

Transport for London

London Underground



Ref: G22-1089

CRL1-LU-K2-CIL-CR001-50003

[REDACTED]
Crossrail Operations Delivery Manager
25 Canada Square, 30th Floor, G5/08
Canary Wharf
London E14 5LQ

Transport Planning
London Underground
55 Broadway
London
SW1H 0BD

5th November 2012

Email: [REDACTED]

Dear [REDACTED]

www.tfl.gov.uk/tube

Re: Review and approval of 2026, 2026+28% AM and PM Peak SDCC (RIBA E design) LU-IM Crossrail Station Legion models and accompanying reports: design suitability from a passenger flow perspective

This letter summarises our agreed position with regards to the technical audits of the Crossrail LU-IM station complex models and their associated RIBA E Stage Design Compliance Certificate (SDCC) modelling reports.

In November 2010 an extensive LU audit of the CRL station models led by [REDACTED] was completed, after a small number of improvements based on the results of the audit, we were left with a set of Legion models fit for purpose each with an agreed set of assumptions. Thanks to this assurance over the technical content of the CRL models we were able to review subsequent modelling reports with confidence and return comments accordingly.

The summary sheets attached highlight our review of the modelling reports and the few cases where and when the new infrastructure falls short of the required capacity under CPFV version 5. Mitigation measures in these circumstances that we have agreed are noted along with their effectiveness. You will notice for Liverpool Street/Moorgate station there are two summary sheets, the first summarises the outcome of sending the identified critical movement (FCC to/from CRL passengers) via the originally intended route and the second via a suggested alternative.

A summary of the static assessment of lift capacities at each station, based on the work produced by your team, are also included.

Assessment is based on the CRL Pedestrian Modelling Guidelines and the CRL Platform Standard (CR-STD-305). However LU has reserved the right to apply its own criteria for assessment when reviewing the SDCC (RIBA E) modelling results. In reference to the Crossrail platform areas, design should not deviate from the currently agreed 4.5m minimum usable width.

Finally, any future modelling workstream will need to be based on these final RIBA E models. Any changes to these models will have to be agreed by both parties and follow a change control process.

Kind Regards

[REDACTED]

Head of Transport Planning

CC: [REDACTED] (CRL), [REDACTED] (LU), [REDACTED] (LU), [REDACTED] (LU), [REDACTED] (LU)

