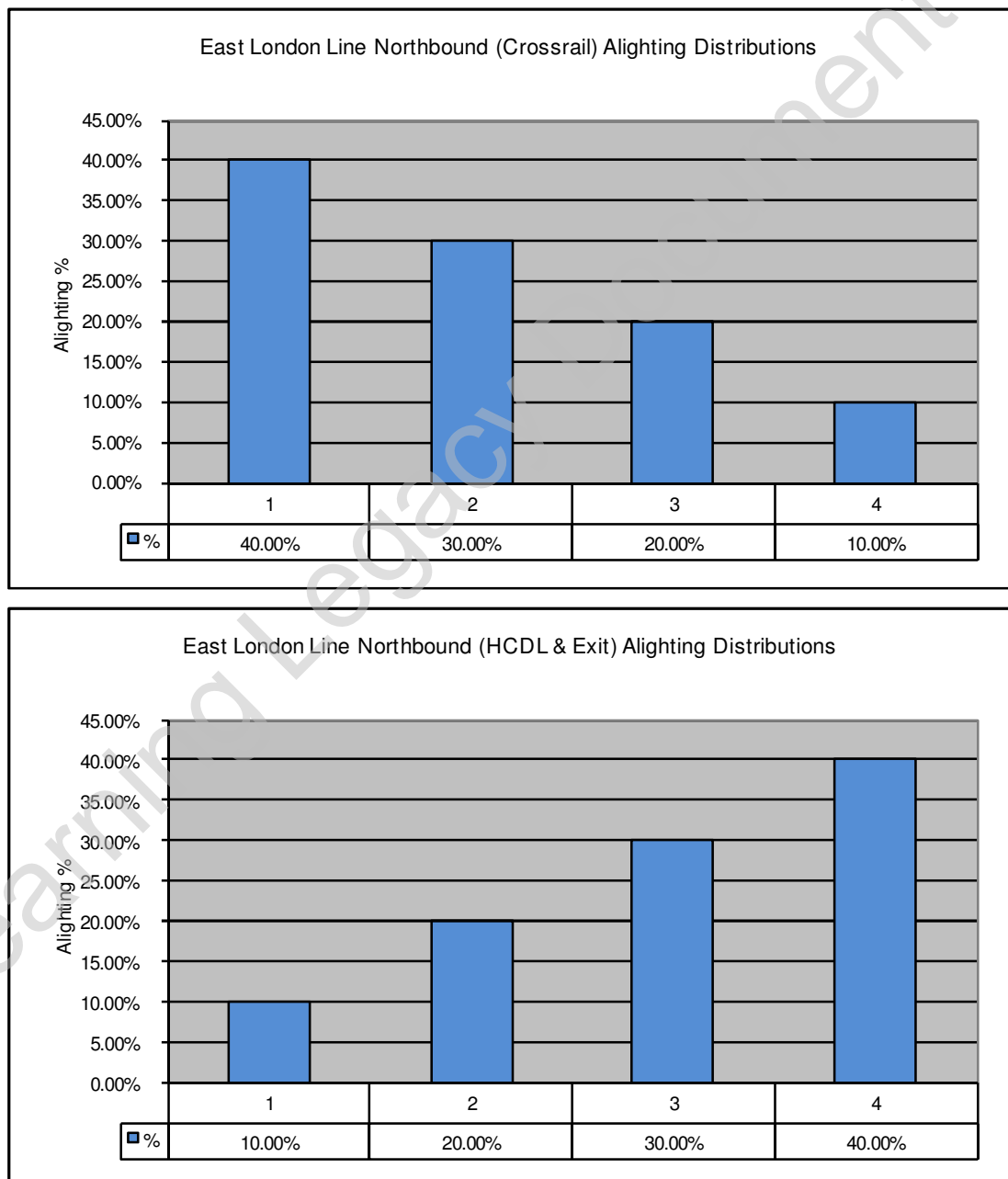
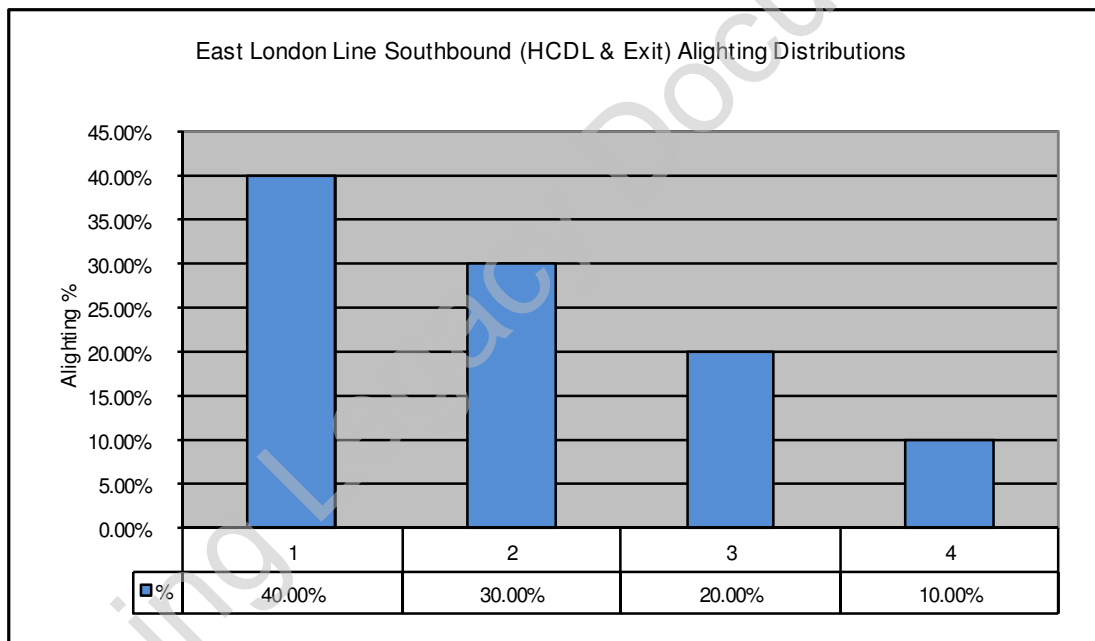
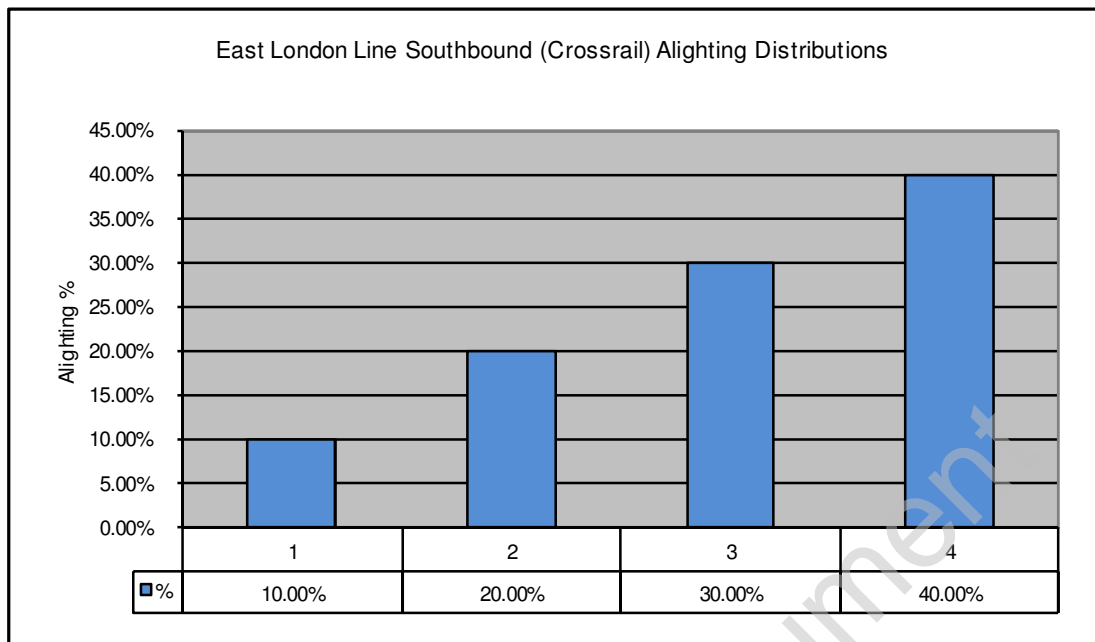


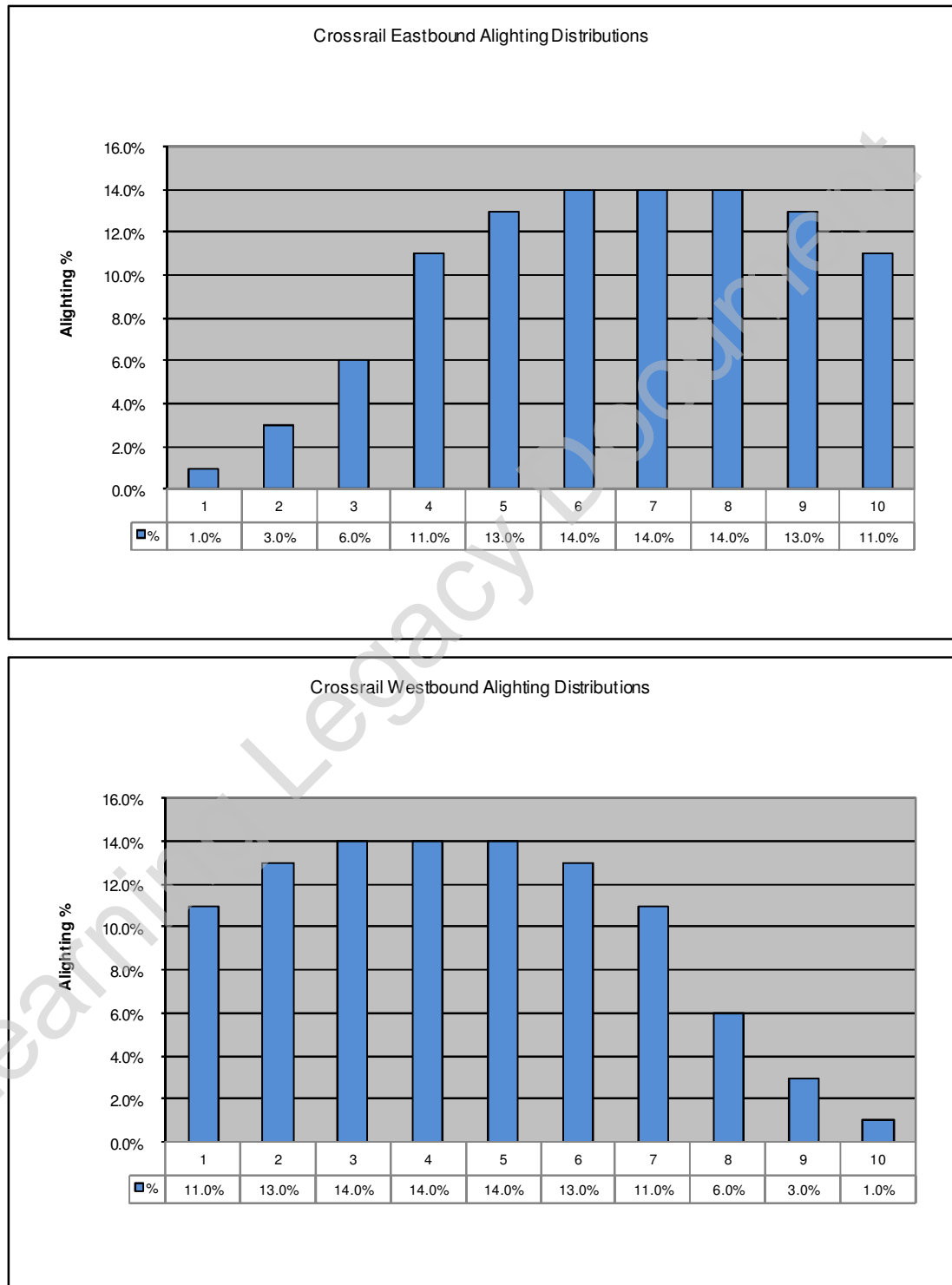
Figure 4.6 – ELLSB Alighting Distributions



4.6.3 Crossrail

- The alighting distributions are as stated in the ACS. **Figure 4.7** below highlights the eastbound and westbound carriage alighting distributions. It can be seen that alighting passengers are weighted to the western end of the platform as this is where the escalators to the Concourse Bridge are located.

Figure 4.7 – Crossrail Carriage Alighting Distributions



4.7 Entity Types and Percentages

4.7.1 The Pedestrian Modelling Guidelines issued by CRL identifies one standard UK commuter and five passenger categories. These are shown in the **Table 4.1** below including the proportion of passengers of each type.

Table 4.1 – Passenger Type & Proportion

Passenger Type	Passenger Description	% of Passengers
STD	UK Commuter	96.29%
A	Wheel Chair User	0.01%
B	Disabled/Elderly Impaired	0.92%
C	Medium Luggage	2.02%
D	Large Luggage	0.41%
E	Adults with Young Children	0.35%

4.7.2 The entity types and corresponding proportions have remained in line with the ACS.

4.8 Train Dwell Time

4.8.1 A summary of the door opening times for each of the services operating at Whitechapel is provided as follows:

- Crossrail – 35 seconds;
- District, Hammersmith & City – 25 seconds; and
- East London Line – 35 seconds.

4.9 Train Arrival Profiles

4.9.1 The train service frequencies including the number of carriages per train at Whitechapel Station are summarised in **Table 4.2** below. The alighting profiles remain consistent with those in the ACS Whitechapel Station Complex. The timetables for each of the services operating at Whitechapel are included in the ACS within **Appendix C**.

Table 4.2 – Train Frequency for Services at Whitechapel Station

Service	Trains per hour (tph) 2026	Trains per hour (tph) 2026+28%	Number of Carriages per Train
East London Line	16	18	4
District, Hammersmith & City	32	32	7
Crossrail	24	30	10

4.10 Whitechapel Station Ticket Office

- 4.10.1 A station survey was undertaken by the C140 team on 24/02/2010. The data collected was used to calculate the percentage of total passengers who purchase tickets on arrival the station as shown in **Table 4.3**.
- 4.10.2 The proposed ticketing facilities at Whitechapel have been summarised in **Table 4.4** below. Crossrail passengers who wish to purchase a ticket will do so from dedicated ticket machines within the ticket hall.

Table 4.3 – Ticket Office Usage (%)

Ticketing Facilities	% POM's	% TIW's
AM	17.5%	7.5%
PM	11.2%	4.8%

Table 4.4 – Proposed Ticket Facilities at Whitechapel

Ticketing Facilities	Number of TIW's	Number of POM's
Crossrail	0	3
All Other Services	2	3

4.11 Unpaid Walkway

- 4.11.1 Part of the new interchange design includes an unpaid walkway which will allow station and non-station users to enter or pass-by from Durward Street. It has been assumed that 20% of station users will enter and exit via the unpaid link. Following the station surveys the model also includes a number of pass-by trips which simulates non-station entities using the unpaid walkway as a link between Durward Street and Whitechapel Road. The volumes have been derived from the surveys undertaken by the design team.

4.12 Crossrail Cancelled Train

- 4.12.1 In order to fully test the capacity of the Crossrail platforms during the peak periods there is a train cancellation on the platform with the highest volume of passengers.
- 4.12.2 During the AM peak the westbound platform has more alighters than boarders and so there is a cancellation at 08:48:00 on this platform. The eastbound platform has more boarders than alighters during the PM peak therefore the train with the most popular destination was cancelled at 17:49:00 during the PM peak the total number of passengers allowed to board the next train after the cancelled train have been restricted to ensure that the train capacity is not compromised. A boarding cap of 245 passengers was modelled as instructed by CRL.

4.13 Stage E Model Checks

- 4.13.1 Following the model runs and prior to submitting the models for audit by CRL/LUL the following checks were undertaken by the modelling team on the Stage E model outputs:
- Entry/exit flows;
 - Internal screenline counts at vertical circulation & passageways;
 - Boarding & alighting counts at HCDL, ELL and Crossrail Platforms;
 - Origin-destination checks;
 - Passenger routing assumptions;
 - Platform distributions;

- Entity types/PRMs; and
- Visual observational checks of model runs.

4.13.2 The checks confirmed consistency with assumptions and demands included in the Assumption Cover Sheets.

4.14 CRL/LUL Model Audit

4.14.1 The modelling analysis included in this report has been based on the Stage E models that were submitted to CRL/LUL for audit 27 August 2010, and include the subsequent model updates as a result of the audit process. The full list of actions has been included in **Appendix H**.

4.14.2 Due to time constraints it was not possible to address all of the 19 actions at this stage. We have however addressed all actions categorised as 'significant'. The modelling results as detailed in this report are from the model re-runs, and the models appended to this report include these updates. The only action from the LUL list that remains to be addressed is action reference WCL10 regarding lift cycle times. It has been agreed with CRL/LUL that this will not have a significant impact on the modelling results and that this action can be undertaken during the next model re-run.

The outstanding action will be addressed by Crossrail during any future model re-runs, if any model runs are necessary.

5 LEGION Modelling Overview – 2026 Normal Operation Results

5.1 Introduction

5.1.1 The modelling exercise has been undertaken using LEGION. The three main elements of the software package that were used are:

- Model Builder;
- Simulator; and
- Analyser.

5.1.2 The application allows the user to simulate individual pedestrian movement within a defined space such as railway stations, sports stadium, airport, transport terminals and any place where people congregate. The software is to present visualisations of the interactions between passengers and the station layout as they move through the station.

5.1.3 Legion achieves this by simulating the movement of pedestrians in a quantitatively verifiable manner, taking into account how individuals interact with each other and with the physical station layout.

5.2 Outputs and Analysis

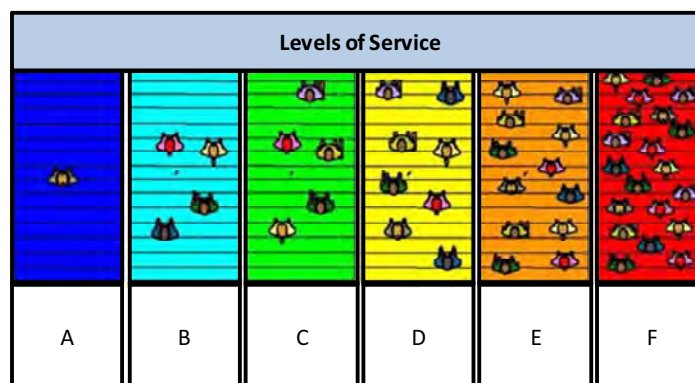
5.2.1 LEGION can be used to gain and extensive insight into likely passenger flows and circulation patterns.

5.2.2 There are a range of outputs available in LEGION such as Space Utilisation Maps which show the extent to which space within the station is being used, Cumulative Mean Density Maps (CMD) which display the mean level of density registered in an area over a defined period of time and Cumulative High Density Maps (CHD) which assess how long various areas register densities greater than a specified limit.

5.2.3 In accordance with the LEGION modelling output note provided by LUL this study includes both CMD and CHD analysis.

5.3 Fruin Levels of Service (LOS)

5.3.1 The CMD plots are based on Fruin Levels of Service (LOS). The LOS system uses the letters A through F: A = Free flow; B = Reasonably free flow; C = Stable flow; D = Approaching unstable flow; E = Unstable flow and F = Forced or breakdown flow. This has been shown graphically below:



5.3.2 To visualise this information LEGION uses a thematic map according to specific legends to report the density values associated with Fruin's levels. The legends are shown in **Figure 5.1** below.

Figure 5.1 – CMD Legend: Persons/Sq. Meter



5.3.3 The following criteria have been agreed with CRL as 'acceptable' limits for operation:

- Open Concourses – Walkways LOS B;
- Queuing for ticket hall facilities - Queuing LOS C;
- Passageways (one-way) - Walkways LOS D;
- Passageways (two-way) - Walkways LOS C;
- Stairs (one-way) - Stairs LOS D;
- Stairs (two-way) - Stairs LOS C;
- Platforms – Walkways/Queuing LOS C.

5.3.4 The above is consistent with Station Planning Standards Guidelines Fifth Edition, Section 2.5.

5.3.5 In order to measure how long an area is affected by congestion a number of Cumulative High Density (CHD) plots have also been included within our analysis.

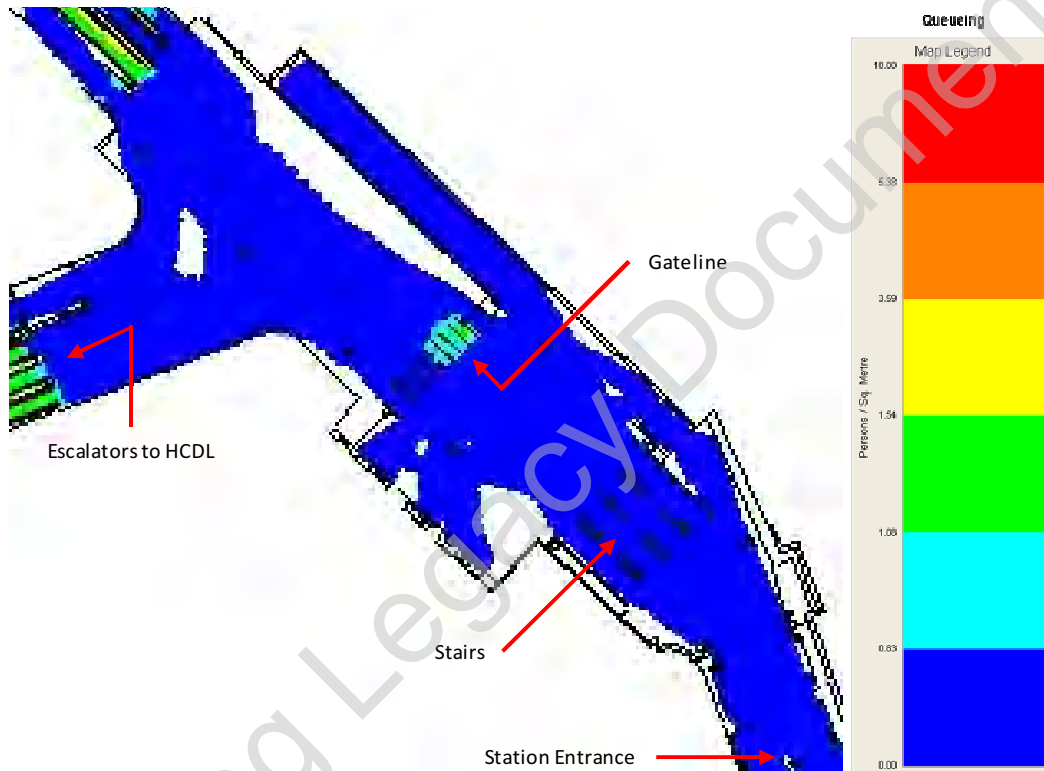
5.3.6 The CHD plots were recorded on the Crossrail platforms and other areas of the station which experience high levels of congestion.