BOND STREET

FDC:																															
Report:	CI 32-WSP-T3-RGN-CI 25-50007 Rev 2.0																														
Model Files:	2026 AM: Bond St AM 2026_Issued August 2011.lgm 2026 PM: Bond St PM 2026_Issued August 2011.lgm 2026 + 28% AM: Bond St AM 2026+28%_Issued August 2011.lgm 2026 + 28% PM: Bond St AM 2026+28%_Issued August 2011.lgm																														
ACS:	2026 AM: ACS Bond Street CRL Station Complex (2026AM) v5.0.xls 2026 PM: ACS Bond Street CRL Station Complex (2026PM) v6.0.xls 2026 + 28% AM: ACS Bond Street CRL Station Complex (2026 plus 28% AM) v5.0.xls 2026 + 28% PM: ACS Bond Street CRL Station Complex (2026 plus 28% PM) v5.0.xls																														
Demand Summary	<div style="display: flex; justify-content: space-around;"> <div style="width: 45%;"> <p style="text-align: center;">23,200 Passengers (0700-1000hrs – 2026AM PEAK)</p> </div> <div style="width: 45%;"> <p style="text-align: center;">36,550 Passengers (1600-1900hrs – 2026PM PEAK)</p> </div> </div>																														
Breakpoint Summary:	<table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th>Area</th> <th>2026</th> <th>2026+7%</th> <th>2026+14%</th> <th>2026+21%</th> <th>2026+28%</th> </tr> </thead> <tbody> <tr> <td>Platform Area</td> <td colspan="5" style="text-align: center;">Bond Street</td> </tr> <tr> <td>Vertical Circulation Areas</td> <td colspan="5" style="text-align: center;">Bond Street</td> </tr> <tr> <td>Ticket Hall Area</td> <td colspan="5" style="text-align: center;">Bond Street</td> </tr> </tbody> </table> <div style="margin-top: 10px;"> <table style="width: 100%; border: none;"> <tr> <td style="width: 20px; border: 1px solid black; background-color: #add8e6;"></td> <td>Operates to required standard WITHOUT intervention</td> </tr> <tr> <td style="width: 20px; border: 1px solid black; background-color: #ffa500;"></td> <td>Requires Intervention to operate to required standard</td> </tr> <tr> <td style="width: 20px; border: 1px solid black; background-color: #add8e6; border-radius: 50%;"></td> <td>Requires MINOR Intervention to operate to required standard</td> </tr> </table> </div>	Area	2026	2026+7%	2026+14%	2026+21%	2026+28%	Platform Area	Bond Street					Vertical Circulation Areas	Bond Street					Ticket Hall Area	Bond Street						Operates to required standard WITHOUT intervention		Requires Intervention to operate to required standard		Requires MINOR Intervention to operate to required standard
Area	2026	2026+7%	2026+14%	2026+21%	2026+28%																										
Platform Area	Bond Street																														
Vertical Circulation Areas	Bond Street																														
Ticket Hall Area	Bond Street																														
	Operates to required standard WITHOUT intervention																														
	Requires Intervention to operate to required standard																														
	Requires MINOR Intervention to operate to required standard																														
Mitigations Identified?	Yes / None Required																														
Details:	<ul style="list-style-type: none"> ▪ Congestion Issues are prevalent in PM Peak ▪ Small pockets of LOS D when assessed against a Queueing LOS exist from around +14% on the <u>CRL EB platform</u> in the PM peak period. Deemed a minor non-compliance. <ul style="list-style-type: none"> ○ Mitigation:= Staff will encourage passengers to utilise entire length of platform ○ Effectiveness:= encouraging a more even spread at times when pockets of crowding exist will eliminate this minor non-compliance and take the platform area up to +28%. ▪ At the western end of the station, the top of the single downwards escalator from the <u>Intermediate Concourse</u> to the CRL platforms shows LOS D when assessed against a Queueing LOS from between +21% and +28%. <ul style="list-style-type: none"> ○ Mitigation:= Open relief stair which can be converted to passenger use including additional doors (if required), upgraded finishes, improved lighting and CCTV. Staff will direct LU->CRL passengers to this one way downwards staircase to access the CRL platforms in times of crowding at top of single downwards escalator. Additional journey time likely. ○ Effectiveness:= Modelling shows that this will lead to compliance at +28% ○ Additionally:= This has also been identified as a mitigation for the Station Planning concession (SP0079 / CR06541) against the non compliant run off and under escalator maintenance would be the most likely way to re-route excess demand, therefore approval to the concession is conditional on CRL fitting out the staircase so it is fit for purpose and operable – refer to concession for further details. 																														



TOTTENHAM COURT ROAD

FDC:

ARUP

Report:

CI34-OVE-T3-RGN-NI05-50006_OptionDI.8_Rev3_10.02.2011

Model Files:

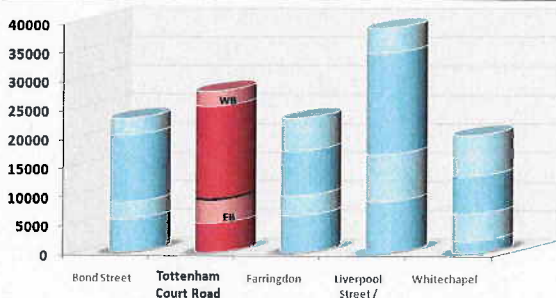
2026 AM: TCR DI.8 AM 75-25split v2.lgm
 2026 PM: TCR DI.8 PM 75-25split v2.lgm
 2026 + 28% AM: TCR_DI.8_AM+28_v2.lgm
 2026 + 28% PM: TCR_DI.8_PM+28_v2.lgm

ACS:

2026 AM: ACS TCR LU CRL Station Complex (2026AM) v1.3_CI34
 2026 PM: ACS TCR LU CRL Station Complex (2026PM) v1.3_CI34
 2026 + 28% AM: ACS TCR LU CRL Station Complex (2026 plus 28% AM) v1.3_CI34
 2026 + 28% PM: ACS TCR LU CRL Station Complex (2026 plus 28% PM) v1.3_CI34