5.3.7 The results shown are based on the busiest 15 minute period in each peak hour. Full modelling results are provided in **Appendices C to G**.

5.4 2026 Normal Operation Results – Station Entrance & Upper Concourse

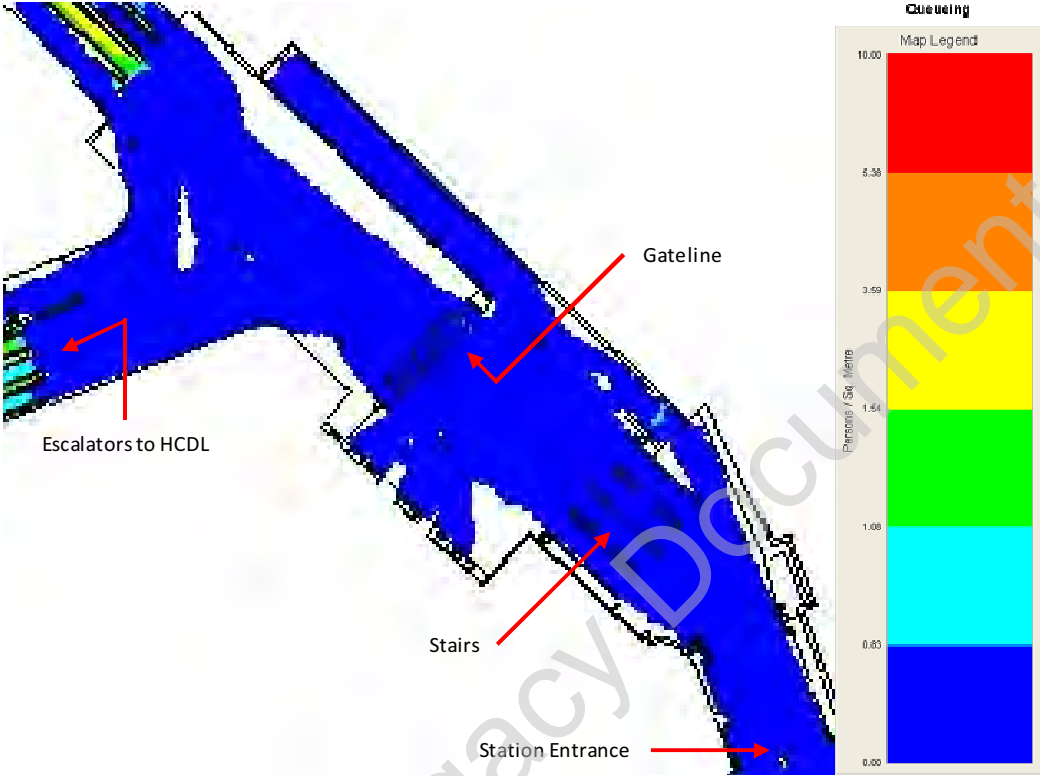
- 5.4.1 The Stage E design includes a single point of entry from Whitechapel High Street. The station concourse houses the ticket hall and includes 10 Automatic Ticket Gates (ATG's), eight of which are standard and two Wide Aisle Gates (WAG's).
- 5.4.2 During the AM peak the nature of the passenger movements is such that the majority of passengers exit the station through the ticket hall.
- 5.4.3 **Figure 5.2** shows the 'Queuing' LOS plot during the busiest AM peak 15 minute period, it can be seen that the gateline is adequate as it does not exceed LOS B. Similarly the approach to the escalators down to HCDL and the Lower Concourse are also within the recommended LOS.

Figure 5.2 – Level of Service (CMD Queuing) - 2026 AM Peak 15 Minutes



5.4.4 The Queuing LOS in the PM peak period is illustrated in **Figure 5.3**. The gateline again shows that there is adequate provision reaching LOS A. Similarly to the AM peak the approach to the escalators does not exceed the recommended LOS.

Figure 5.3 – Level of Service (CMD Queuing) – 2026 PM Peak 15 Minutes



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5.4.5 The 'Walkways' LOS in the AM and PM peak periods are illustrated in **Figures 5.4** and **5.5**. Both plots show that the Station Entrance passageway reaches a LOC C. The Upper Concourse area where passengers transit to and from HCDL platforms also reaches LOS C. The plots show that the station concourse has adequate space to accommodate the demand in the peak periods.

Figure 5.4 – Level of Service (CMD Walkways) - 2026 AM Peak 15 Minutes

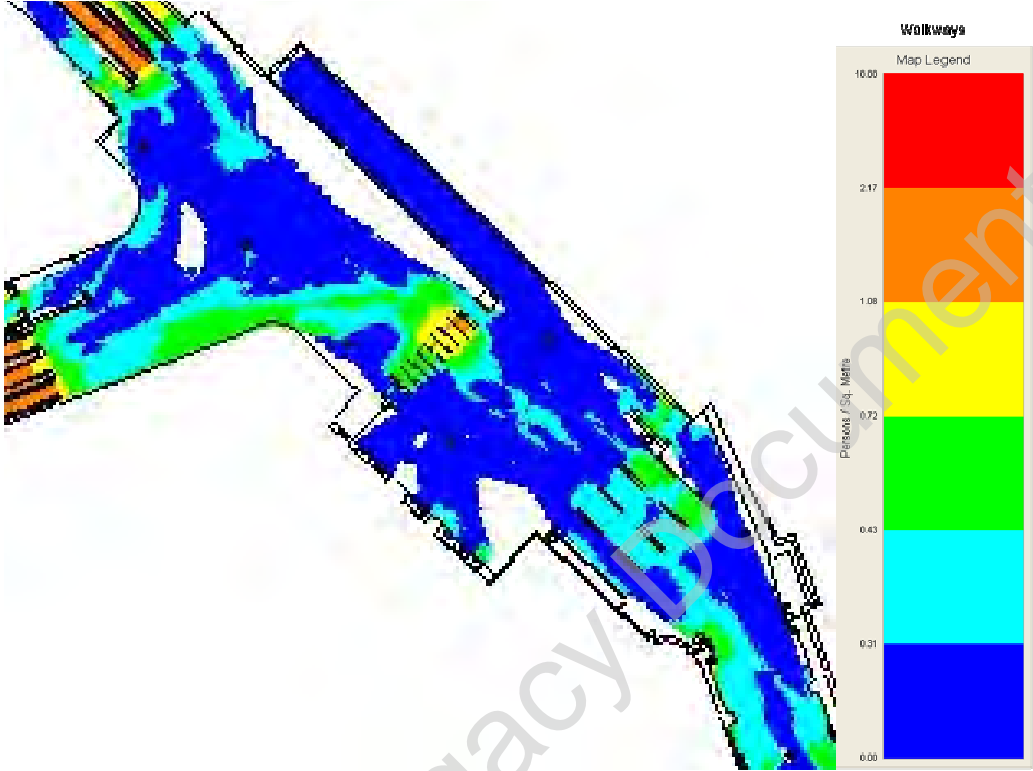
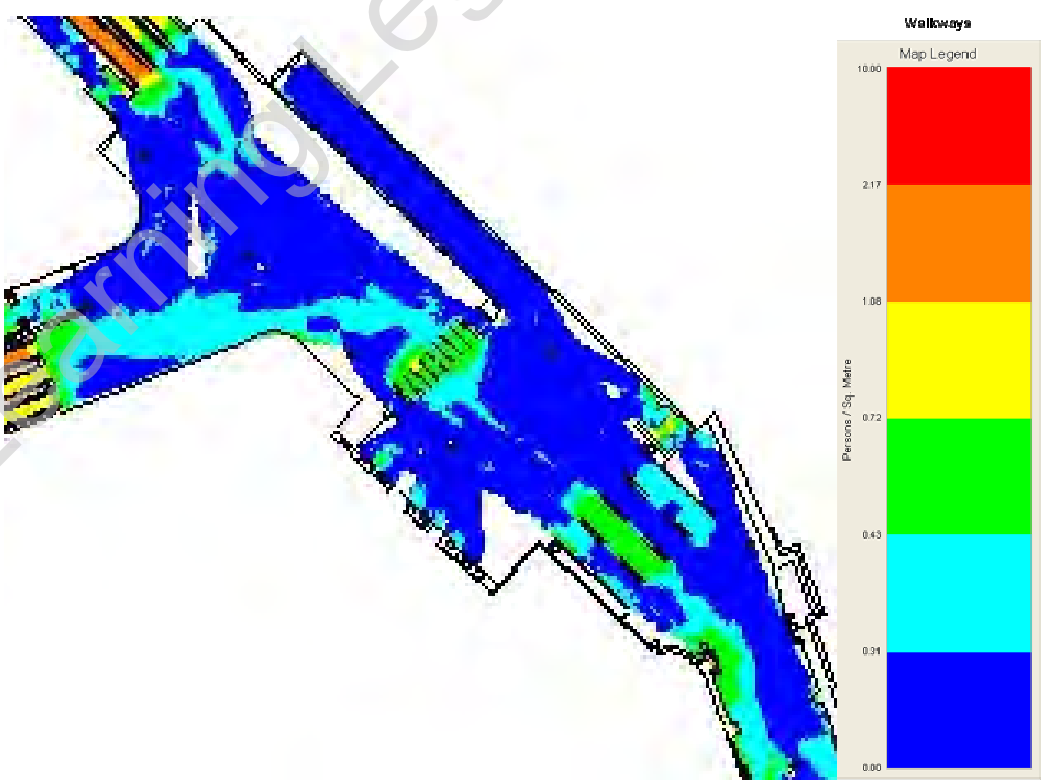


Figure 5.5 – Level of Service (CMD Walkways) - 2026 PM Peak 15 Minutes



5.4.6 **Figure 5.6** and **5.7** shows the 'Walkways' LOS at the Crossrail end of the Concourse Bridge for the AM and PM peaks. The AM plot shows that the area reaches LOS C and the PM shows LOS B, specifically where interchanging passengers interact.

Figure 5.6 – Level of Service (CMD Walkways) – 2026 AM Peak 15 Minutes

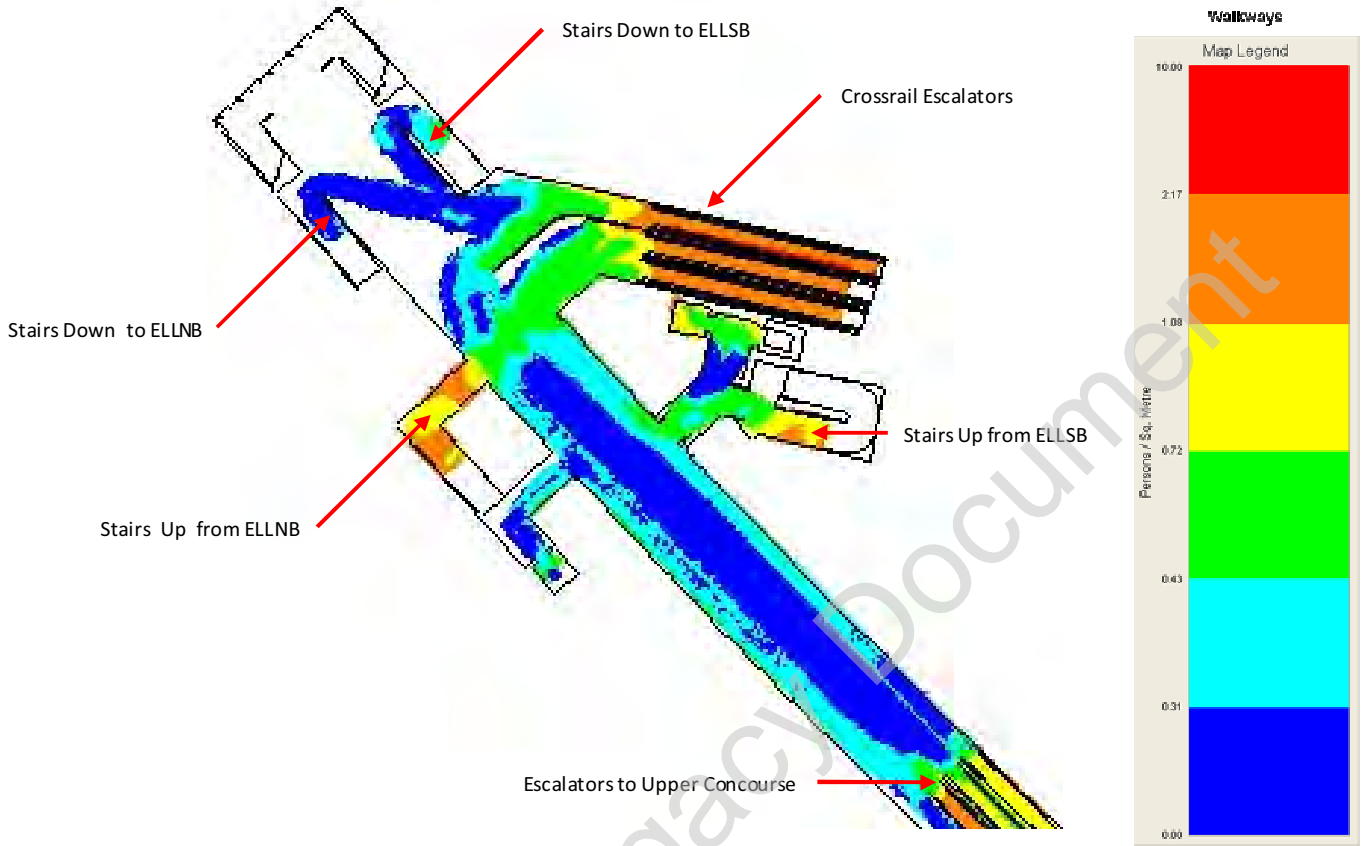
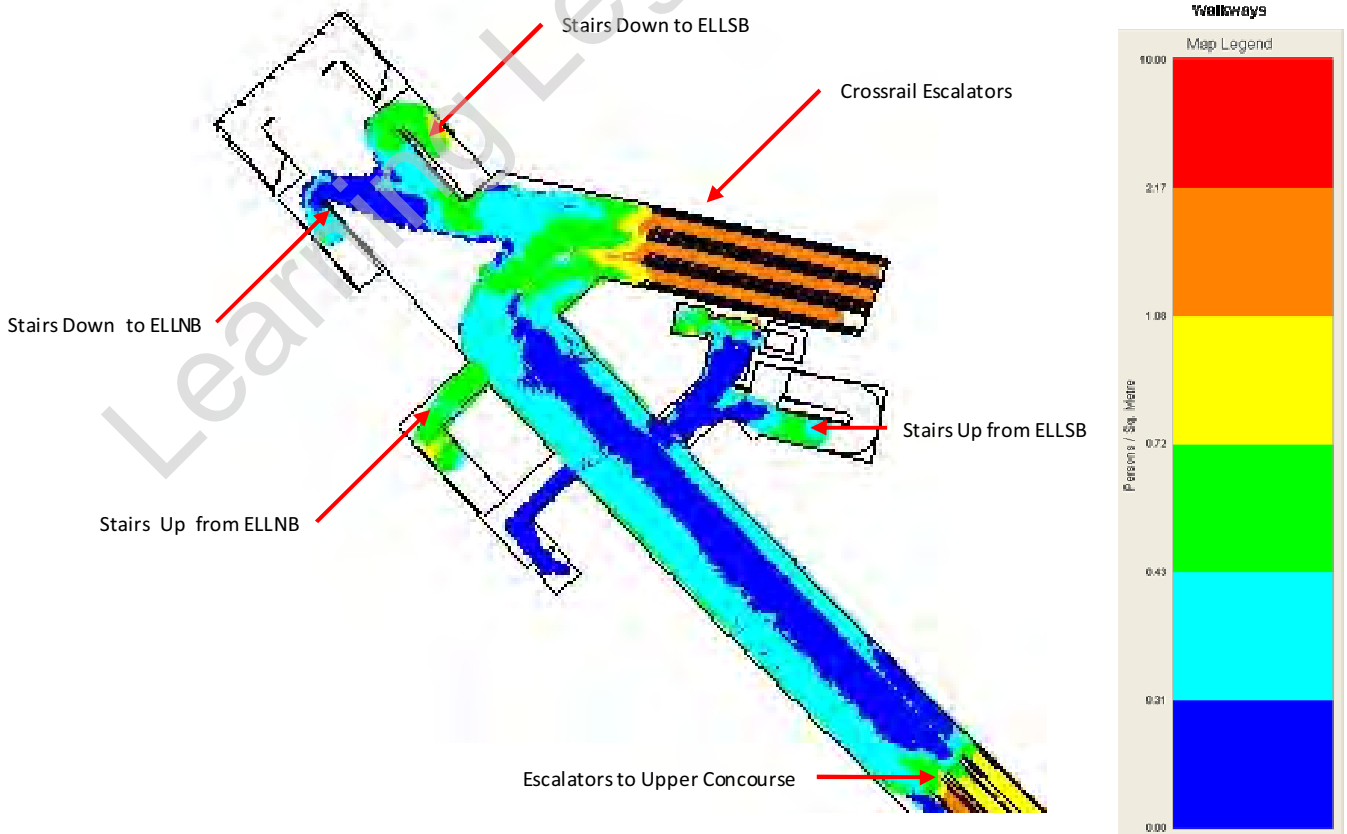


Figure 5.7 – Level of Service (CMD Walkways) – 2026 PM Peak 15 Minutes

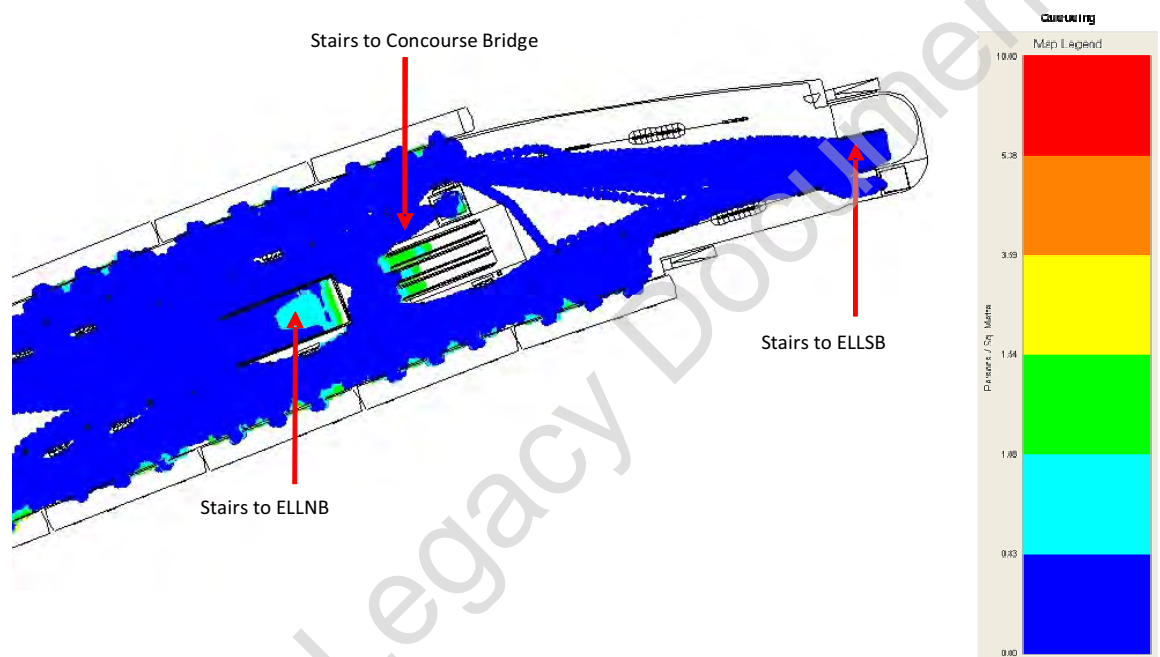


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5.5 Hammersmith & City and District Line Platforms

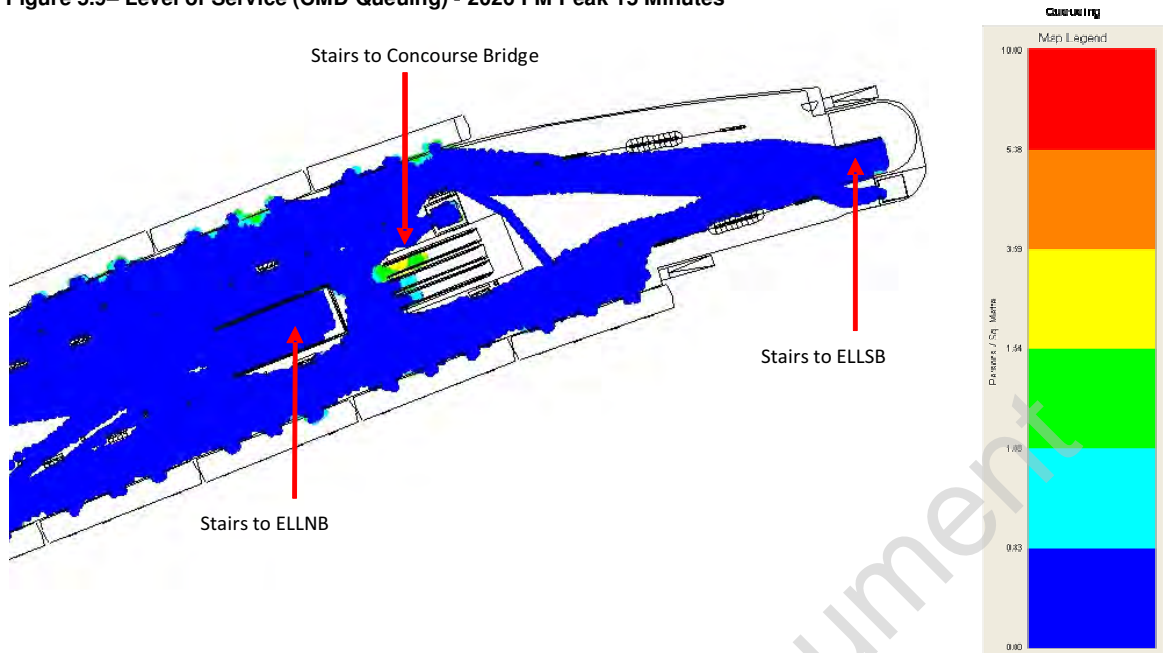
- 5.5.1 The key passenger movements during the AM peak period are passengers boarding and alighting westbound trains. The proposed layout includes a generous platform width which would adequately cope with movements in the AM peak, including the various cross-flows between trains and escalators/stairs. The majority of passengers boarding HCDL services during the AM peak originate from ELL (northbound), and Crossrail (westbound).
- 5.5.2 **Figure 5.8** shows the LOS 'Queuing' for the eastern end of the HCDL platform during the busiest 15 minute AM peak period. The eastbound platform does not exceed LOS A and the westbound LOS B, both are within the acceptable LOS C as agreed with CRL. The approach to the escalators also shows LOS B which is acceptable.