Demand Summary

Crossrail Boarders and Alighters

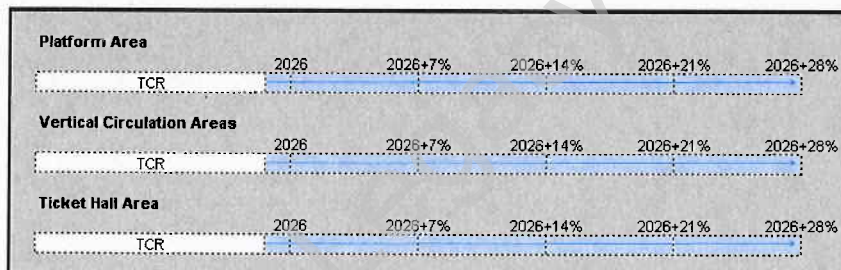


27,950 Passengers (0700-1000hrs – 2026AM PEAK)



40,000 Passengers (1600-1900hrs – 2026PM PEAK)

Breakpoint Summary:



Operates to required standard WITHOUT intervention

Mitigations Identified?

Yes / **None Required**

Details:

- No Issues arising from reviewing this report
- Hence no breakpoints/mitigations identified
- Option DI.8 model from the Project Assure workstream is carried through as the base model
- Additionally:** On existing infrastructure (post LU upgrade) the middle of the three Northern Line staircases shows as being particularly over utilised with density levels higher than what is deemed acceptable in both the AM and PM Peak 2026+28% scenarios. Due to the staircases in this area being predominantly signed as one way and an extensive process of modelling to find the optimal configuration for these stairs mitigations are somewhat limited. However, if levels of queuing and congestion did become too high on the middle stair then to help relieve this it would be advisable to make use of the bottom bi-directional stair and direct a proportion of passengers this way to leave the SB platform.



FARRINGDON



FDC:		
Report:	C136-SWN-Z-RGN-M123-00008_Rev3.0	
Model Files:	2026 AM:	FARR_2026_AM.lgm
	2026 PM:	FARR_2026_PM.lgm
	2026 + 28% AM:	FARR_2026+28%_AM.lgm
	2026 + 28% PM:	FARR_2026+28%_PM.lgm
ACS:	2026 AM:	ASC Farringdon LU TL CRL Station Complex (2026AM) v1.3.xls
	2026 PM:	ASC Farringdon LU TL CRL Station Complex (2026PM) v1.2.xls
	2026 + 28% AM:	ASC Farringdon LU TL CRL Station Complex (2026+28%AM) v1.2.xls
	2026 + 28% PM:	ASC Farringdon LU TL CRL Station Complex (2026+28%PM) v1.2.xls
Demand Summary	<p>23,400 Passengers (0700-1000hrs – 2026AM PEAK)</p>	<p>24,100 Passengers (1600-1900hrs – 2026PM PEAK)</p>
Breakpoint Summary:		
Mitigations Identified?	Yes / None Required	
Details:	<ul style="list-style-type: none"> ▪ Congestion issues and operational intervention points are mainly prevalent in PM Peak but also exists for the AM Peak ▪ There is a heavy demand bias towards the Farringdon/West end of the station compared to Barbican (80:20) ▪ There are large areas of LOS D in the direction served by a single escalator on the <u>Western Escalator</u> bank between the Thameslink NB and Crossrail platforms: <ul style="list-style-type: none"> ○ If a single up escalator is provided in the PM Peak at the base of this escalator there are large areas of LOS D when assessed against a Queuing LOS from 2026 onwards. At demand levels 2026+28% this quantifies as an average of ~45s delay per passenger to step onto the first tread of the escalator compared to free flow in the peak 15mins. ○ Similarly, but not until somewhere between 2026+14% and 2026+21% crowding at the top of the single downwards escalator in the AM Peak results in large areas of LOS D when assessed against a Queueing LOS ○ It has been shown that a 4th escalator is not feasible due to ground conditions (C121-MMD-C2-RGN-M123-00002) ○ Mitigation:= If congestion levels become too high open up the relief stair which will be designed for passenger use including additional doors (if required), upgraded finishes, improved lighting and CCTV. Staff will direct CRL passengers to this one way downwards staircase to access the CRL platforms in times of crowding with escalator directions configured to suit. ○ Effectiveness:= Static and more recently dynamic assessment shows that the relief stair will provide the required additional vertical capacity and take existing congestion plots through to 2026+28% acceptance (This satisfies the concerns expressed within the concession with LU reference CR06439/SP0198 and CPFR). However, there is likely to be over a minute and a half increase in journey time for those CRL Boarders being redirected (although now via an uncongested route) via the relief stair. ○ Additionally:= If required, reversing an escalator in peak periods needs careful planning and more than one member of staff ○ Additionally:= FDC modeller attributes some caution to this mitigation for the PM Peak due to the reconfiguration of escalators to 2 up, 1 down. The caution being that there is a risk that crowding is being transferred to top of any single downwards escalator, and the 2 escalators on the up – between train arrivals – could be perceived as empty for those heading in the down direction. <u>An operational decision will need to be made as to whether to accept the delay to passengers at the base of the single upwards escalators or to enforce the mitigation in the PM Peak.</u> ○ Mitigation:= An alternative mitigation to send more exiting passengers to Lindsey Street has been proposed but this will require staff intervention and signage and will be difficult to impose on regular commuters. ○ Effectiveness:= Sending additional 'exiters' to Lindsey Street (to take the 80:20 split closer to 50:50) will take existing congestion plots through to 2026+28%/CPFR acceptance. NB. Interchange passengers still need to use the western escalator bank regardless. 	