Figure 5.8– Level of Service (CMD Queuing) – 2026 AM Peak 15 Minutes



- 5.5.3 During the PM peak passengers alighting the eastbound trains head towards the Station Exit and Crossrail eastbound platforms. **Figure 5.9** shows the 'Queuing' LOS for the eastern end of the HCDL platform during the busiest 15 minute period.
- 5.5.4 LOS B can be seen at the bottom of the escalator, the eastbound platform also reaches LOS B and the westbound does not exceed LOS A. The HCDL platform analysis has show that during the busiest AM and PM peaks the platform is adequate to accommodate the 2026 demands.

Figure 5.9– Level of Service (CMD Queuing) - 2026 PM Peak 15 Minutes



5.5.5 The 'Walkways' LOS in the AM and PM peak periods are shown in **Figures 5.10** and **5.11**. Both plots show that HCDL platform does not exceed a LOS C and are within the agreed limits.

Figure 5.10– Level of Service (CMD Walkways) – 2026 AM Peak 15 Minutes

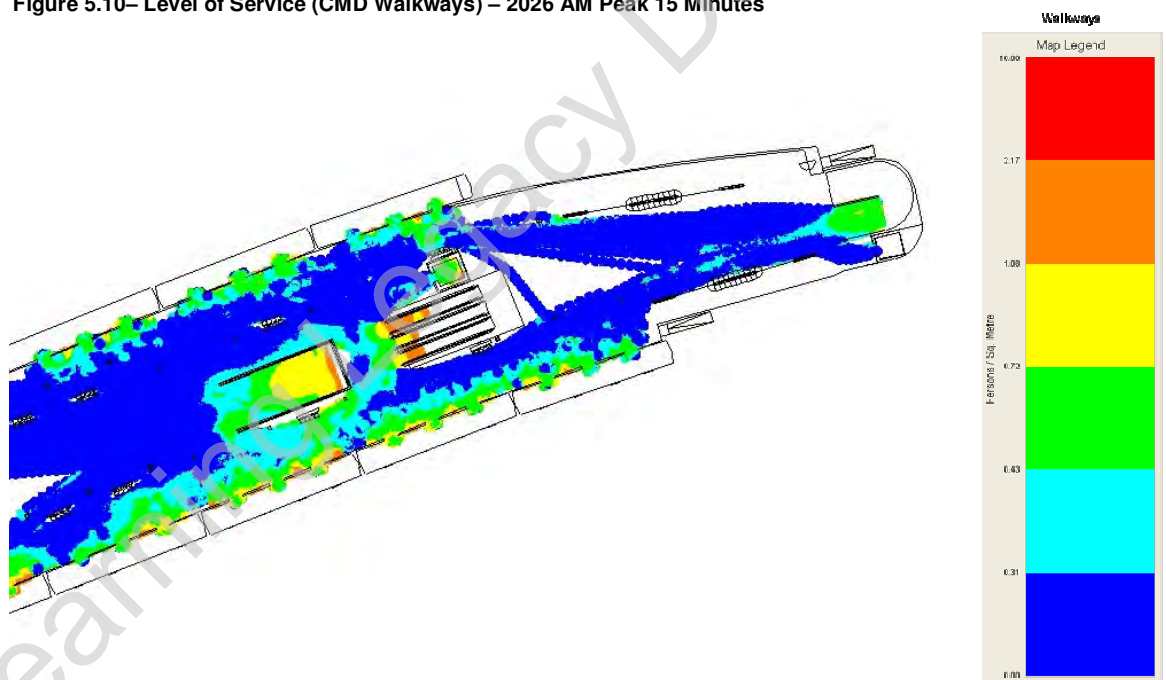
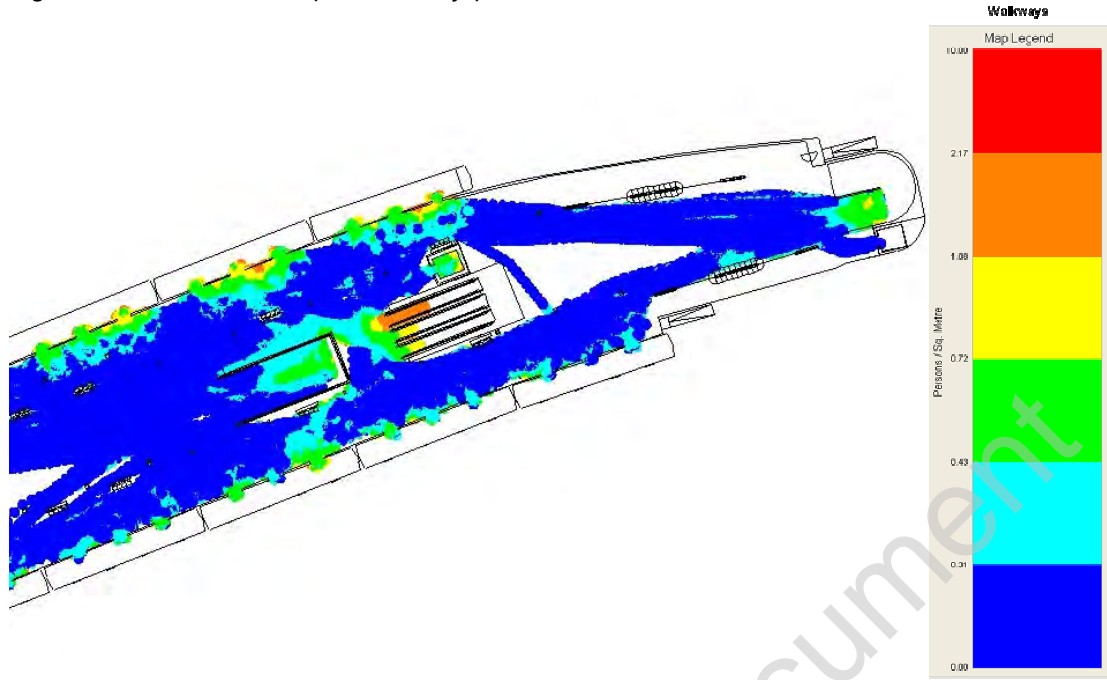


Figure 5.11– Level of Service (CMD Walkways) – 2026 PM Peak 15 Minutes

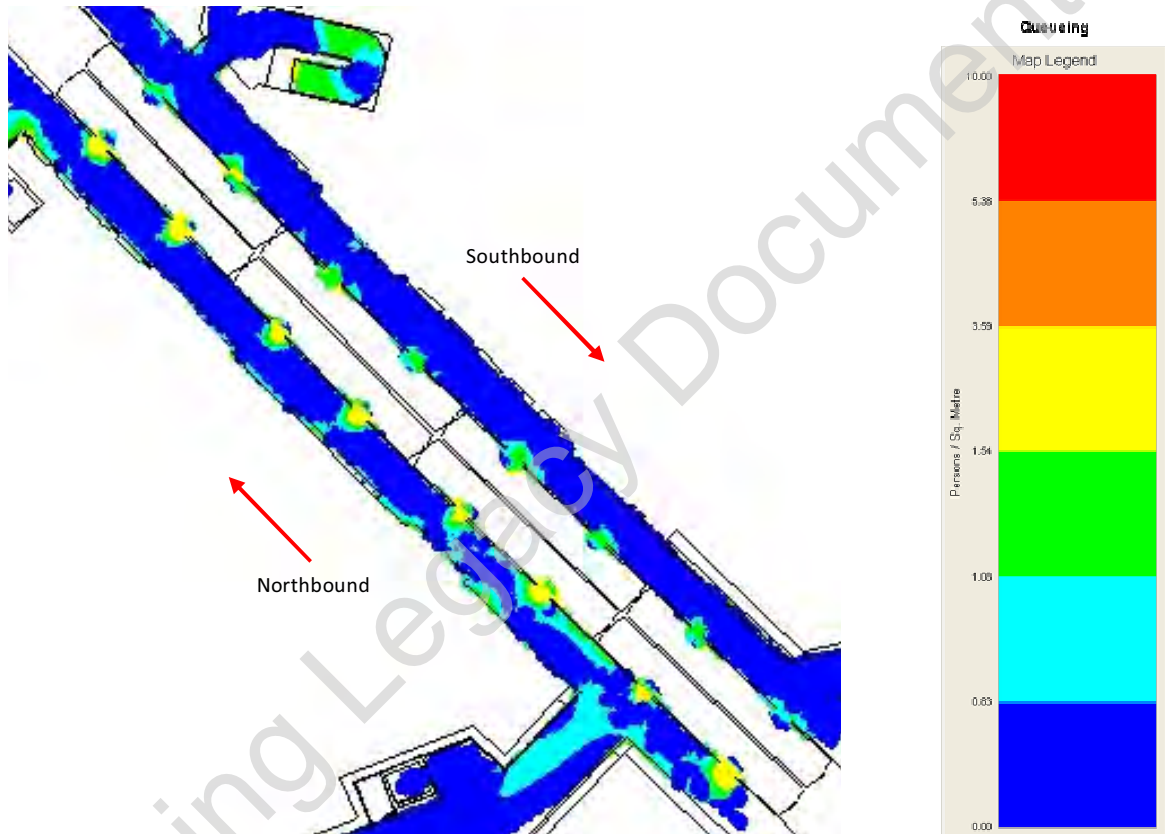


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5.6 East London Line Platforms

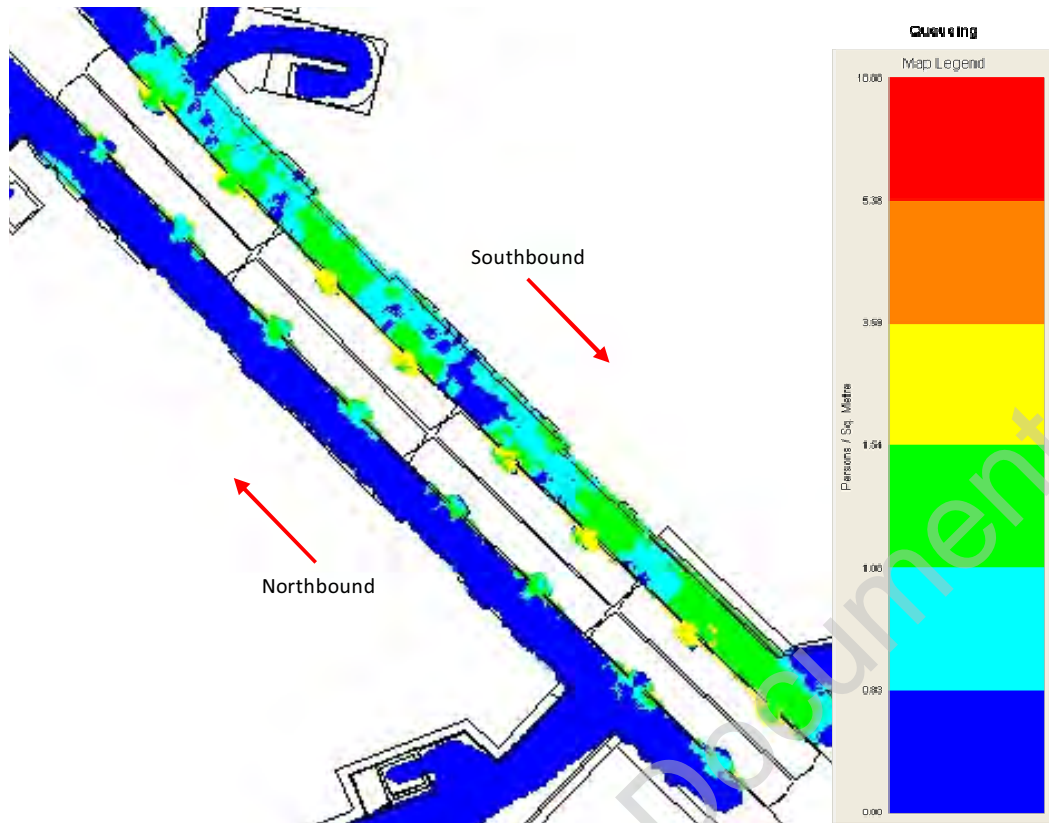
- 5.6.1 The nature of passenger movements during the AM peak period is such that the majority are alighting from the northbound platform, with a high proportion heading towards HCDL platforms via the southern end of the ELL platform.
- 5.6.2 **Figure 5.12** shows the 'Queuing' LOS on the East London Line during the AM peak 15 minute period.
- 5.6.3 The 'Queuing' plot shows a LOS C on the northbound platform and LOS A on the southbound. There is some congestion around the carriage doors resulting in LOS D; however this is due to the large number of alighting passengers and does not affect the operation of the platform.

Figure 5.12– Level of Service (CMD Queuing) – 2026 AM Peak 15 Minutes



- 5.6.4 The LEGION modelling analysis has therefore identified that the platform width would adequately accommodate passengers during the AM peak period.
- 5.6.5 For the PM peak period the greatest impact comes from passengers boarding southbound trains, particularly at the southern end with connections from HCDL.
- Figure 5.13** shows the 'Queuing' LOS plot during the peak 15 minute period. The plot identifies a LOS A on the northbound platform and LOS C on the southbound, mainly outside carriages 1 and 2.

Figure 5.13 – Level of Service (CMD Queuing) – 2026 PM Peak 15 Minutes



5.6.6 The LEGION modelling analysis has therefore identified that the platform width would adequately accommodate passengers during the PM peak period.

5.7 East London Line Stairs

5.7.1 The East London Line platforms have a total of 6 staircases which connect to the various other elements of the station. The stairs located to the south of the platforms link directly with HCDL. The staircases to the north are used only by passengers routing to and from Crossrail, therefore these staircases operate as one-way up and one-way down.

5.7.2 **Figure 5.14** shows the 'Stairs' LOS plot for the AM peak period. The main stair worth noting is the two-way staircase on the northbound platform to/from HCDL. A section of the staircase reaches LOS D however, the full staircase does not experience LOS D and therefore it is not considered to be an issue. All of the other stairs on the East London Line do not exceed the acceptable LOS (LOS D for one-way stairs).

Figure 5.14 – Level of Service (CMD Stairs) – 2026 AM Peak 15 Minutes

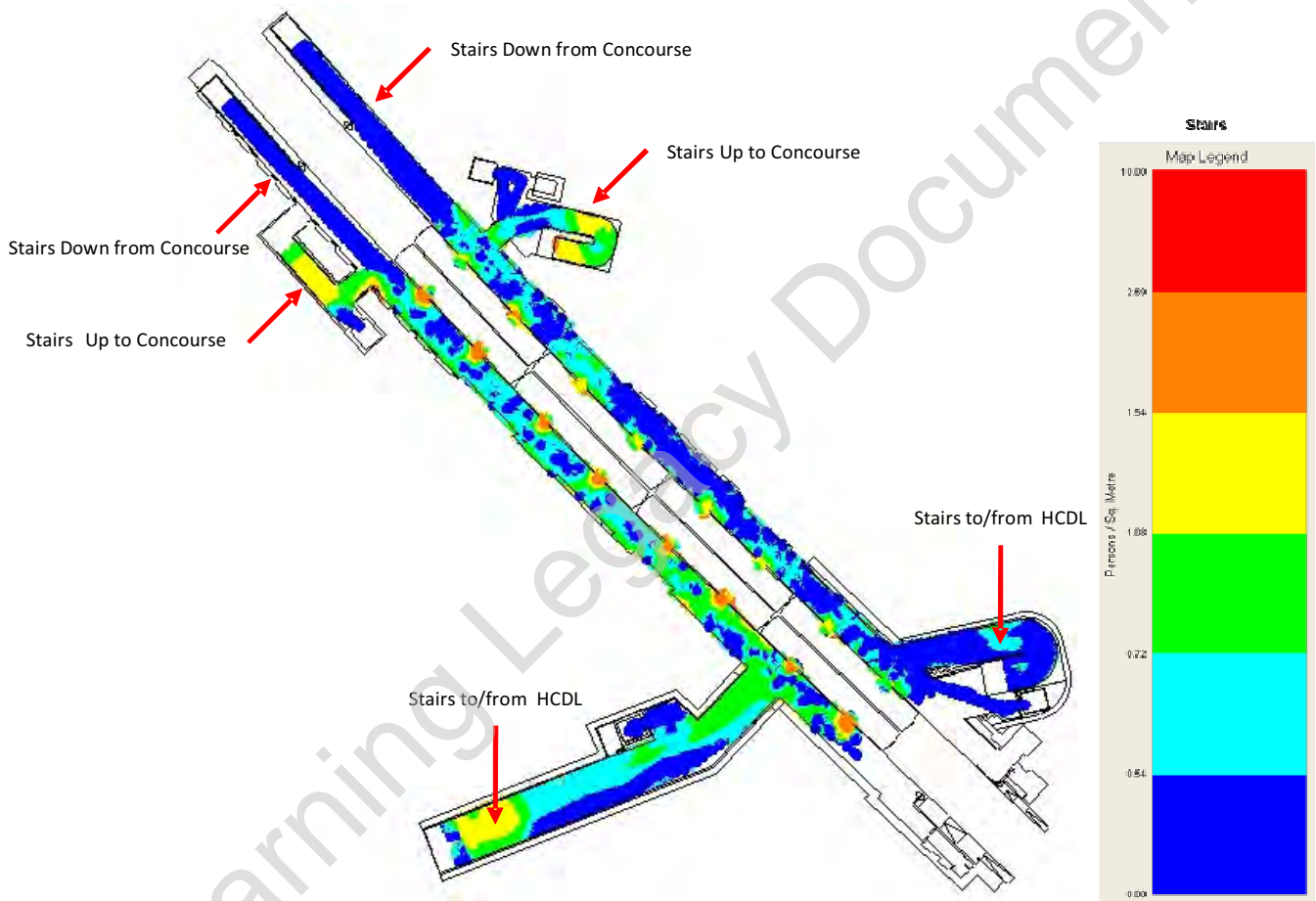
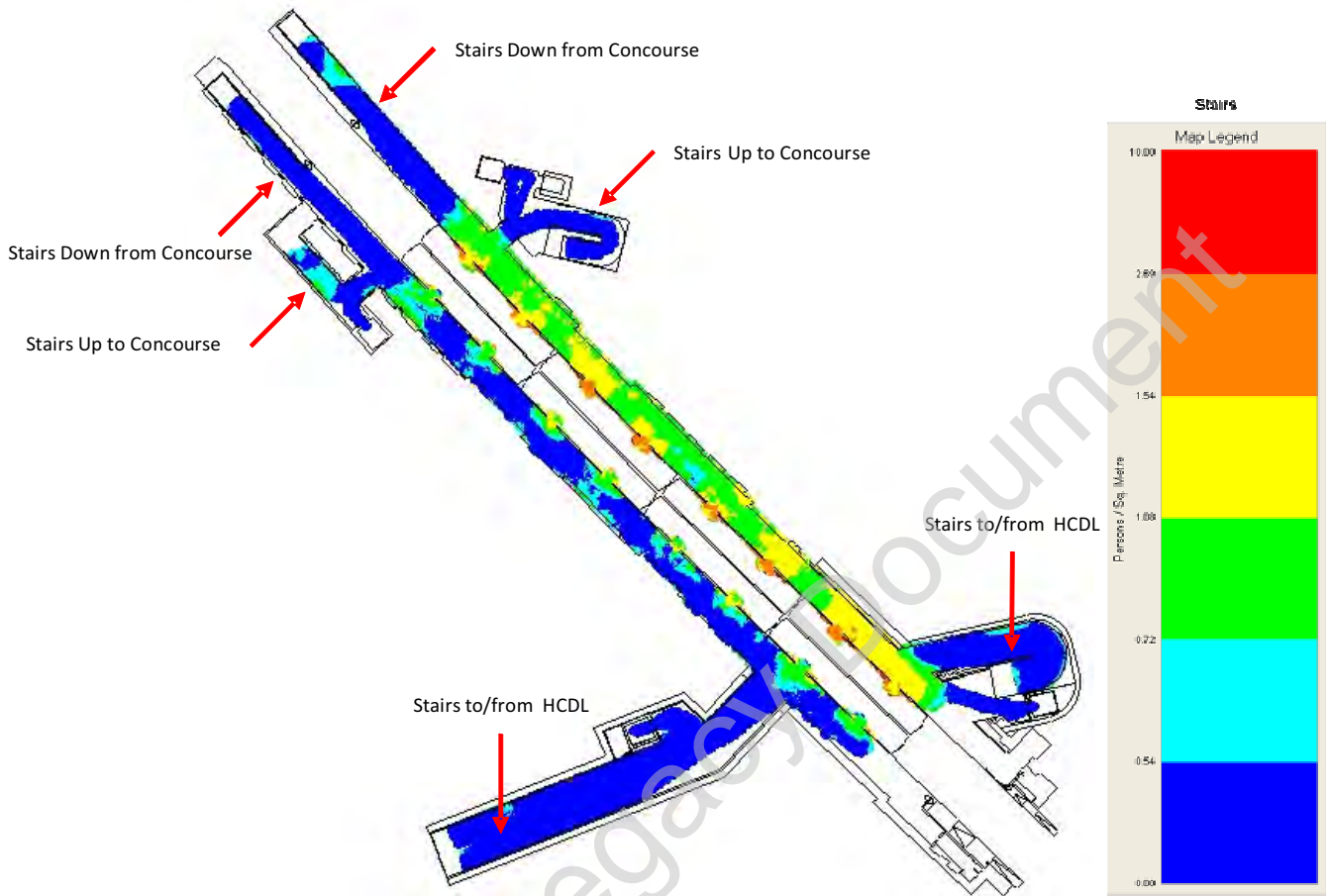


Figure 5.15 shows the 'Stairs' LOS plot for the PM peak period. All of the stairs operate within the agreed limits with LOS B being the highest recorded.

Figure 5.15 – Level of Service (CMD Stairs) – 2026 PM Peak 15 Minutes



5.7.3 The analysis has therefore shown that the stairs on the East London Line would operate within capacity and do not exceed the agreed LOS.

5.8 Crossrail Platforms

- 5.8.1 **Figure 5.16** shows the CAD plan and the measurements of the Crossrail platforms, passageway and adit. The effective width of the platform is 4.50m. There is a single adit linking the eastbound and westbound platforms which measures 5.80m. **Figure 5.17** shows how the measurements for the platforms and adit were defined.

Figure 5.16 – Crossrail Platform and Adit Widths

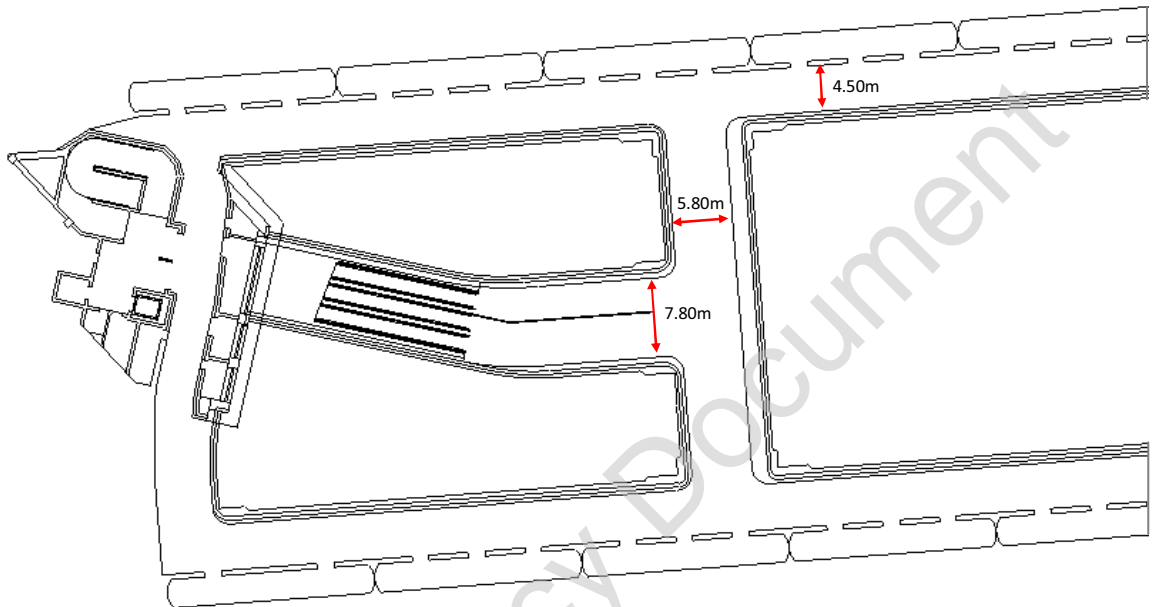
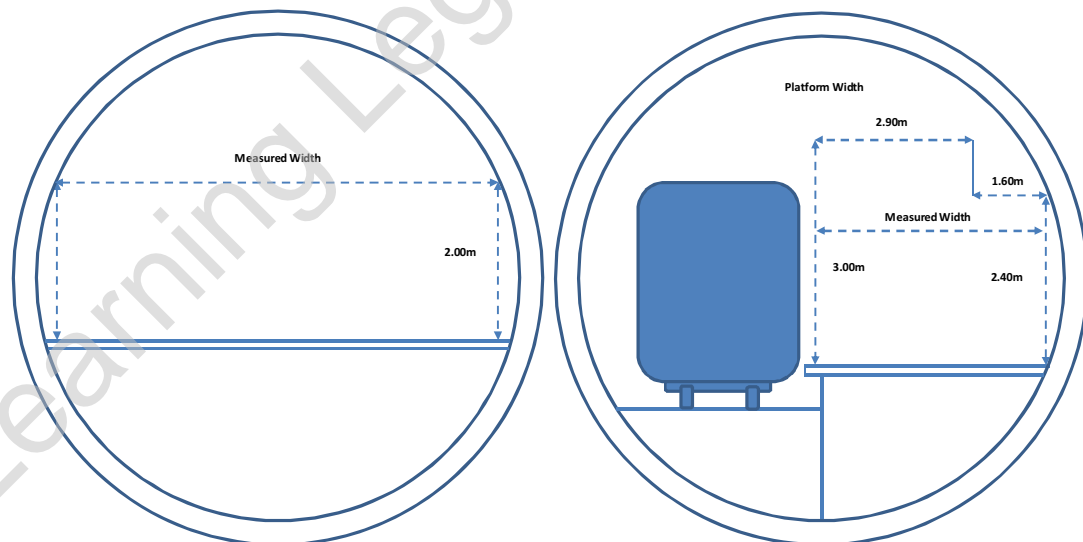


Figure 5.17 – Crossrail Platform and Adit Width Definition

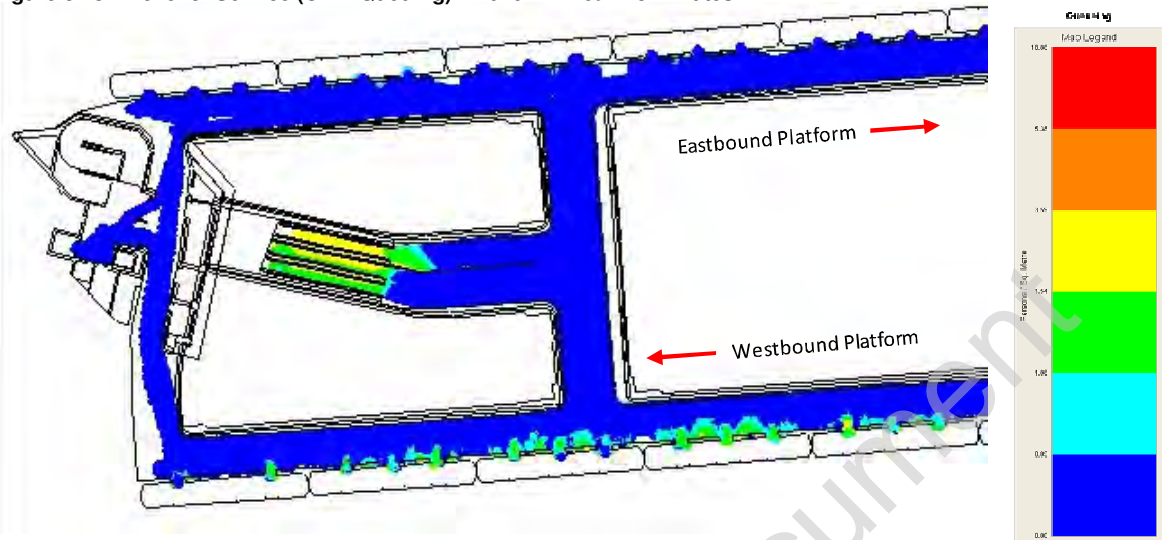


Not to Scale

- 5.8.2 During the AM peak the westbound platform experiences a large volume of boarding passengers. **Figure 5.18** shows the 'Queuing' LOS during the AM peak 15 minute period.
- 5.8.3 The plot shows small clusters of LOS B/C on the westbound platform which represents the large number of boarders. This is still within the agreed LOS limits. Similarly the

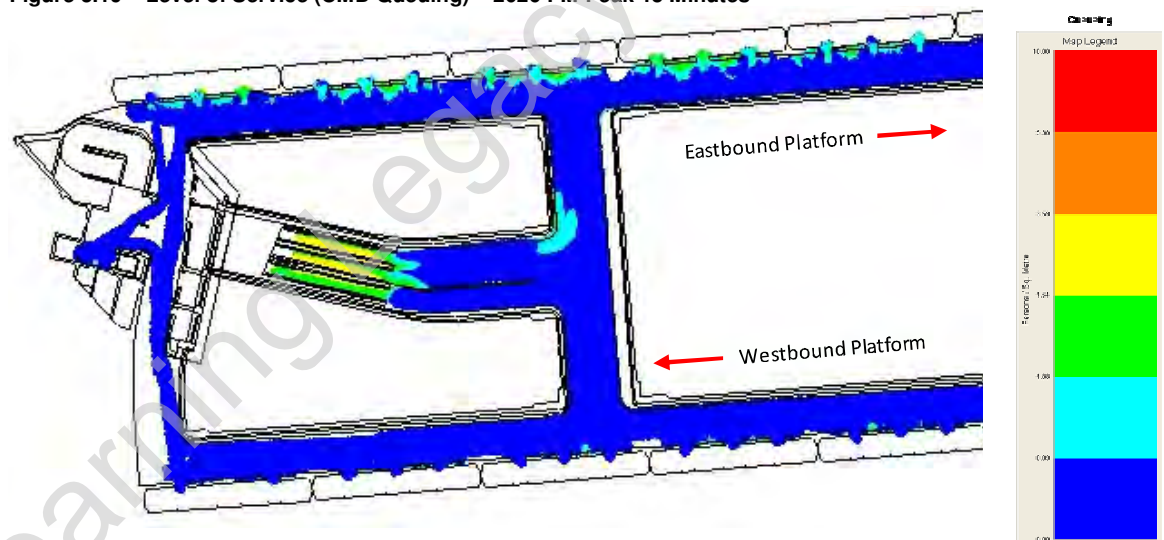
eastbound platform shows LOS A which is well within the acceptable LOS. The approach to the UP escalator from Crossrail experiences a small cluster of LOS C.

Figure 5.18 – Level of Service (CMD Queuing) – 2026 AM Peak 15 Minutes



5.8.4 The passenger movements in the PM are broadly the reverse with a large number of alighting passengers on the eastbound platform. **Figure 5.19** shows the 'Queuing' LOS during the PM peak 15 minute period.

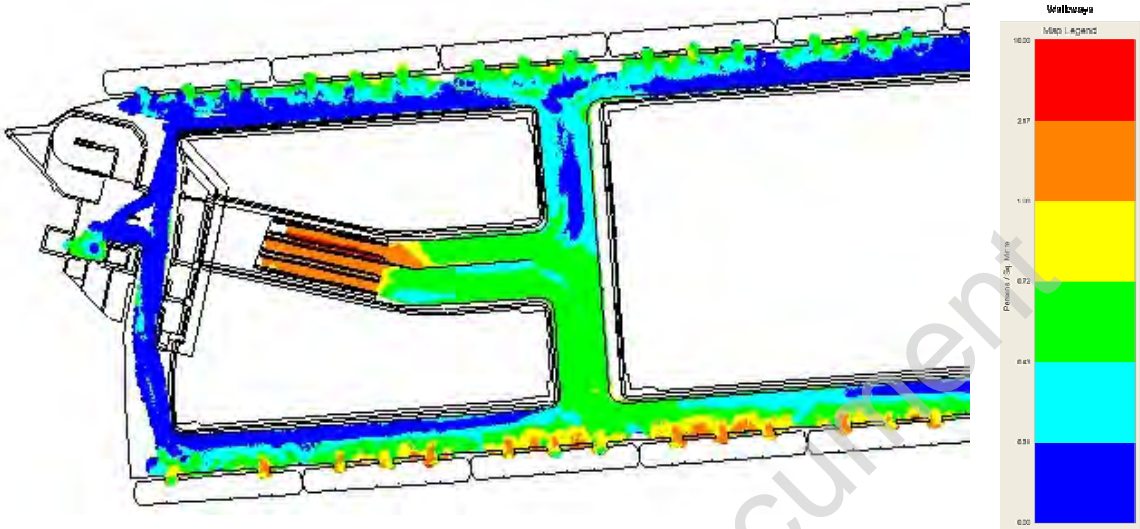
Figure 5.19 – Level of Service (CMD Queuing) – 2026 PM Peak 15 Minutes



5.8.5 Similarly to the AM the plot shows small clusters of LOS B/C, this time on the eastbound platform representing the large number of alighters. This LOS is well within the agreed LOS limits. The westbound platform shows LOS A which is well within the acceptable LOS. The UP escalators from Crossrail experience a small cluster of LOS C.

5.8.6 **Figure 5.20** shows the 'Walkways' LOS during the AM peak 15 minutes period. The adits and passageway show a LOS C, and the westbound platform shows LOS C and the eastbound LOS B, therefore the platform operates within the agreed LOS limits.

Figure 5.20 – Level of Service (CMD Walkways) – 2026 AM Peak 15 Minutes



5.8.7 **Figure 5.21** shows the 'Walkways' LOS during the PM peak 15 minutes period. A section of the eastbound adit experiences LOS D but this does not cover the entire width of the adit and it therefore considered acceptable. The westbound platform shows LOS B and eastbound LOS C, both are acceptable.

Figure 5.21 – Level of Service (CMD Walkways) – 2026 PM Peak 15 Minutes



5.8.8 The LEGION modelling analysis has therefore identified that the Crossrail platform, adits and passageway would adequately accommodate passengers during the 2026 AM and PM peak periods.

5.9 Summary of 2026 Modelling Results

5.9.1 In summary the Legion modelling analysis has shown that the Stage E design would operate within capacity and accommodate the 2026 AM and PM demands. The Concourse Bridge and Station Entrance would comfortably operate within capacity and the District, Hammersmith & City, East London Line and Crossrail platforms would also operate within the agreed limits.

6 LEGION Modelling – 2026 +28% Normal Operation Results

6.1 Introduction

6.1.1 The LEGION analysis has shown that the station design would successfully accommodate the 2026 AM and PM demands. The next scenario undertaken was the 2026 +28% scenario. There were a number of updates applied to the models as a result of the +28% test to included;

- An increase in the number of TPH on the East London Line and Crossrail (see **Table 4.2**); and
- An additional origin/destination from the Crossrail platforms - Ealing Broadway.

6.1.2 All other elements of the station remain the same as described in the 2026 analysis. Cumulative Mean Density Plots for the entire modelled area have been saved to disc and are provided in **Appendix E**.

6.2 Station Entrance and Upper Concourse Bridge

6.2.1 **Figure 6.1** shows the 'Queuing' LOS plot during the AM peak 15 minute period. It can be seen that the gateline is adequate as it does not exceed LOS C. Similarly the approach to the escalators down to HCDL and the Lower Concourse are also within the agreed LOS.

Figure 6.1 – Level of Service (CMD Queuing) – 2026 +28% AM Peak 15 Minutes



6.2.2 The Queuing LOS in the PM peak period is illustrated in **Figure 6.2**. The gateline again shows that there is adequate provision reaching only LOS A. Similarly to the AM peak the approach to the escalators does not exceed the recommended LOS.

Figure 6.2 – Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes



6.2.3 The 'Walkways' LOS in the AM and PM peak periods are illustrated in **Figures 6.3** and **6.4**. Both plots show that the Station Entrance passageway reaches a LOC C. The Upper Concourse area where passengers transit to and from HCDL platforms also reaches LOS C. The plots show that the station concourse has adequate space to accommodate the demand in the peak periods.

Figure 6.3 – Level of Service (CMD Walkways) – 2026 +28% AM Peak 15 Minutes

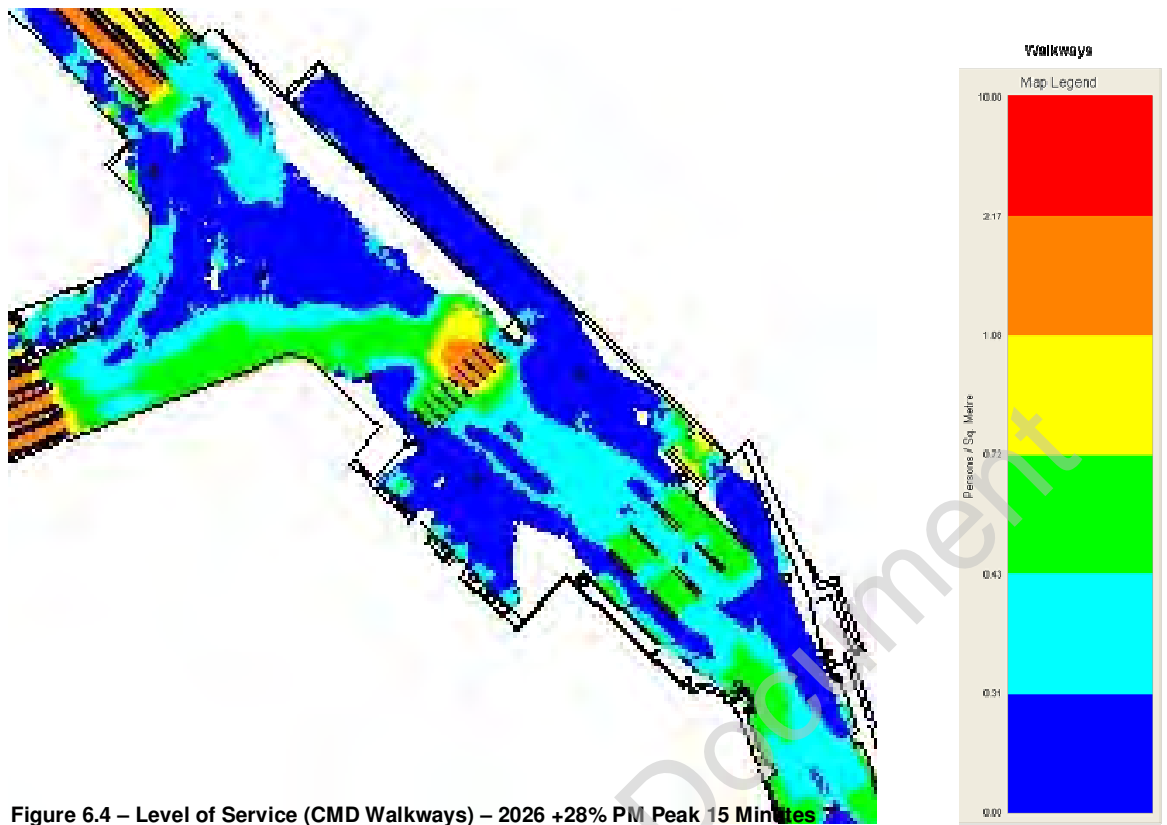


Figure 6.4 – Level of Service (CMD Walkways) – 2026 +28% PM Peak 15 Minutes

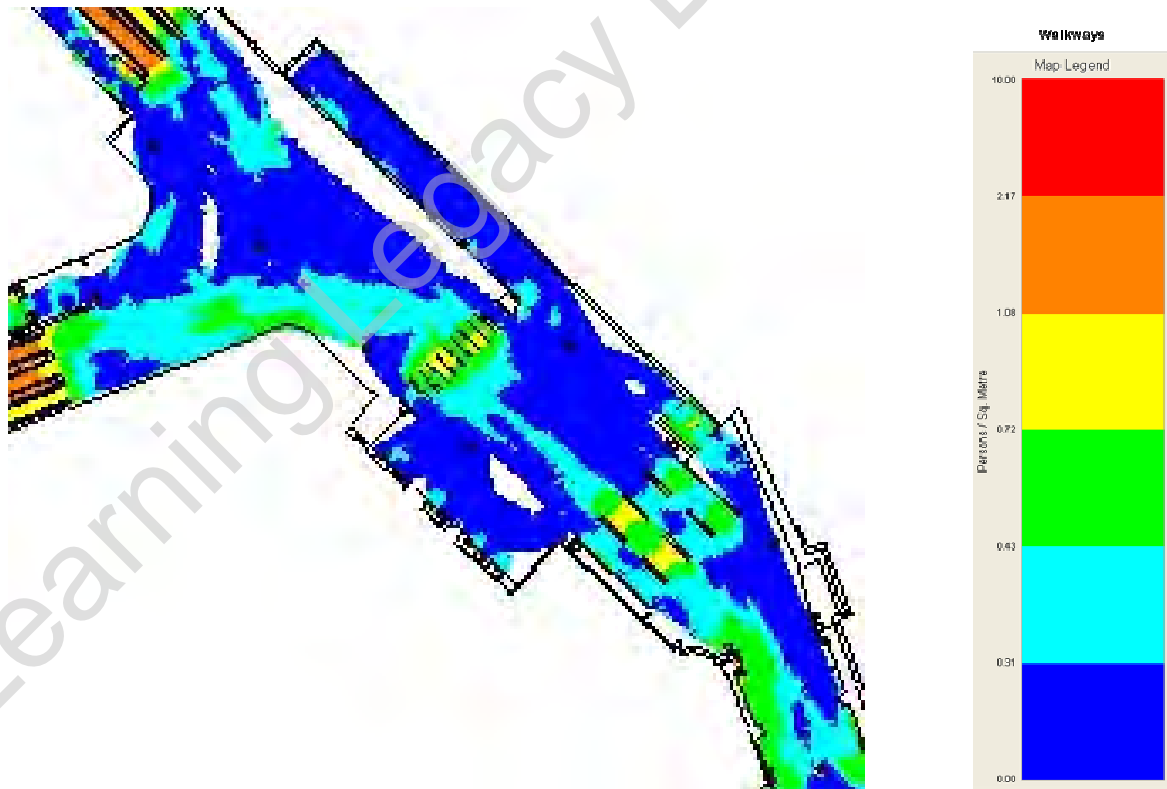
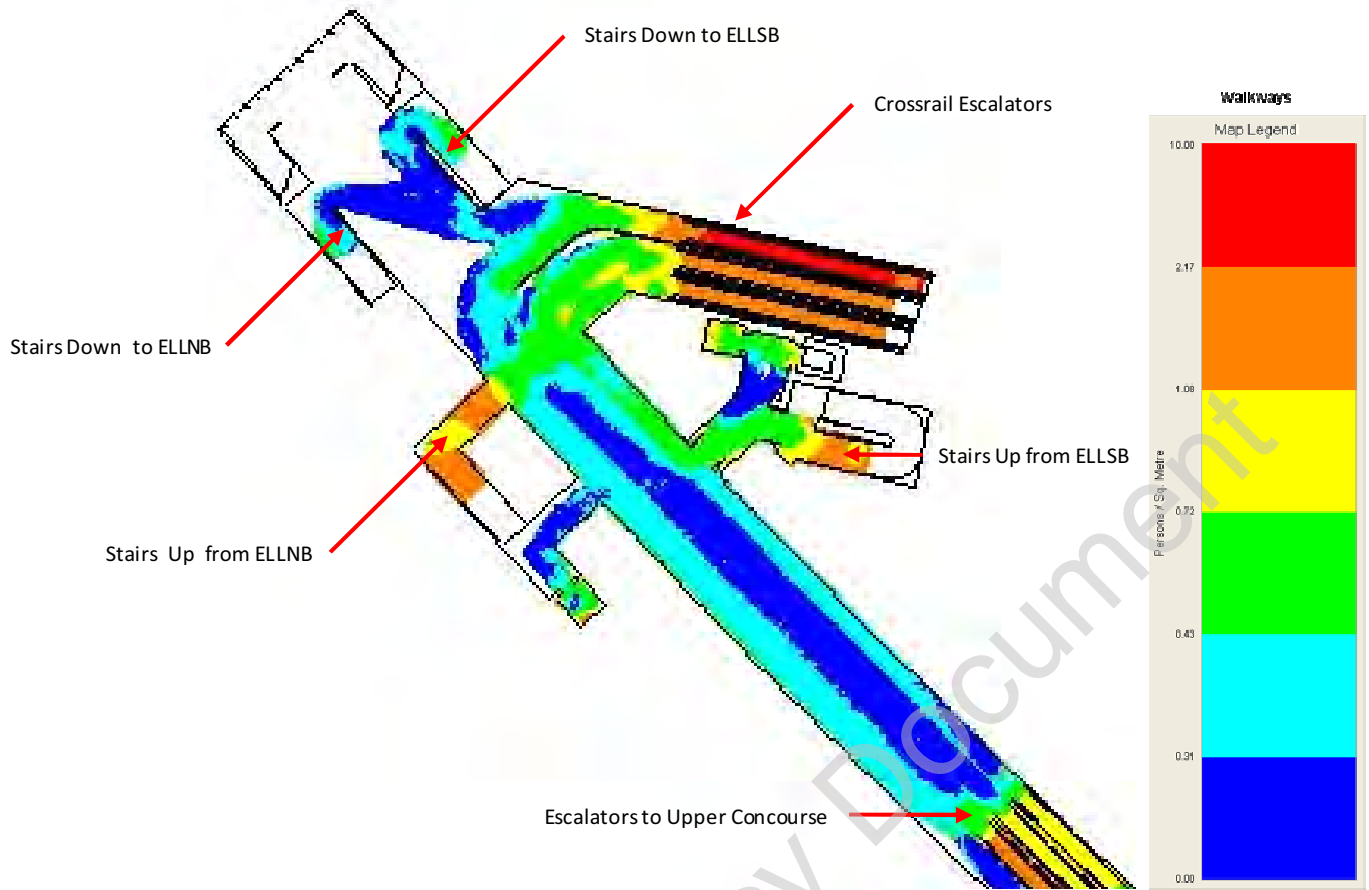