LIVERPOOL STREET / MOORGATE - RIBA E REPORT
 {Option#1 - FCC <-> CRL via NL Link}

FDC:		
Report:	CI38-LU-A-XCS-CI01-5000I Rev4	
Model Files:	2026 AM: LIV 2026 0800-0930 AM PRM lift v08c.lgm 2026 PM: LIV 2026 1715-1845 PM PRM lift v05.lgm 2026 + 28% AM: LIV 2026+28% 0800-0930 AM PRM lift v10c.lgm 2026 + 7% PM: LIV 2026+07% 1715-1845 PM PRM lift simple v08.lgm 2026 + 14% PM: LIV 2026+14% 1715-1845 PM PRM lift simple v06.lgm 2026 + 21% PM: LIV 2026+21% 1715-1845 PM PRM lift simple v08.lgm	
ACS:	2026 AM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026AM) v1.6.xls 2026 PM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026PM) v1.5.xls 2026 +28% AM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026 plus 28% AM) v1.4.xls 2026 +28% PM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026 plus 28% PM) v1.4.xls	
Demand Summary Crossrail Boarders and Alighters	<p style="text-align: center;">39,050 Passengers (0700-1000hrs – 2026AM PEAK)</p>	<p style="text-align: center;">39,600 Passengers (1600-1900hrs – 2026PM PEAK)</p>
Breakpoint Summary:	<div style="border: 1px solid black; padding: 10px;"> <p>Platform Area</p> <p>Liverpool Street/Moorgate: 2026 (blue), 2026+7% (orange), 2026+14% (yellow), 2026+21% (red), 2026+28% (green)</p> <p>NL Link Vertical Circulation Area</p> <p>Liverpool Street/Moorgate: 2026 (blue), 2026+7% (orange), 2026+14% (yellow), 2026+21% (red), 2026+28% (green) < Refer to Option #2 ></p> <p>Integrated TH (MET EB Stair)</p> <p>Liverpool Street/Moorgate: 2026 (blue), 2026+7% (orange), 2026+14% (yellow), 2026+21% (red), 2026+28% (green)</p> <p>Integrated TH (MET WB Stair)</p> <p>Liverpool Street/Moorgate: 2026 (blue), 2026+7% (orange), 2026+14% (yellow), 2026+21% (red), 2026+28% (green)</p> </div> <div style="margin-top: 10px;"> <p> Operates to required standard WITHOUT intervention </p> <p> Requires Intervention to operate to required standard </p> <p> Requires Intervention to operate to required standard However if this mitigation is found to be required on an ongoing basis the NTH will require extra capacity. </p> <p> Requires timesable to be followed without fault (i.e. consistently regular based headways, TPH fully achieved) to operate platform </p> <p> In a consistent regular based headway timesable with TPH fully achieved passengers first noticed as unable to board EB service between 1745-1800hrs </p> <p> Management Intervention required even in best possible service suggesting an increase in TPH is advisable </p> </div>	
Mitigations Identified?	Yes / No / None Required [For Platform Area, and MET WB and MET EB Stairs] Yes / No / None Required [For NL Link Vertical Circulation, NB. See Option #2]	



Details:

- A non-compliant location for new infrastructure in the PM Peak is the **CRL EB Platform** with Levels of Service E evident when assessed against a Walkway LOS and Levels of Service D evident when assessed against a Queueing LOS in the FDC base models at 2026.
 - **Mitigation:** Staff and signage will have to be deployed to encourage passengers to use the central concourse and access the platform via less congested furthestmost cross passages from the Moorgate side of the station to help with platform spreading.
 - **Effectiveness:** Compliance extended to somewhere between 2026+7% and 2026+14% before crowding on platform becomes unacceptable.
 - **Additionally:** in a regular headway based perfectly performing timetable between 2026+7% and 2026+14% is also the period when left behinds are first noticed in the PM Peak (◆). However, under these optimal conditions modelling suggests management intervention is not required on the CRL EB platform until some time between 2026+14% and 2026+21% (◆) suggesting an increase in TPH (from 24 TPH) is highly advisable around this time period. A perfect timetable and a frequency of 30 TPH will improve conditions after this point in time; however any perturbation to the train service will significantly affect the operational performance of this platform.

 - Another non-compliant location is the **Northern Line Link Stair** onto the Northern Line platforms in both the AM and PM Peak
 - **Mitigation:** Re-routing strategy is for all FCC-CRL and CRL-FCC passengers to avoid the link and interchange via the Integrated TH. This is described in Liverpool Street/Moorgate (Option#2) Summary Sheet
 - **Effectiveness:** Effectiveness highlighted in Liverpool Street/Moorgate (Option#2) Summary Sheet

 - A third non-compliant location is the **Integrated TH MET WB Stair** with this new piece of infrastructure registering as non-compliant from between 2026+14% and 2026+21% in the PM Peak. By 2026+28% demand levels this staircase is half a metre less than the desirable width being close to 15% over capacity in the peak fifteen minutes. However, the design width represents the absolute maximum achievable due to physical constraints.
 - **Mitigation:** If congestion levels become too high in the PM Peak staff presence will be required to turn this stair into one-way mode during the busiest parts of this period. When operating as one way (in down direction it will be necessary to redirect all MET WB Alighters away from this stair and to accessing the Integrated TH via the MET EB stair – these passengers (who account for 15% of overall stair demand) will now be going via the underpass to reach these destinations.
 - **Effectiveness:** The additional journey time for MET WB Alighters to exit or interchange via the MET EB stair is likely to be higher than the wait time to queue and access the stair itself. Hence, we do not expect this mitigation to be actively managed. However, the untested mitigations described above are likely to take the MET WB stair up to +28% compliance with a minor impact on MET EB stair (the AM Peak is when this stair falls into difficulty), if the MET EB stair is deemed overcrowded then the NTH should be used for those passengers wishing to exit the station.
- Additionally:**
- **On existing infrastructure** the dimension of the existing MET EB stair has not changed in any Integrated Ticket Hall design and this staircase like the MET WB stair is overcapacity by 2026+28% (by circa 15%) but only in the AM Peak. For compliance to be achieved, intervention is necessary from 2026+14% onwards. The untested mitigation is to direct a proportion of MET EB Alighters to exit the station via the NTH. If this mitigation is found to be required on an ongoing basis the NTH will require extra capacity. The passageway between the NTH and MET EB platform may also suffer through this extra patronage. If train service disruption occurs in peak periods then congestion on the MET EB staircase will worsen.
 - **On existing infrastructure** the FCC platforms are particularly overcrowded in the AM Peak and unacceptable due mainly to FCC -> Northern Line movements and queueing at the top of the single downwards escalator. This is, however, a similar situation to what the station experiences today.
 - For the NL Link to be compliant at 2026+28% demand levels a reduction in usage is necessary, the most obvious passengers to displace are the FCC passengers who were originally re-routed via this link (they account for a third of the overall demand on the link). The ideal answer would be to build an FCC-CRL link coming from the front of the FCC platforms. This additional interchange link would take the NL Link stair up to +28% compliance, improve journey time significantly for FCC <-> CRL interchangers and not transfer demand onto already over capacity elements of the station.
 - The second summary sheet for Liverpool Street/Moorgate investigates the impact of sending FCC <-> CRL interchangers via existing infrastructure, namely via the Northern Line Ticket Hall and onto the Integrated TH to access Crossrail.