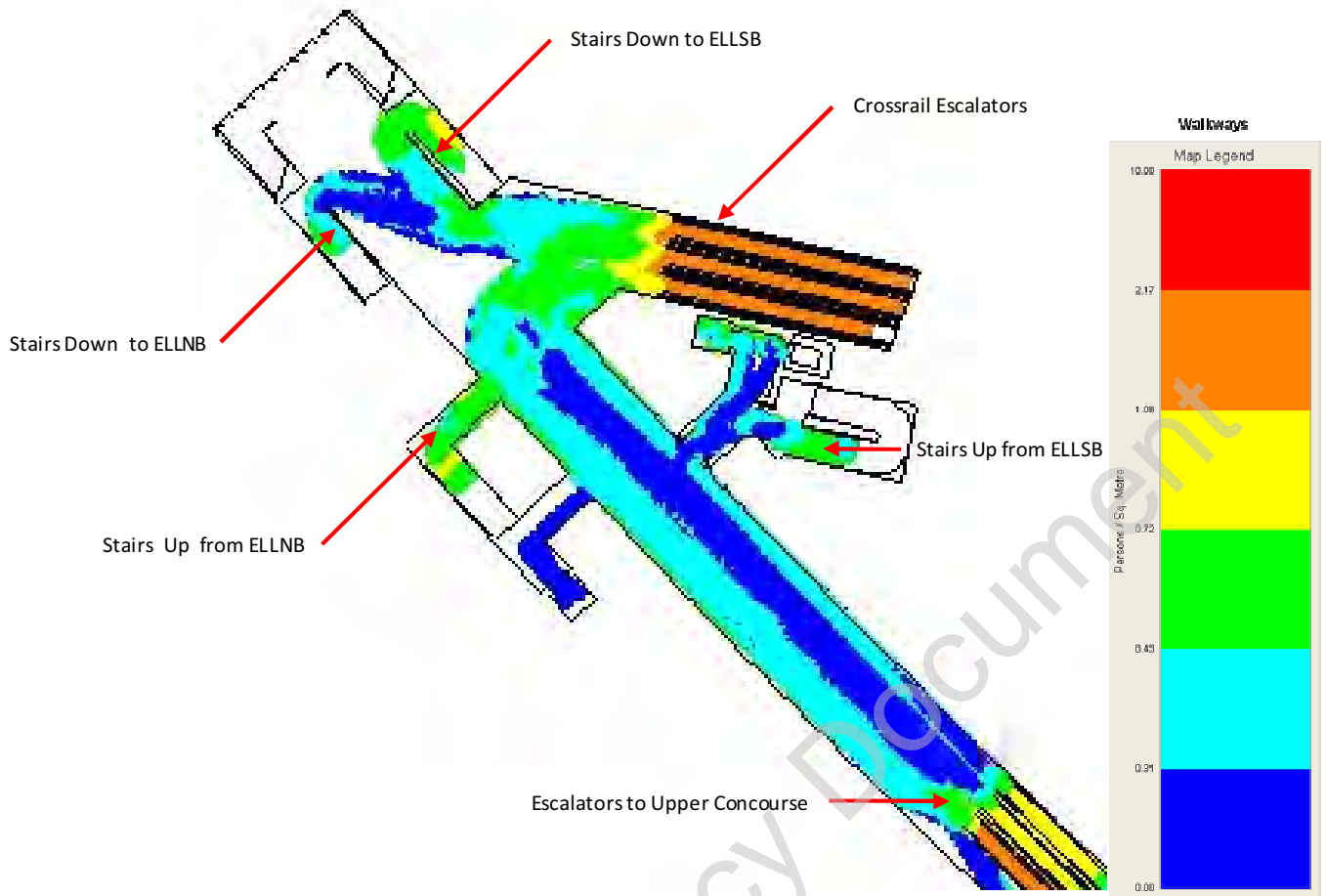
Figure 6.5 – Level of Service (CMD Walkways) – 2026 +28% AM Peak 15 Minutes

6.2.4 **Figure 6.5** and **6.6** show the 'Walkways' LOS at the Crossrail end of the Concourse Bridge for the AM and PM peaks. The AM plot shows that the area reaches LOS C.



6.2.5 The Concourse Bridge also reaches LOS C in the PM peak, specifically where transit passengers interact. The levels of service during the AM and PM peaks on the Concourse are in accordance with the agreed limits.

Figure 6.6 – Level of Service (CMD Walkways) – 2026 +28% PM Peak 15 Minutes

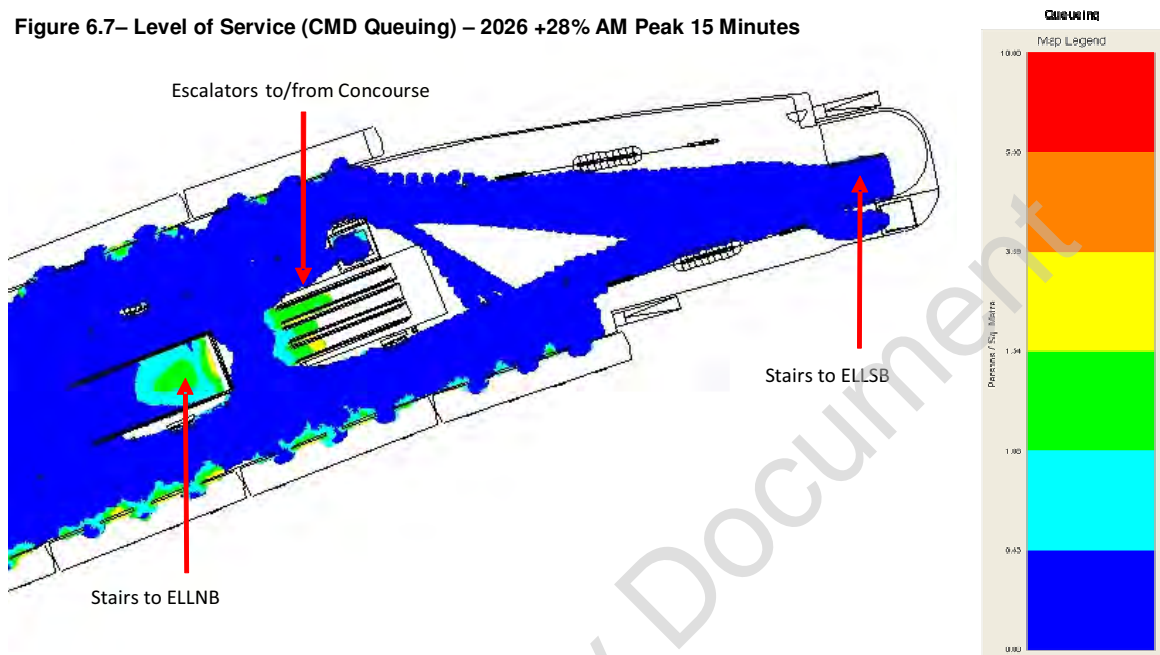


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6.3 Hammersmith & City and District Line Platforms

6.3.1 **Figure 6.7** shows the LOS 'Queuing' for the eastern end of the HCDL platform during the busiest 15 minute AM peak period. The eastbound platform does not exceed LOS A and the westbound LOS B. Both are within the acceptable LOS C as agreed with CRL. The approach to the escalator reaches LOS B which again is acceptable.

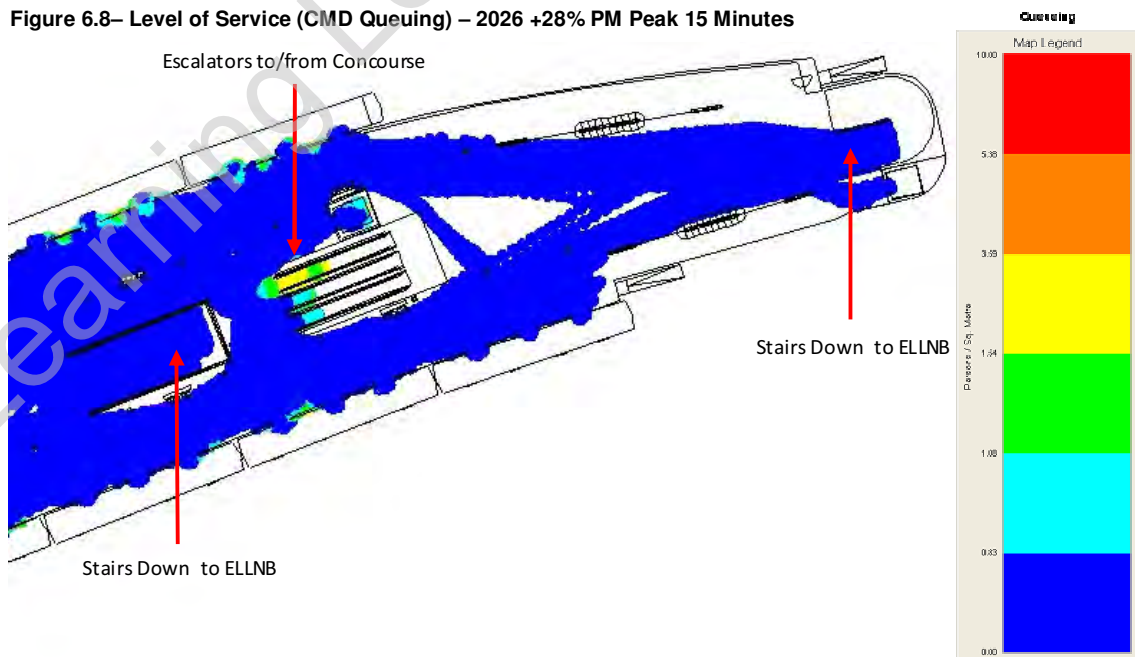
Figure 6.7– Level of Service (CMD Queuing) – 2026 +28% AM Peak 15 Minutes



6.3.2 **Figure 6.8** shows the LOS 'Queuing' for the eastern end of the HCDL platform during the busiest 15 minute PM peak period.

6.3.3 LOS C can be seen at the bottom of the escalator, the eastbound platform also reaches LOS B and the westbound does not exceed LOS A. The HCDL platform analysis has shown that during the busiest AM and PM peaks the platform is adequate to accommodate the 2026 +28% demands.

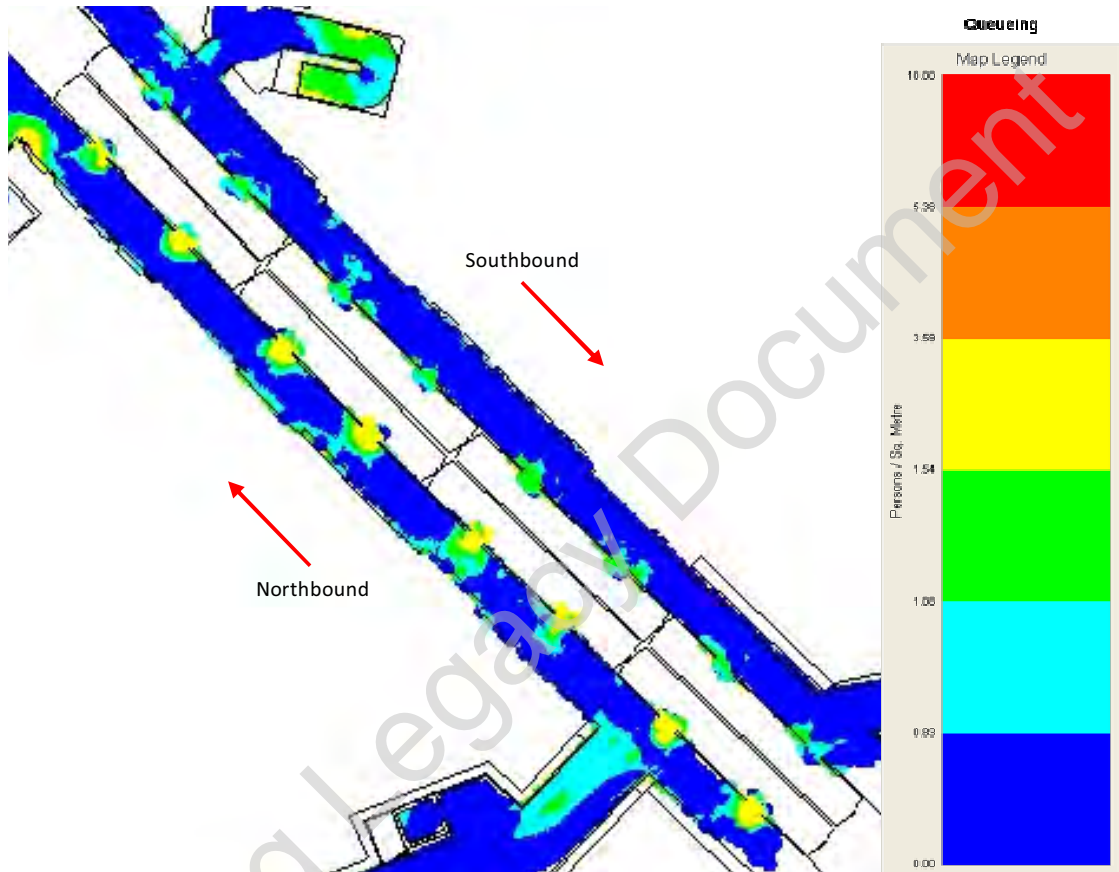
Figure 6.8– Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes



6.4 East London Line Platforms

- 6.4.1 **Figure 6.9** shows the 'Queuing' LOS on the East London Line during the AM peak 15 minute period.
- 6.4.2 The 'Queuing' plot shows a LOS C on the northbound platform and LOS A on the southbound. There is some congestion around the carriage doors resulting in LOS D however, this is due to the large number of alighting passengers and does not affect the operation of the platform.

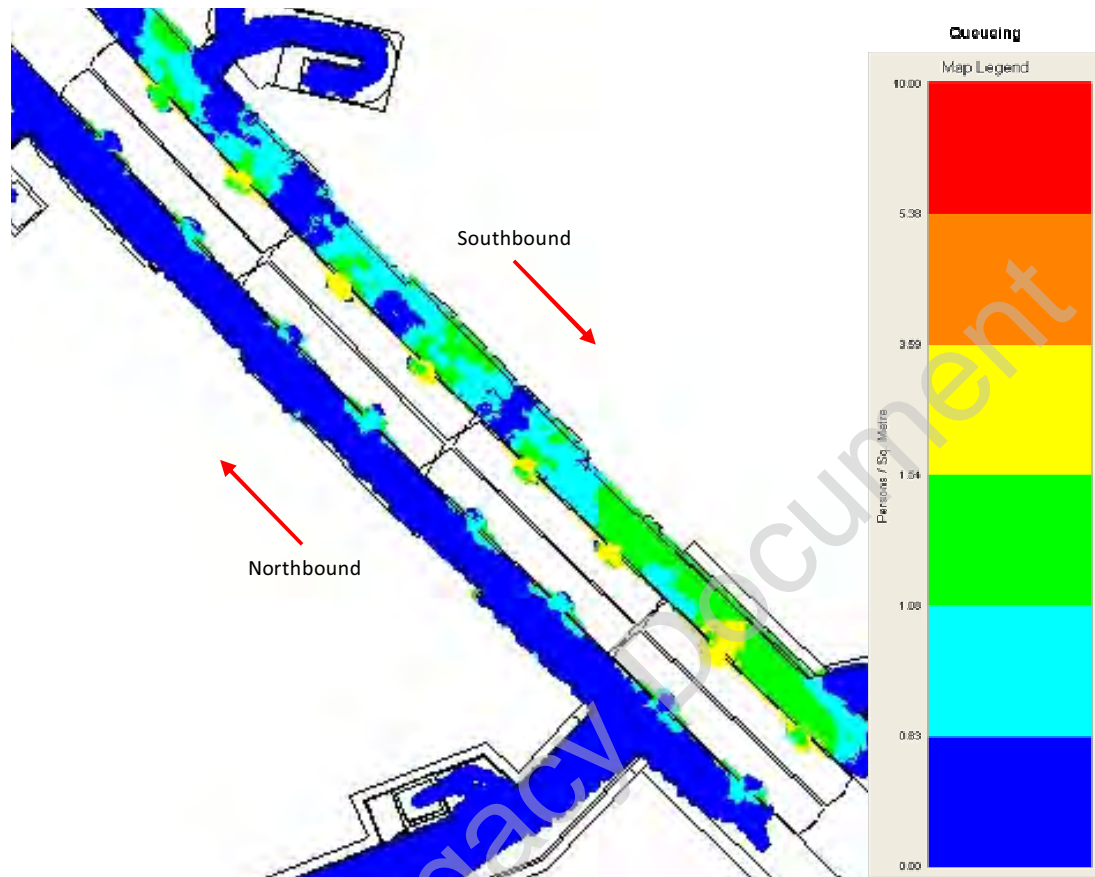
Figure 6.9– Level of Service (CMD Queuing) – 2026 +28% AM Peak 15 Minutes



- 6.4.3 The LEGION modelling analysis has therefore identified that the platform width would adequately accommodate passengers during the AM peak period.
- 6.4.4 During the PM peak period the greatest impact comes from passengers boarding southbound trains, particularly at the southern end with connections from HCDL.

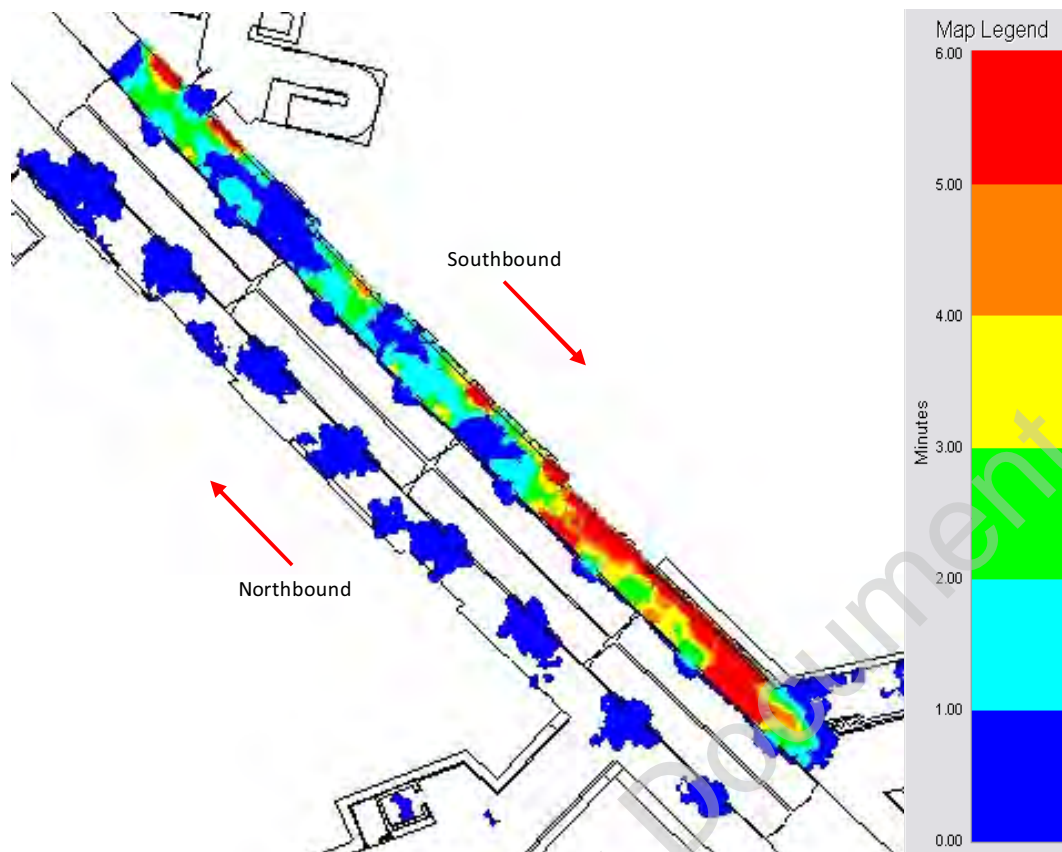
Figure 6.10 shows the 'Queuing' LOS plot during the peak 15 minute period.

Figure 6.10 – Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes



- 6.4.5 The plot identifies LOS A on the northbound platform. The southbound platform reaches LOS C at the southern end, with a small cluster of LOS D.
- 6.4.6 There are a significant number of passengers boarding trains on the East London Line southbound platform during the PM period, resulting in congestion as noted above. Cumulative High Density (CHD) plots have been recorded to assess how long passengers on this platform would experience congestion higher than LOS C. In accordance with SPSPG LOS C equates to 0.8sqm per passenger. The CHD plots have been assessed for 'Queuing' and show the length of time that the platforms have registered densities greater than 0.8sqm per passengers (1.25 passengers/sqm).
- 6.4.7 **Figure 6.11** shows the 'Queuing' CHD plot for the East London Line platform during the PM peak.