LIVERPOOL STREET / MOORGATE - MITIGATION RE-ROUTING REPORT
 (Option#2- FCC <-> CRL via Integrated TH)

FDC:		
Report:	C138-MMD-A-RGN-C101-50013 Rev 2.0 – Liverpool Street Station Northern Line Link Stair Passenger Modelling Study	
Model Files:	2026 AM: LIV 2026 0800-0930 AM_NLL test v03.lgm 2026 + 28% AM: LIV 2026+28_ 0800-0930 AM_NLL test v07.lgm	
ACS:	2026 AM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026AM) v1.67.xls 2026 +28% AM: 2010-10-12 ACS Liverpool Street Moorgate LU CRL Station Complex (2026 plus 28% AM) v1.5.xls	
Demand Summary Crossrail Boarders and Alighters	<p style="text-align: center;">39,050 Passengers (0700-1000hrs – 2026AM PEAK)</p>	<p style="text-align: center;">39,600 Passengers (1600-1900hrs – 2026PM PEAK)</p>
Breakpoint Summary:	<div style="border: 1px solid black; padding: 10px;"> <p>Platform Area</p> <p>Liverpool Street/Moorgate: 2026, 2026+7%, 2026+14%, 2026+21%, 2026+28%</p> <p>NL Link Vertical Circulation Area</p> <p>Liverpool Street/Moorgate: 2026, 2026+7%, 2026+14%, 2026+21%, 2026+28%</p> <p>Integrated TH [MET EB Stair]</p> <p>Liverpool Street/Moorgate: 2026, 2026+7%, 2026+14%, 2026+21%, 2026+28%</p> <p>Integrated TH [MET WB Stair]</p> <p>Liverpool Street/Moorgate: 2026, 2026+7%, 2026+14%, 2026+21%, 2026+28%</p> <p>Northern TH [PsgW to MET WB] now used by CRL passengers</p> <p>Liverpool Street/Moorgate: 2026, 2026+7%, 2026+14%, 2026+21%, 2026+28%</p> </div> <div style="margin-top: 10px;"> <p> Operates to required standard WITHOUT intervention </p> <p> Requires Intervention to operate to required standard </p> <p> Requires timetable to be followed without fault (i.e. consistently regular based headways. TPH fully achieved) to operate platform </p> <p> Requires Intervention to operate to required standard. However if this mitigation is found to be required on an ongoing basis the NTH will require extra capacity. </p> <p> in a consistent regular based headway timetable with TPH fully achieved passengers first needed as unable to board EB service between 1745-1800hrs </p> <p> Management Intervention required even in best possible service suggesting an increase in TPH is advisable </p> </div>	
Mitigations Identified?	<p style="text-align: center;"> Yes / No / None-Required [For Platform Area, and MET WB and MET EB Stairs] </p> <p style="text-align: center;"> Yes / No / None-Required [For PsgW from Northern TH to MET WB] </p>	





Details:

- The original modelling and Assumption Cover Sheets (ACS) assumed that both Northern Line and FCC to/from Crossrail interchange passengers would be routed via the new NL Link. This routing assumption is changed in this option because the NL Link stair could not be made wide enough to accommodate the forecast number of passengers (LU concession Ref: C138-003E/SP0113) and was labelled as a safety concern by the FDC. To reduce the numbers on this stair, passengers between FCC and Crossrail have been re-routed via the Integrated TH. This routing has a similar walk time from Origin to Destination as our base routing assumption so with an appropriate signage strategy in place may not require staff enforcement.
- A previous non-compliant location was the NL Link Stair, however under this routing option this new infrastructure is now compliant at 2026+28% demand levels in both the AM and PM.
- The routing via the Integrated TH means that the displaced passengers must use the Integrated TH MET EB Stair which was already registering as non-compliant from 2026+14% onwards. If this stair cannot be widened due to physical constraints then the following mitigation should be considered:
 - **Mitigation:**= If congestion levels become too high in the AM Peak staff presence will be required to turn the Integrated TH MET EB Stair into one way (up) operation with a minority of entering passengers now having to access the MET EB platform by using the Integrated TH MET WB Stair and the underpass. This one-way operation will be needed during the majority of the AM peak period and will require staff presence to enforce.
 - **Effectiveness:**= Dynamic modelling shows that this stair operates at LOS E when assessed against a Staircase LOS in 2026+28% and is hence registering as non-compliant however the modelling does not show excessive crowding at the base of this stair. As a consequence of the delay on the staircase itself, passengers can expect additional journey time over this element. If congestion levels do become too high and/or platform clearance becomes an issue staff may decide to re-direct a proportion of passengers to the NTH. However, the passageway linking the MET EB and NTH will then fail somewhere between 2026+7% and 2026+14%. Importantly, the NTH itself will need additional capacity by 2026+14%. These 'knock-on effects' of the mitigation will require physical alterations to ultimately resolve. NB. If this mitigation is found to be required on an ongoing basis the NTH will require extra capacity and the corridor linking the MET WB and NTH will need widening.

NB. If train service disruption occurs in peak periods then congestion on the Integrated TH MET EB Stair is likely to worsen. This may lead to an inability to clear the platform before the next train arrives and extended dwells, as well as increasing the possibility of non-stopping subsequent MET EB services.
- As under the previous option another non-compliant location for new infrastructure in the PM Peak is the CRL EB Platform.
 - **Mitigations** and **Effectiveness** described in 'Option#1 – FCC <-> CRL via NL Link' Summary Sheet
- As under the previous option non-compliant location is the Integrated TH MET WB Stair.
 - **Mitigations** and **Effectiveness** described in 'Option#1 – FCC <-> CRL via NL Link' Summary Sheet



WHITECHAPEL

FDC:



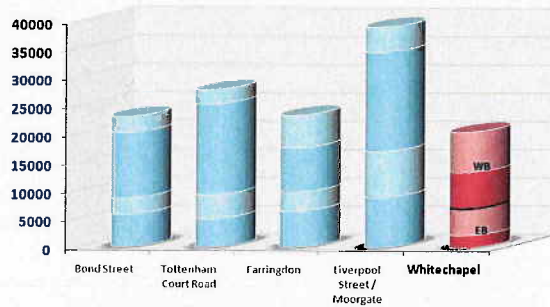
Report: **Whitechapel Revised Demand Sensitivity Report_v3.doc (Consolidated Report)**

Model Files: 2026 + 28% AM: WHI VE 2026+28% AM Sensitivity v6.lgm
 2026 + 28% PM: WHI VE 2026+28% PM (70% Any) Sensitivity v2.lgm

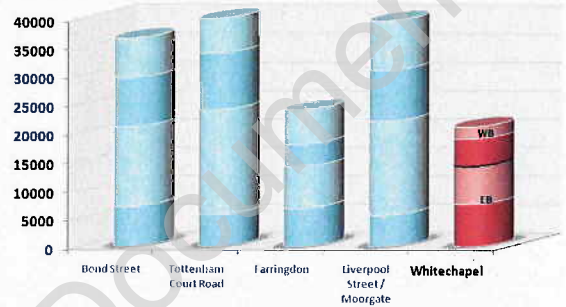
ACS: 2026 + 28% AM: ACS Whitechapel LU CRL Station Complex (2026 plus 28% AM) Sensitivity_v1.0.xls
 2026 + 28% PM: ACS Whitechapel LU CRL Station Complex (2026 plus 28% PM) Sensitivity_v1.0.xls

Demand Summary

Crossrail Boarders and Alighters

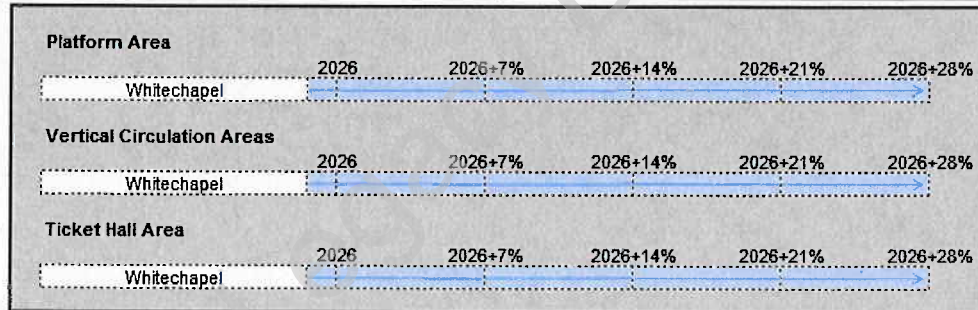


20,450 Passengers (0700-1000hrs – 2026AM PEAK)



21,000 Passengers (1600-1900hrs – 2026PM PEAK)

Breakpoint Summary:



Mitigations Identified?