Figure 6.11 – CHD Queuing – 2026 +28% PM Peak 15 Minutes

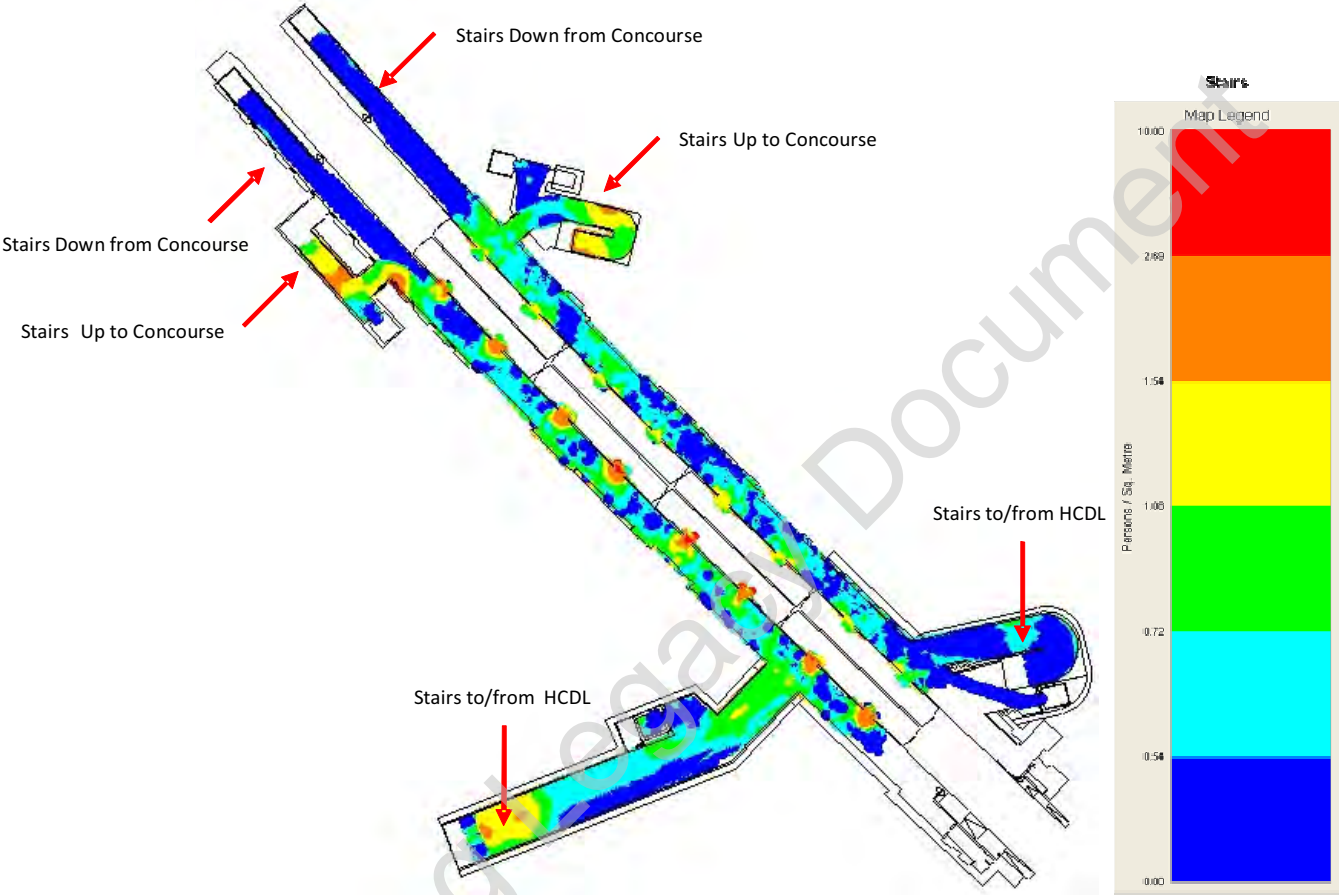


- 6.4.8 Certain areas of the southbound (coloured red) would experience a density greater than LOS C for a period of 5 minutes or more.
- 6.4.9 This is also the case for the 15 minute periods either side of the peak 15 minutes. CHD plots for the full modelled period are provided in **Appendix G**.
- 6.4.10 As the southbound platform is approaching/at capacity for certain periods of the 2026 +28% analysis it was agreed with CRL/LUL that a number of mitigation strategies would be tested. These are detailed in the following Chapter.

6.5 East London Line Stairs

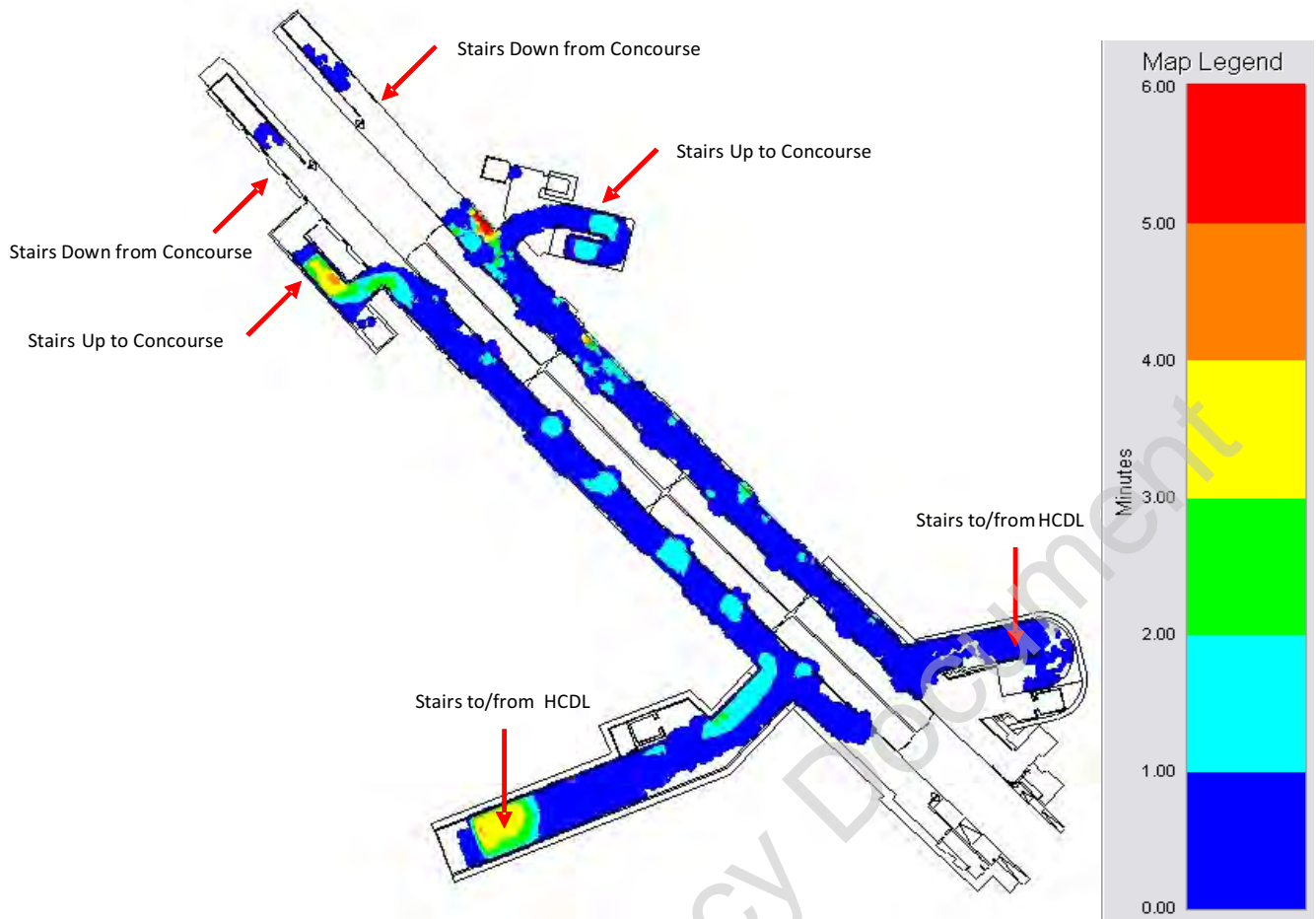
6.5.1 **Figure 6.12** shows the 'Stairs' LOS plot for the AM peak period. The main stairs worth noting are the two-way staircase on the northbound platform to/from HCDL and the one-way stair UP to the concourse from the northbound platform. A section of the staircases reach LOS D with a small cluster of E however, both do not experience this LOS before or after the 15 minute peak and therefore it is not considered to be an issue as this congestion is small and only for a very short period.

Figure 6.12 – Level of Service (CMD Stairs) – 2026 +28% AM Peak 15 Minutes



6.5.2 The 'Stairs' CHD plot shown in **Figure 6.13** confirms that density greater than LOS C is only experienced for 3–4 minutes during the peak 15 minute period. All of the other stairs on the East London Line do not exceed the acceptable LOS.

Figure 6.13 – CHD Stairs – 2026 +28% AM Peak 15 Minutes



6.5.3 **Figure 6.14** shows the 'Stairs' LOS plot for the PM peak period. All of the stairs operate within the agreed limits with LOS B/C being the highest recorded.

Figure 6.14 – Level of Service (CMD Stairs) – 2026 +28% PM Peak 15 Minutes

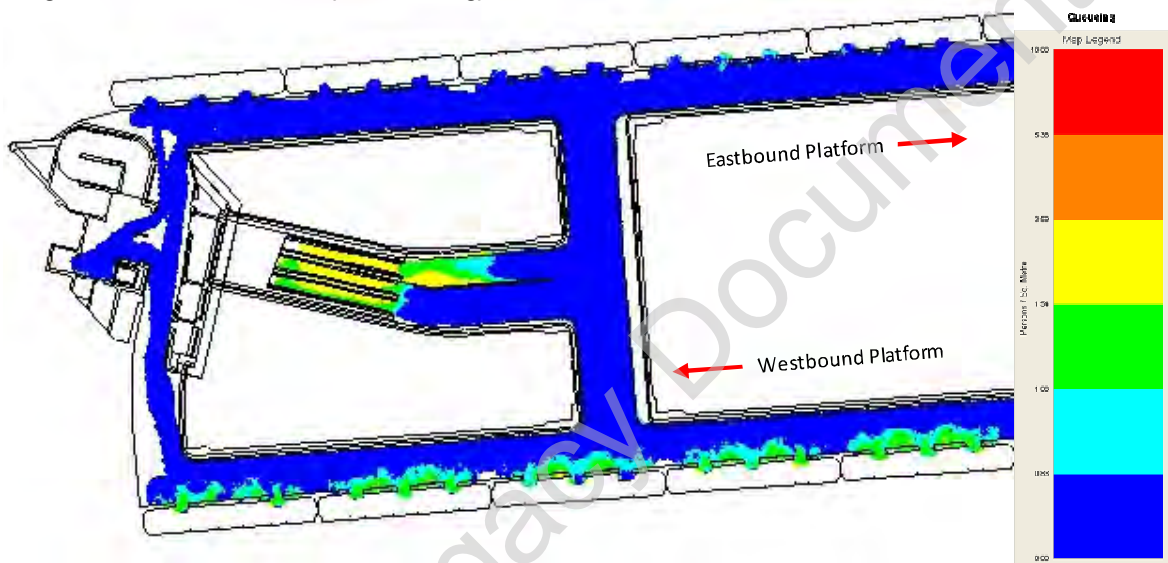


6.5.4 The analysis has therefore shown that the stairs on the East London Line would operate within capacity during the 2026 +28% demand scenario.

6.6 Crossrail Platforms

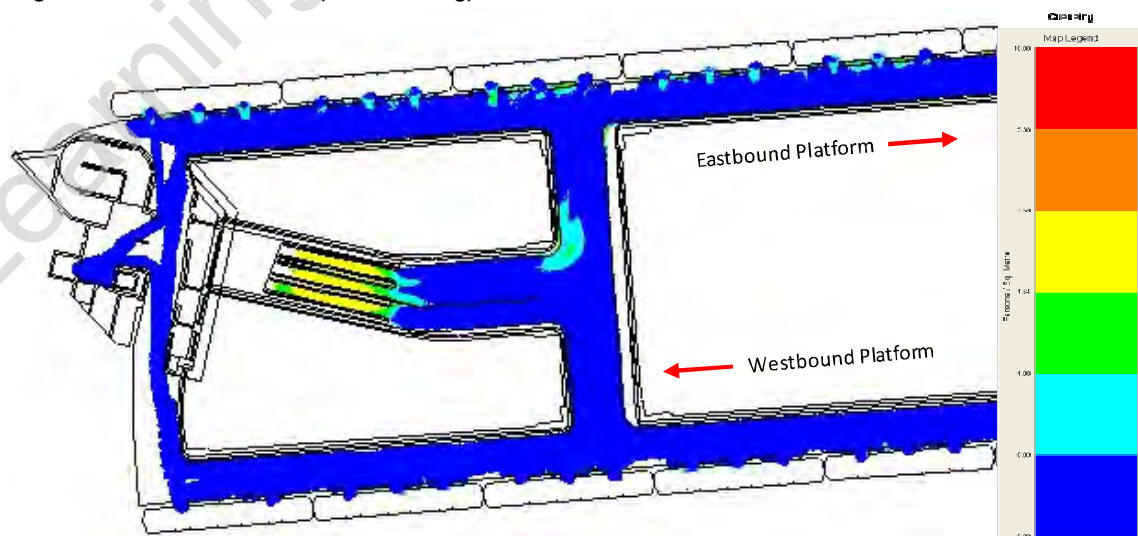
- 6.6.1 During the AM peak the westbound platform experiences a large volume of boarding passengers. **Figure 6.15** shows the 'Queuing' LOS during the AM peak 15 minute period.
- 6.6.2 The plot shows LOS C on the westbound platform which represents the large number of boarders and this is within the agreed LOS limits. Similarly the eastbound platform shows LOS A which is well within the acceptable LOS. The approach to the UP escalator from Crossrail experiences a small cluster of LOS D however, this does not extend to the full width of the passage and so it not considered being an issue.

Figure 6.15 – Level of Service (CMD Queuing) – 2026 +28% AM Peak 15 Minutes



- 6.6.3 The passenger movements in the PM are broadly the reverse with a large number of alighting passengers on the eastbound platform. **Figure 6.16** shows the 'Queuing' LOS during the PM peak 15 minute period.

Figure 6.16 – Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes

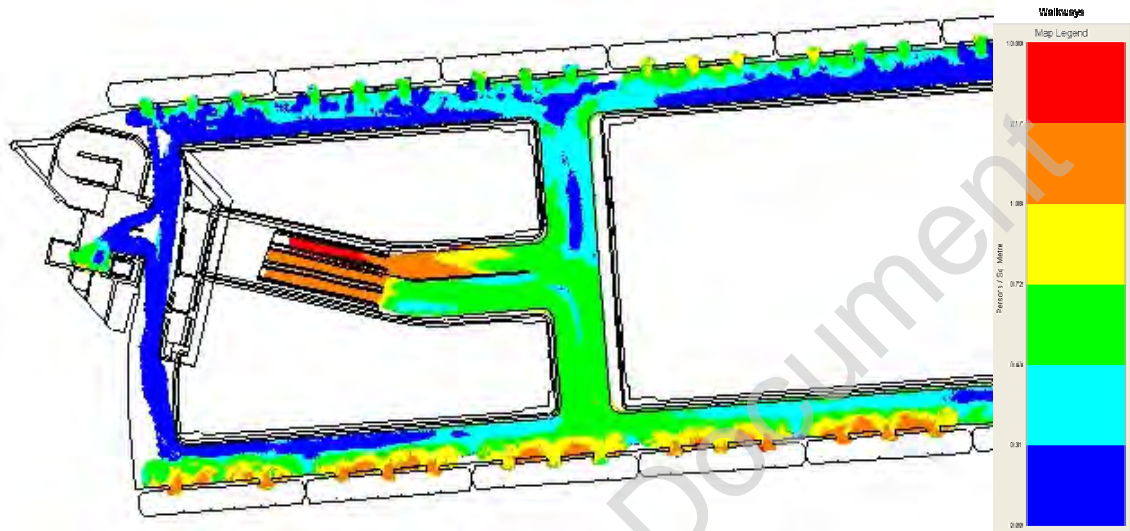


- 6.6.4 Similarly to the AM the plot shows small clusters of LOS C, this time on the eastbound platform representing the large number of alighters. The westbound platform shows LOS

A which is well within the acceptable LOS. The UP escalators from Crossrail experience a small cluster of LOS B.

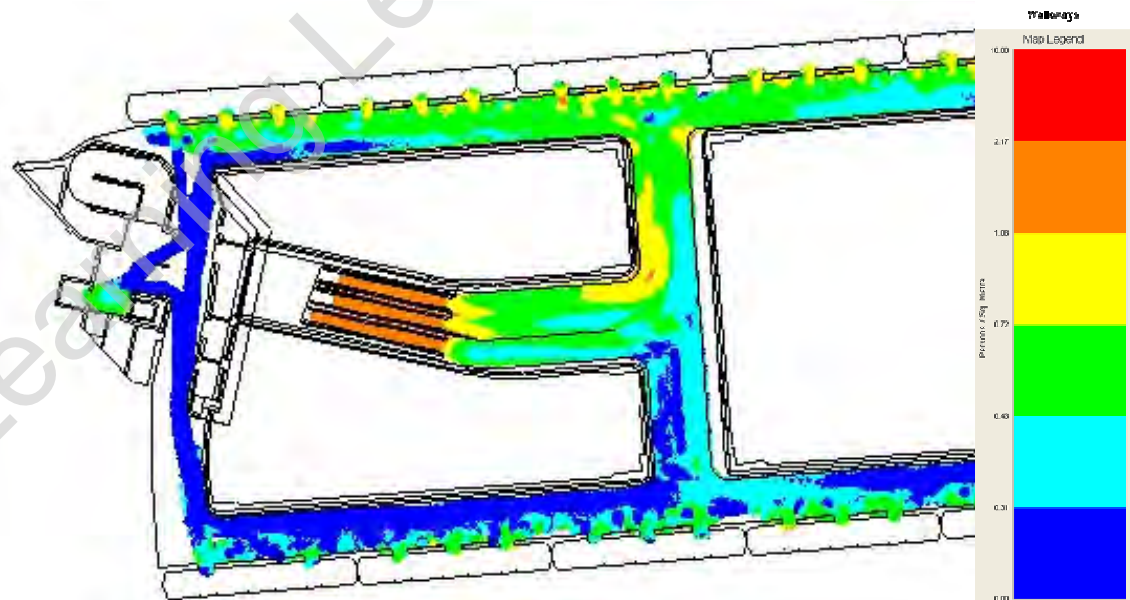
6.6.5 **Figure 6.17** shows the 'Walkways' LOS during the AM peak 15 minute period. The adits and passageway show a LOS C, the westbound platform shows LOS C and the eastbound LOS B, therefore the platform is considered to operate within the agreed LOS limits.

Figure 6.17 – Level of Service (CMD Walkways) – 2026 +28% AM Peak 15 Minutes



6.6.6 **Figure 6.18** shows the 'Walkways' LOS during the PM peak 15 minutes period. A section of the eastbound adit experiences LOS D but this does not cover the entire width of the adit and is considered acceptable. The westbound platform shows LOS B and eastbound LOS C, both are acceptable.

Figure 6.18 – Level of Service (CMD Walkways) – 2026 +28% PM Peak 15 Minutes



6.6.7 The LEGION modelling analysis has therefore identified that the Crossrail platform, adits and passageway would accommodate passenger demands during the AM and PM peak periods.

6.6.8 To confirm that the levels of congestion on the Crossrail platforms are acceptable **Figure 6.19** and **6.20** show the 'Walkways' CHD plots of the AM and PM peaks are shown below.

Figure 6.19 – CHD Walkways – 2026 +28% AM Peak 15 Minutes

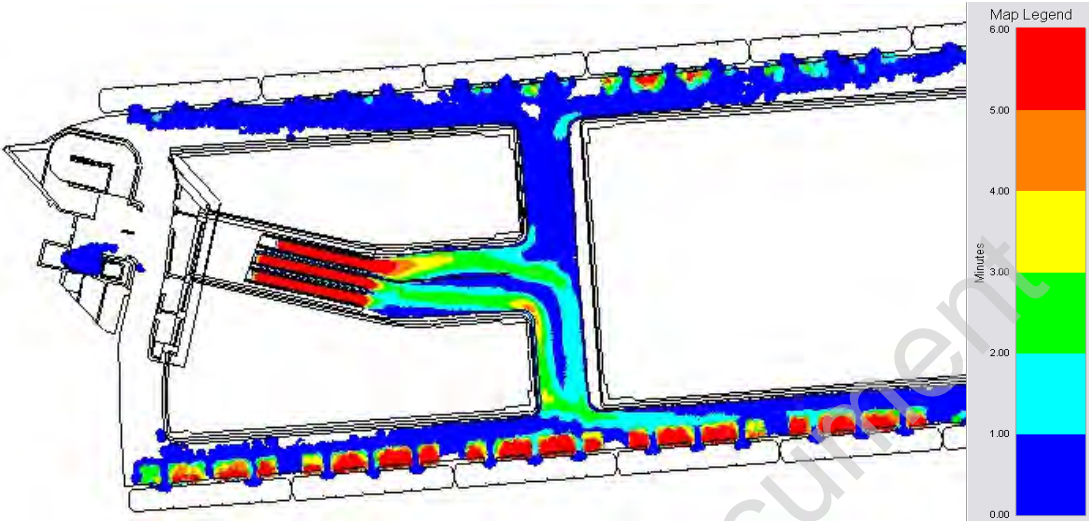
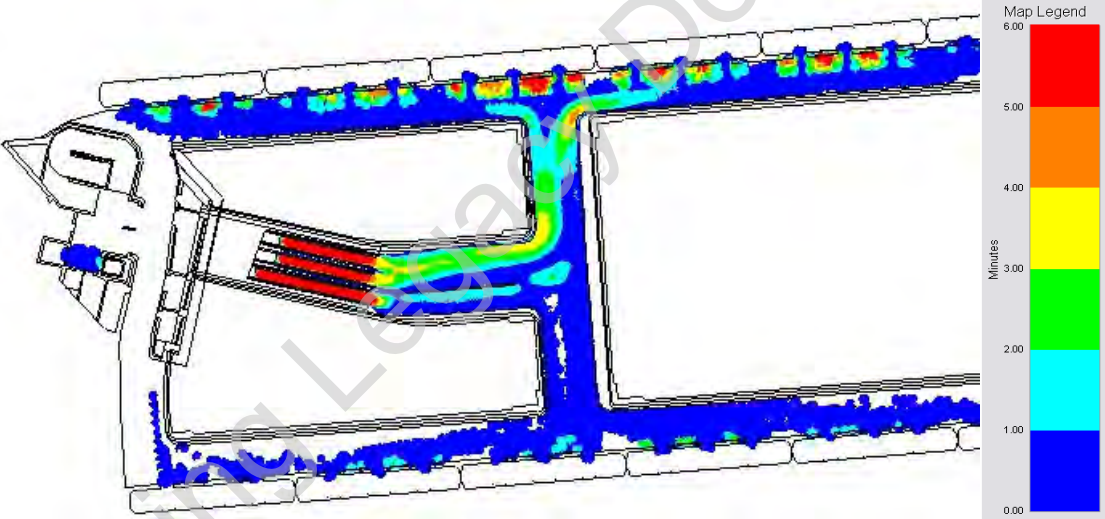


Figure 6.20 – CHD Walkways – 2026 +28% PM Peak 15 Minutes



6.6.9 During the AM peak the westbound adit link experiences a density greater than LOS C for 2-3 minutes during the busiest 15 minute period. The PM peak shows broadly the reverse of the AM for the adit linking with the eastbound platform.

6.7 Summary of 2026 +28% Modelling Results

6.7.1 The 2026+28% Legion modelling analysis has shown that the Stage E design would operate within capacity during the AM and PM peak periods. The Concourse Bridge and Station Entrance continue to operate within capacity and the District, Hammersmith & City, East London Line and Crossrail platforms also operate within the agreed limits. During the PM peak period the analysis has shown small sections of the East London Line southbound platform to be approaching/at capacity and therefore we have investigated potential mitigation measures as detailed in the following Chapter.

7 LEGION Modelling – 2026 +28% PM Mitigation Results

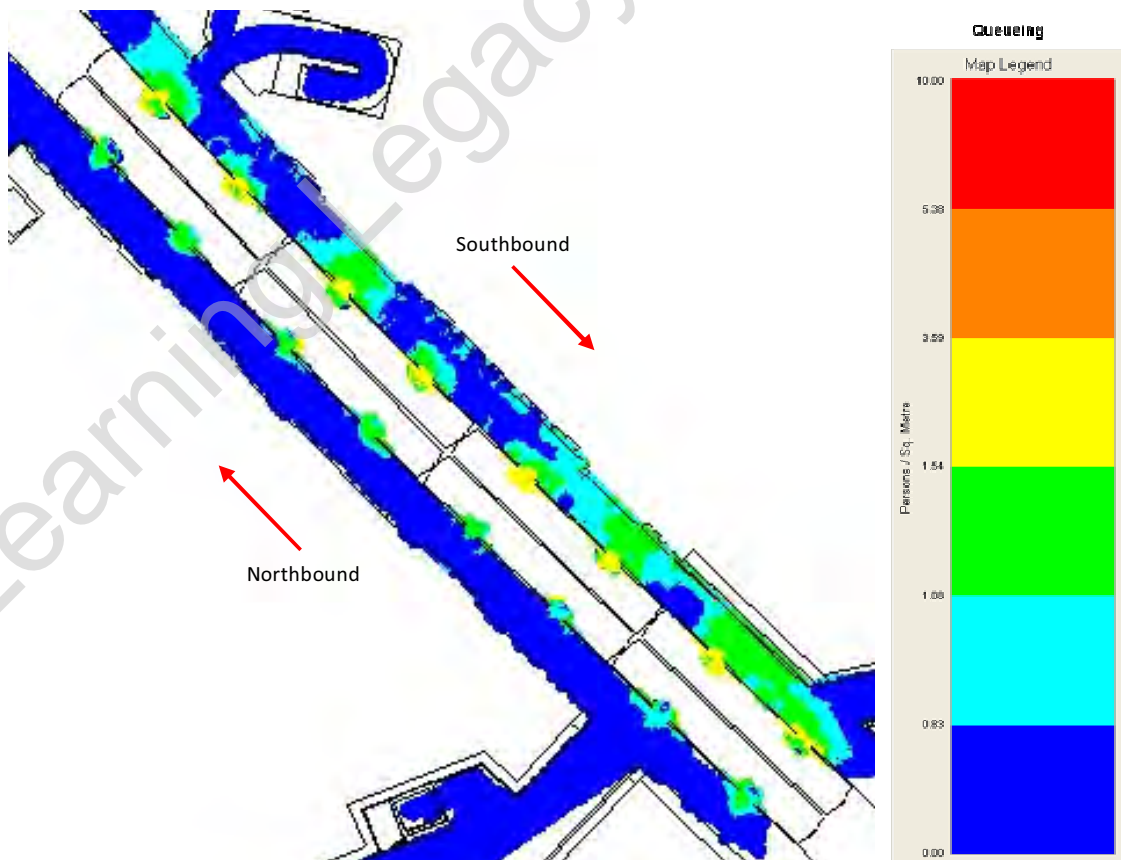
7.1 Introduction

- 7.1.1 In order to manage the high volume of boarding passengers on the East London Line southbound platform during the PM peak a number of mitigation measures were agreed with CRL and LUL
- 7.1.2 The first test assumes that more passengers would be encouraged to 'board the next train'. The modelling is based on 47% of passengers boarding the next service and this mitigation tests assumes that 70% of passengers on the platform would board the next train and be encouraged to interchange further down the line e.g. at Canada Water.
- 7.1.3 The second mitigation test would comprise the introduction of a one-way operation on the ELL southbound platform requiring passengers to access the platform from the northern end, and egress from the southern end stairs to HCDL platforms.
- 7.1.4 The results shown are for the ELL platforms only. Cumulative Mean Density Plots for the entire modelled area are provided in **Appendix F**.

7.2 East London Line Southbound Board the Next Train (PM Only)

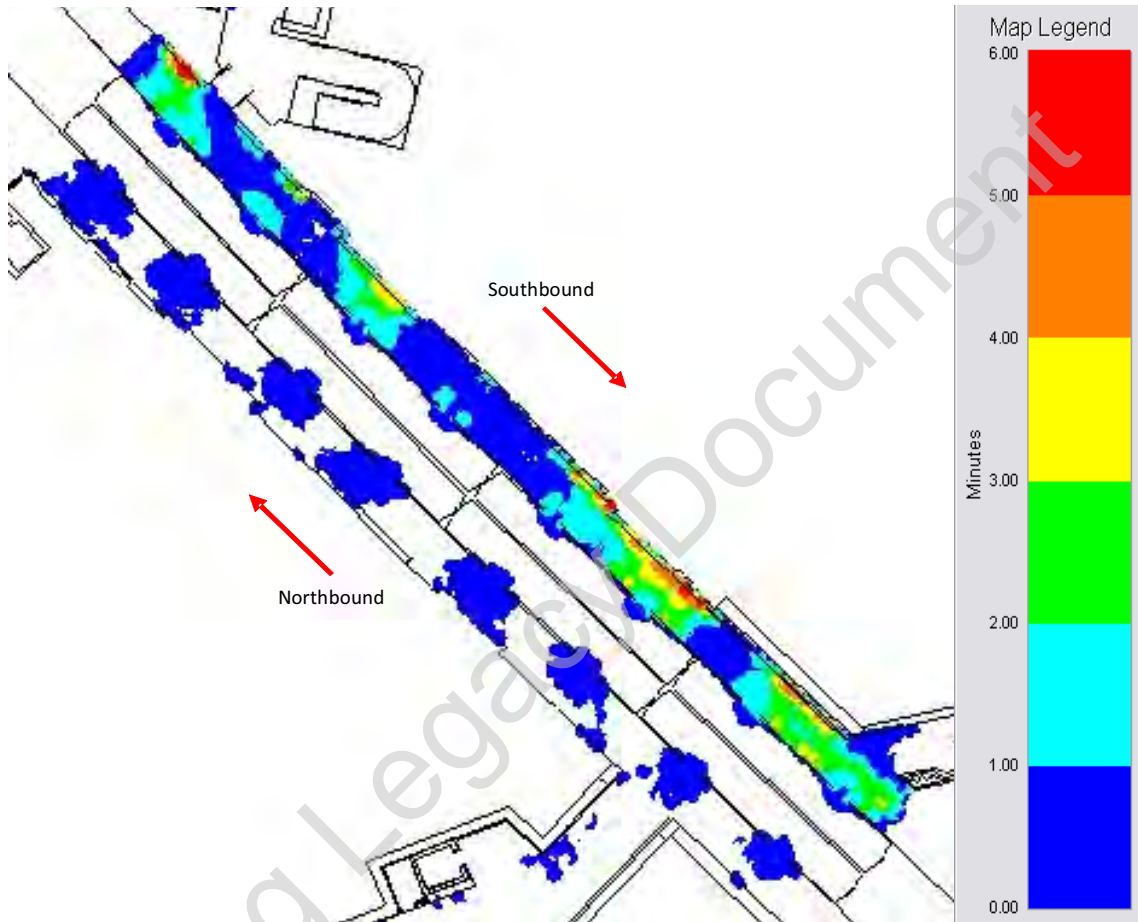
- 7.2.1 **Figure 7.1** shows the 'Queuing' LOS during the PM peak 15 minute period. By implementing the 'Board Next Train' strategy the plot shows a 'Queuing' LOS C, so within acceptable limits.

Figure 7.1 – Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes



7.2.2 **Figure 7.2** shows the 'Queuing' CHD plot during the PM peak 15 minute period. As more passengers board the next train there is less congestion on the platforms and so the time passengers experience congestion levels above LOS C has reduced to between 2 and 3 minutes.

Figure 7.2 – CHD Queuing – 2026 +28% PM Peak 15 Minutes

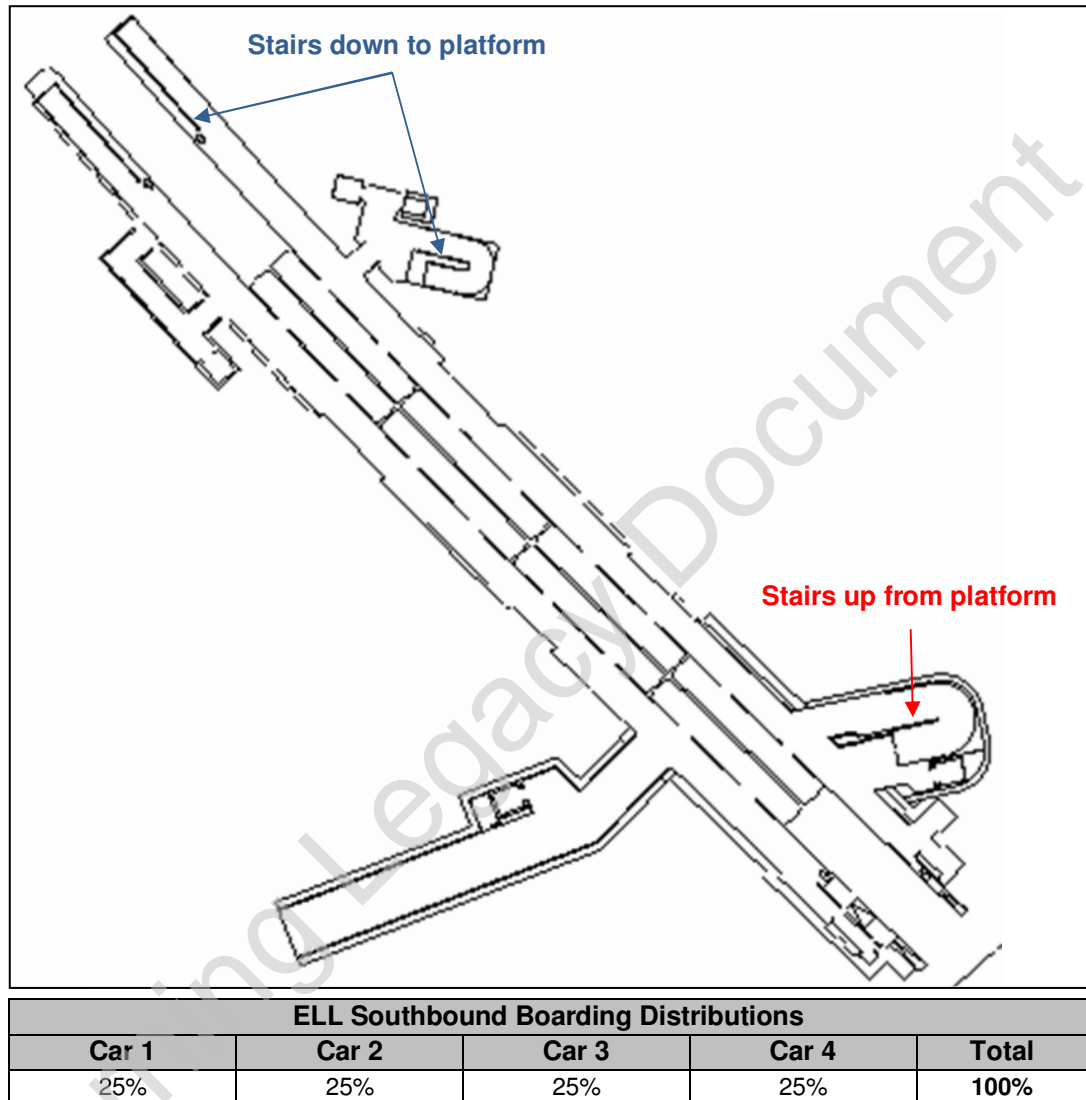


7.3 East London Line Southbound One-way (PM Only)

7.3.1 For this test the southbound platform would operate as a one-way platform, with passengers accessing the platform via the north end and egress via the stairs to HCLD.

Figure 7.3 highlights the staircase operation and the re-proportioned boarding percentages.

Figure 7.3 – One-way Stair Operation



7.4 Passenger Routeing Assumptions – One-Way (2026 +28% PM only)

7.4.1 The test assumes that the one-way system would only be required to operate during the PM peak on the East London Line Southbound platform.

7.4.2 District, Hammersmith & City

- Assumption that all HCDL - ELLSB passengers would use the escalators to the Concourse Bridge, then route towards the Down stairs to ELLSB located within the northern concourse;

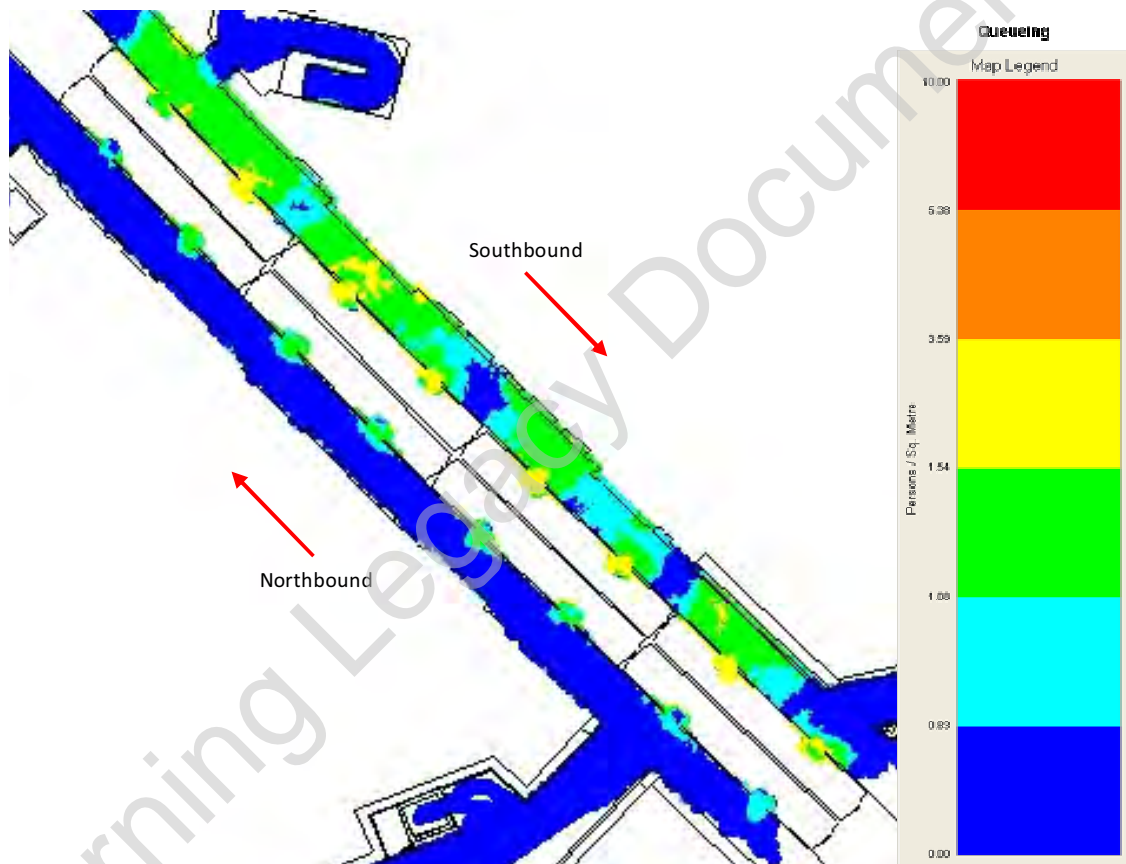
7.4.3 East London Line

- Assumption that all ELLSB - HCDL passengers would use the southern staircase located on the East London Line Southbound platform, which connects directly to the HCDL platform;

- Assumption that all ELL - Crossrail passengers would also use the southern staircase located on the ELLSB platform. All ELL - Crossrail passengers would then use the escalators to the Concourse Bridge and finally route towards the escalators down to Crossrail.
- It has been assumed that Crossrail – ELLSB passengers route via the one-way staircase to ELLSB located at the northern end of the Concourse Bridge.

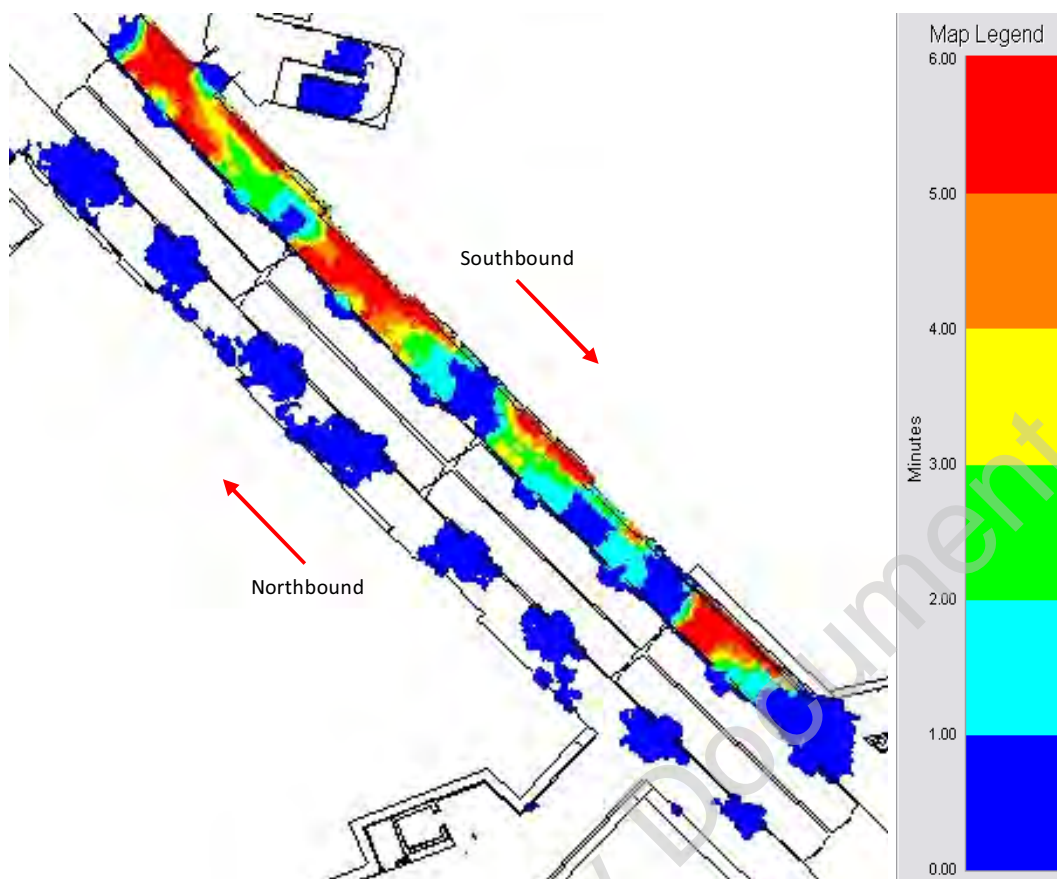
7.4.4 **Figure 7.4** shows the 'Queuing' LOS during the PM peak 15 minute period. By implementing the one-way operation the plot shows 'Queuing' LOS C with a small cluster of D, which is not a significant improvement on the two-way operation results.

Figure 7.4 – Level of Service (CMD Queuing) – 2026 +28% PM Peak 15 Minutes



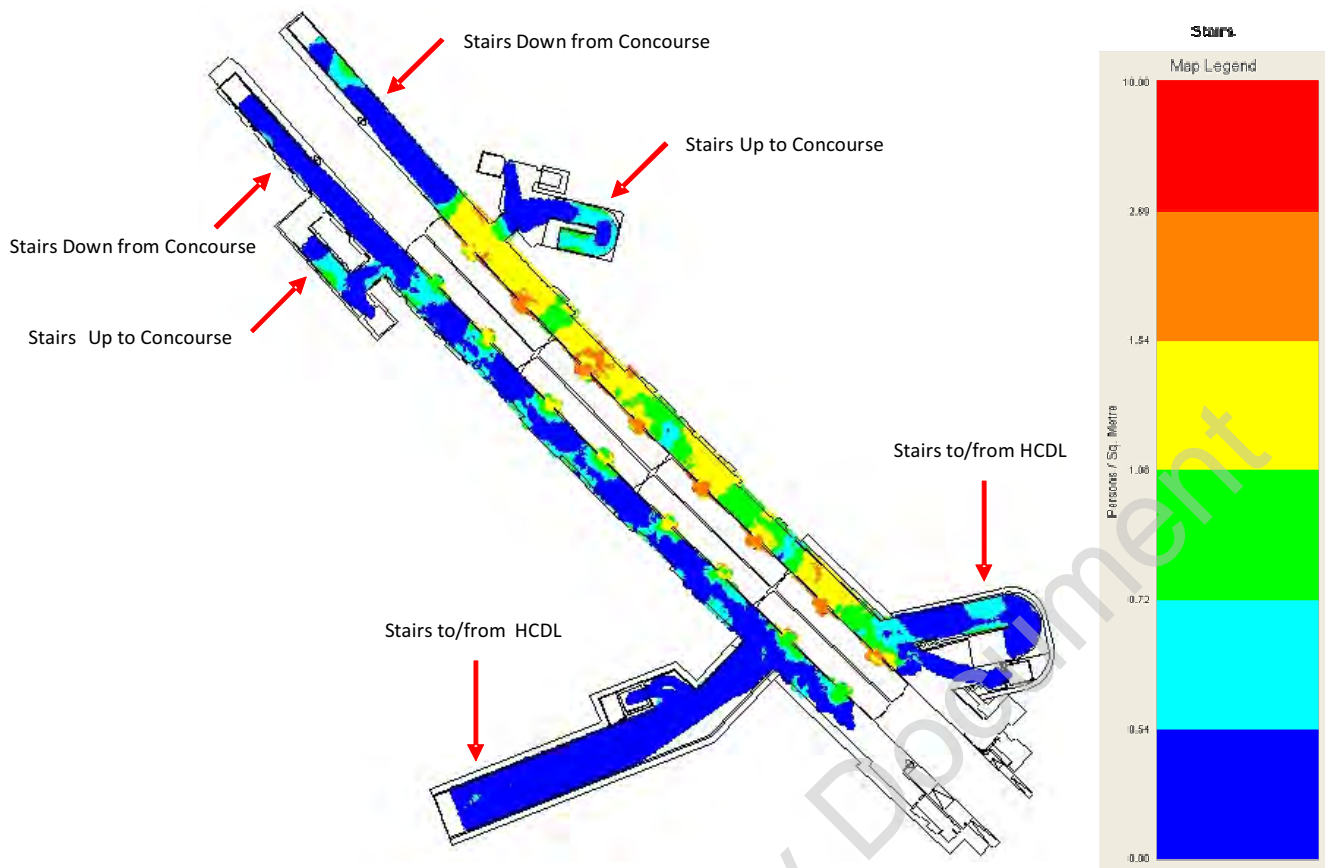
7.4.5 **Figure 7.5** shows the 'Queuing' CHD plot during the PM peak 15 minute period. The length of time that passengers spend congested has not significantly improved and remains similar to the 5+ minutes as shown during normal operation.

Figure 7.5 – CHD Queuing – 2026 +28% PM Peak 15 Minutes



7.4.6 **Figure 7.6** shows the ‘Stairs’ LOS during the PM peak 15 minute period. From the plot it can be seen that the stairs on the East London Line platform do not exceed LOS C and would comfortably operate within capacity during the One-way operation.

Figure 7.6 – Level of Service (CMD Stairs) – 2026 +28% PM Peak 15 Minutes



7.5 Summary of 2026 +28% PM Mitigation Modelling Results

- 7.5.1 The first mitigation test has shown that encouraging more passengers to 'board the next train' would result in an improved LOS on the platform and would also significantly reduce the length of time passengers experience a density great than LOS C.
- 7.5.2 The second mitigation test involving the implementing a one-way operation on the ELL southbound platform would have no significant benefits in terms of improved LOS. The main difference would be to shift the congested areas from the southern end of the platform to the northern end.

8 Summary & Conclusions

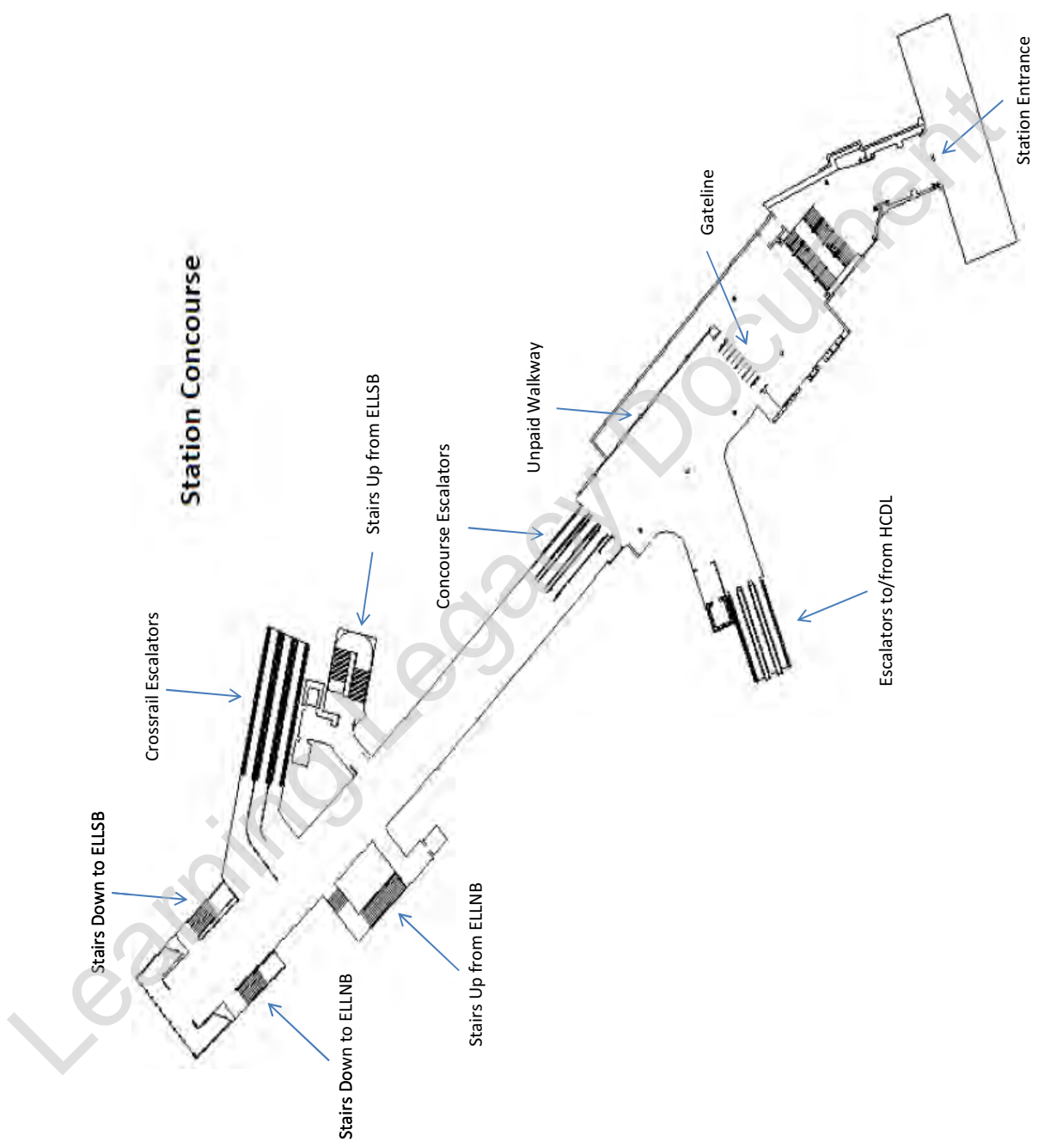
- 8.1.1 In summary, the LEGION modelling exercise has demonstrated (Chapter 5) that the geometry of the Stage E layout design under Normal Operation would accommodate the 2026 AM and PM peak passenger demands, and would operate within capacity in accordance with the 'acceptable' limits for operation (Section 5.3.3). This includes all station areas, ticket hall, stairs, escalators, passageways and platforms.
- 8.1.2 Additionally, the modelling exercise has demonstrated (Chapter 6) that the geometry of the Stage E layout designs would satisfy the 'acceptable' limits for operation (Section 5.3.3) for the AM and PM 2026 +28% demands.
- 8.1.3 Due to the high volume of boarding passengers during the PM peak on the East London Line southbound platform the LEGION modelling results have shown that small sections of the platform would be approaching/at capacity in the 2026 +28% scenario. In discussions with Crossrail Limited and London Underground Limited a number of potential operational mitigation measures have been discussed, agreed and tested (see Chapter 7). The results show that these mitigation measures would provide significant improvements, and result in acceptable Levels of Service for passengers on the East London Line southbound platform, should it be necessary to introduce these mitigation measures in the future.

Learning Legacy Document

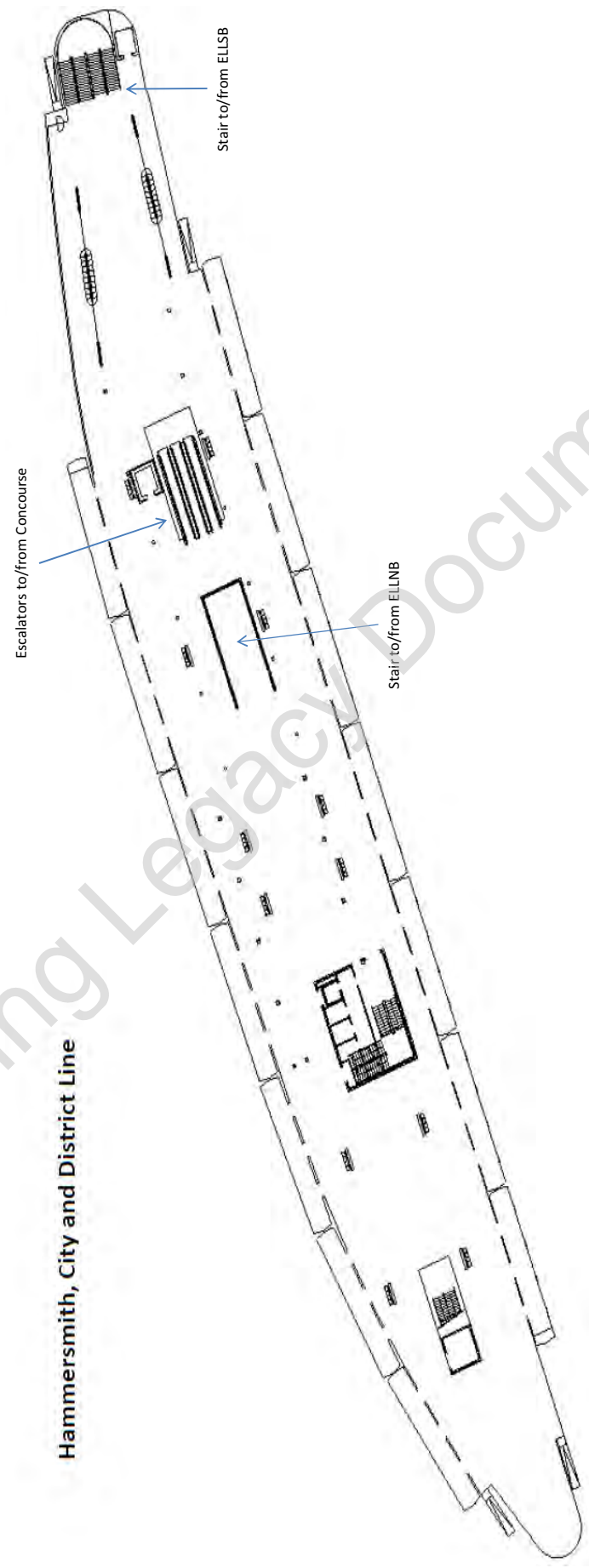
9 Appendices

9.1 Appendix A - Station Layout Plans

Learning Legacy Document

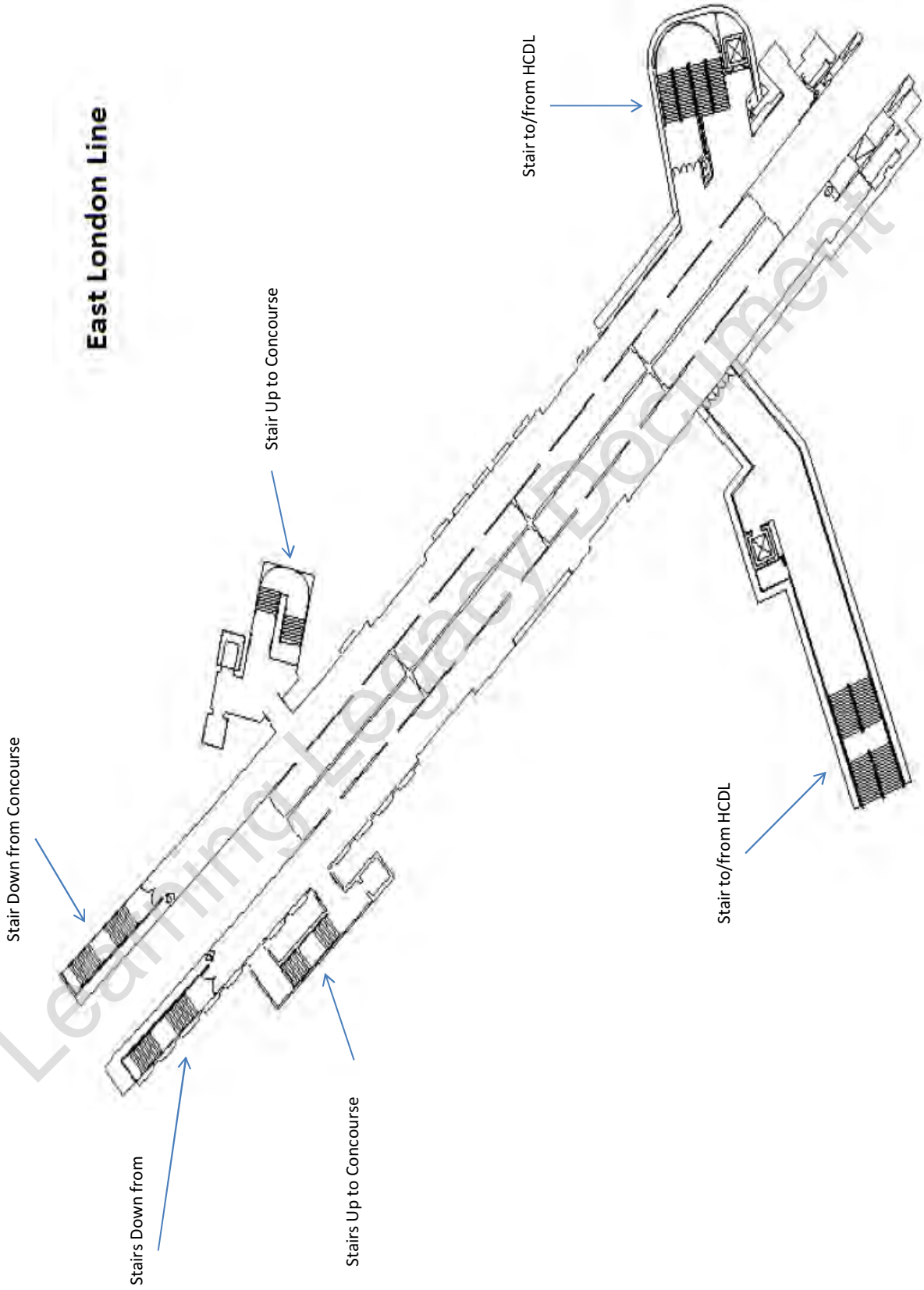


Hammersmith, City and District Line



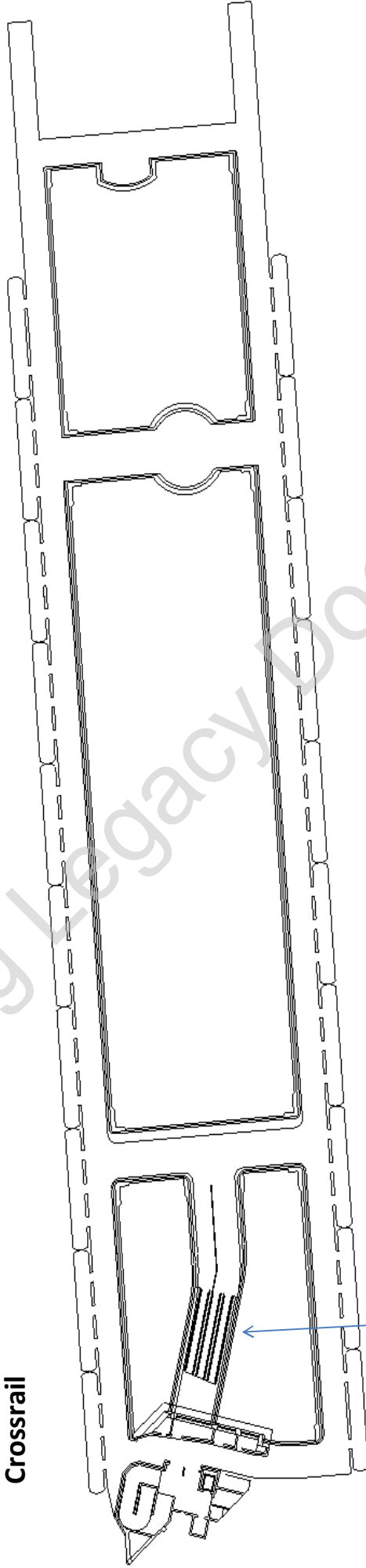
Learning Legacy Document

East London Line



Learning Legacy Document

Crossrail



Escalators to/from Concourse

9.2 Appendix B - 2026 Demand Matrices

Learning Legacy Document

2026 With Crossrail - AM Peak Period Demand at Whitechapel								
WCHXR153RuAM	WHITECHAPEL ENTRANCE	WHITECHAPEL DISTRICT/H&C (EB)	WHITECHAPEL DISTRICT/H&C(WB)	WHITECHAPEL EAST LONDON (NB)	WHITECHAPEL EAST LONDON (SB)	WHITECHAPEL CROSSRAIL (EB)	WHITECHAPEL CROSSRAIL (WB)	TOTAL
WHITECHAPEL ENTRANCE	-	900	1050	100	350	950	1200	4550
WHITECHAPEL DISTRICT/H&C (EB)	1800	-	-	50	50	300	0	2200
WHITECHAPEL DISTRICT/H&C (WB)	1950	-	-	950	650	200	2050	5800
WHITECHAPEL EAST LONDON (NB)	1800	1150	1950	-	-	950	2750	8600
WHITECHAPEL EAST LONDON (SB)	50	750	600	-	-	850	1100	3350
WHITECHAPEL CROSSRAIL (EB)	700	550	0	150	750	-	-	2150
WHITECHAPEL CROSSRAIL (WB)	1300	200	1900	700	1050	1400	-	6550
TOTAL	7600	3550	5500	1950	2850	4650	7100	33200

2026 With Crossrail - PM Peak Period Demand at Whitechapel								
WCHXR153RuPM	WHITECHAPEL ENTRANCE	WHITECHAPEL DISTRICT/H&C (EB)	WHITECHAPEL DISTRICT/H&C(WB)	WHITECHAPEL EAST LONDON (NB)	WHITECHAPEL EAST LONDON (SB)	WHITECHAPEL CROSSRAIL (EB)	WHITECHAPEL CROSSRAIL (WB)	TOTAL
WHITECHAPEL ENTRANCE	-	2000	1850	50	1850	1300	700	7750
WHITECHAPEL DISTRICT/H&C (EB)	1350	-	-	600	1950	1900	0	5800
WHITECHAPEL DISTRICT/H&C (WB)	1150	-	-	750	1150	200	550	3800
WHITECHAPEL EAST LONDON (NB)	500	650	50	-	-	1050	750	3000
WHITECHAPEL EAST LONDON (SB)	150	950	50	-	-	700	150	2000
WHITECHAPEL CROSSRAIL (EB)	1500	2050	0	1100	2750	-	-	7400
WHITECHAPEL CROSSRAIL (WB)	1200	200	300	850	950	1400	-	4900
TOTAL	5850	5850	2250	3350	8650	6550	2150	34650

9.3 Appendix C - LEGION Model Files and Assumption Cover Sheets
(See separate CD)

Learning Legacy Document

**9.4 Appendix D - 2026 Normal Operation Cumulative Mean/Max Density Plots
(See separate CD)**

Learning Legacy Document

9.5 Appendix E - 2026 +28% Cumulative Mean/Max Density Plots
(See separate CD)

Learning Legacy Document

**9.6 Appendix F - 2026 +28% PM Mitigation Cumulative Mean/Max Density Plots
(See separate CD)**

Learning Legacy Document

9.7 Appendix G - 2026 +28% Cumulative High Density Maps
(See separate CD)

Learning Legacy Document

9.8 Appendix H - London Underground Limited Model Audit Action List

Learning Legacy Document



Crossrail Ltd
14 Pier Walk
North Greenwich
London
SE10 0ES

Station Modelling Team

London Underground

Floor 2N,

55 Broadway

London

SW1H 0BD

email



www.tfl.gov.uk/tube

G22-524

9 October 2010

Dear



Re: Whitechapel CRL Station 2026, 2026+28% AM and PM Peak Model Audit – ACTIONS LOG

Please find enclosed within this letter the agreed actions log following our 'Post Audit Meeting' held in CRL offices on Tuesday 5th October 2010.

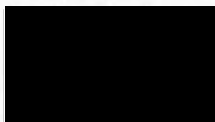
Kind Regards



Recipients:



CC:



Registered office is as above.

Registered in England and Wales,
Company Number 1900907

London Underground Limited is a company controlled by a local authority within the meaning of Part V Local Government and Housing Act 1989. The controlling authority is Transport for London.

ISSUES LOG - Audit of the Whitechapel LU CRL Complex - 2026 and 2026+28% AM and PM Peak Models

Post Audit Meeting - Tuesday 05 October 2010 [Hyder, CRL, London Underground]

		SIGNIFICANT	UNKNOWN	INSIGNIFICANT	ACTION
WCL1	PRM Speed Profiles are not in accordance to the Legion Best Practice Guide [SIGNIFICANT]				Hyder to update model to ensure correct speed profiles for PRM Type D and E (very small proportion of passengers) when model is next re-run.
WCL2	Wide Aisle Gates (WAGS) not represented as per Legion Best Practice Guide [SIGNIFICANT]				Hyder to update model amending this delay parameter at next model re-run
WCL3	Boarding Profiles to HCDL EB platform not consistent with Assumptions Cover Sheet (ACS) [SIGNIFICANT]				Hyder to update model amending this the Boarding profile from this staircase at next model re-run
WCL4	A mistake was spotted in the ACS for the 2026 models which was handed over to the FDC's [SIGNIFICANT but workaround exists]				Hyder to update 2026 models with correct Alighting Popularity %s for CRL WB at next model re-run. 2026AM: 55% (SHN) and 45% (ABM), 2026PM: 44% (SHN) and 56% (ABM)
WCL5	Passengers are seen walking through the train carriage to navigate along the platform [SIGNIFICANT]				Hyder to ensure this does not happen during next model re-run (could bring credibility of model into question during presentations)
WCL6	Unknown sources behind background passenger demand using the 'unpaid link' [SIGNIFICANT]				Hyder made clear the rationale and made reference to a document that already contained information regarding the sources behind the background demand. Hyder to forward on documentation to LU and also to make reference survey undertaken (times, dates etc.) during subsequent 2026, 2026+28% modelling reports.
WCL7	Entrance to ELL Routing Assumptions [SIGNIFICANT]				Hyder noted that disrupting this assumption (100% Entry->ELL passengers currently use HCDL platforms to access ELL platforms) would only make the model get better. LU requested some Journey Time analysis to be undertaken to see the difference in walk time between the two possible routes. Agreed to leave as is in the model but make reference to this discussion in the report. Hyder to send LU walk time differences for information.
WCL8	CAD at top of Crossrail Escalators [UNKNOWN]				Hyder to remove unnecessary CAD at next model re-run
WCL9	Unpaid link to Ticket Machine passengers navigate across the gateline to get to the ticket machines [INSIGNIFICANT]				Hyder to relay crossflow issue to architect and to discuss possible remedies to minimise this (e.g. extend 'wall' of unpaid link by a few metres). To be considered in next scheme design iteration.
WCL10	Lift Cycle Times [UNKNOWN]				Hyder noted that these were detailed in the Stage D report. Hyder to check heights between levels to ensure 10s lift movement time between each level is realistic and to make sure logic is detailed in the 2026, 2026+28% modelling report.
WCL11	We appear to be losing alighting passengers sometimes having more than a 1% variation than the number of alighters we were expecting in the Assumptions Cover Sheet [INSIGNIFICANT]				None, recommendation passed from LU to Hyder for future modelling to ensure variation is minimised.
WCL12	Some passengers are positioned on the edge of the HCDL platforms for unrealistic periods of time [INSIGNIFICANT]				Hyder to rectify in next model re-run (easy fix).
WCL13	Platform Train Interface logic on the LU / London Underground services could make future alterations to the model difficult [INSIGNIFICANT]				None, observation.
WCL14	Platform Train Interface logic on the CRL platforms [UNKNOWN]				Recommendation to Hyder make Waiting Zone's wider near the Platform Edge Doors (at next model re-run). LU/CRL to consider sensitivity test regarding current instructed logic to see if this logic is making a significant impact on the results compared to using the logic currently being used on LU/Overground platforms.
WCL15	Street demand is evenly spread [UNKNOWN]				Hyder to add 'Random Noise' at next model re-run (suggested parameters 0,0,2)
WCL16	Carriage naming conventions are counter-intuitive and this could lead to future misinterpretation and arrival profiles imported in reverse [INSIGNIFICANT]				None, observation.
WCL17	The number of entity types in the model [INSIGNIFICANT]				None
WCL18	Cancelled train logic is evident but only partially captured by interrogating model [SIGNIFICANT]				Hyder to go into more detail in subsequent 2026, 2026+28% report since not clear on ACS how, why, by how much boarding/alighters have been constrained in period after cancelled train.
WCL19	London Overground SB to HCDL platform staircase labelled as a One Way System Element in the Assumption Cover Sheets but bi-directional in the model itself [INSIGNIFICANT]				None