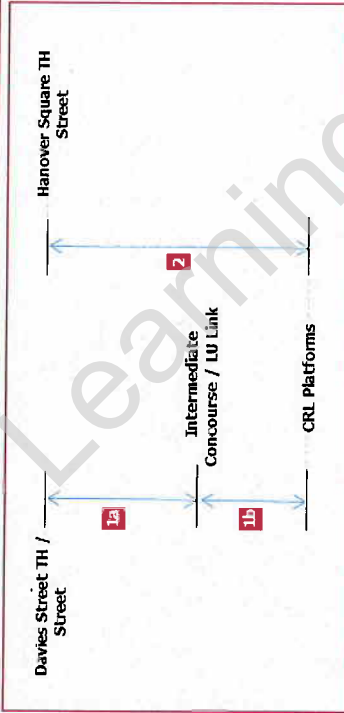
Yes / **None Required**

Details:

- Revised LU/CRL agreed demand submitted through CPFR change control in July 2011 (#CP854)
 - This report was produced by CRL and is based on these more informed figures but only shows the results at +28% demand levels. It also features the outcome of project assure workstream with escalators less than 5m in height removed and replaced with staircases.
 - The revised demand increased 2026+28% PM entry and exit by 3,200 but did not change modelling conclusions
 - No Issues coming from reviewing this report for new infrastructure
 - Hence no Interventions/mitigations identified
- Additionally:=
- On existing infrastructure** there is a known problem with ELL SB platform in the PM Peak, platforms were not widened as part of CRL build and are known to be narrow. Intervention such as station control / comms will be needed during peak periods in PM Peak. These issues may be assisted through "Project Bold" which will increase the length of ELL trains by adding an additional car.
 - Model currently assumes 70% of passengers always board the first ELL SB train (and make movements at stations such as Canada Water to board train of choice). With this optimistic measure in place platform density in peak fifteen minutes is still showing up a just over unacceptable.
 - Alternative mitigation for ELL SB platform has been identified as a one way system with access from the northern stairs and egress from the southern stair. However, the overall platform density and length of time that passengers experience unacceptable densities does not significantly improve.
 - Due to pulsing from train arrivals on the ELL platforms the existing Stairs connecting the ELL NB and HCDL platforms show unacceptable LOS E in AM Peak which is likely to cause delays to these interchange passengers

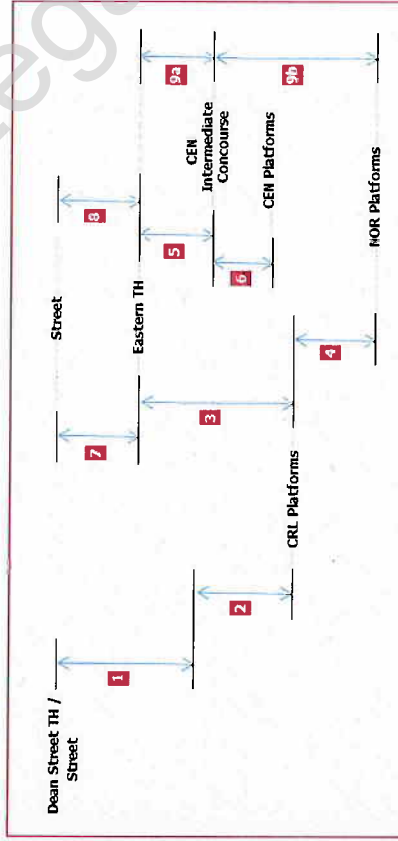
LIFT STATIC ASSESSMENTS (1 of 3)

BOS



2026+28% Demand Levels		Static Assessment assuming capacity of lift ~ 70% of plated capacity	
	AM	PM	
1a	✓	✓	Up: {100%, 100%} Down: {100%, 100%}
1b	✓	✓	Up: {100%, 100%} Down: {100%, 100%}
2	✓	✓	Up: {100%, 100%} Down: {100%, 19%}

TCR



2026+28% Demand Levels		Static Assessment assuming capacity of lift ~ 70% of plated capacity	
	AM	PM	
1	✓	✓	Up: {100%, 100%} Down: {100%, 33%}
2	✓	✓	Up: {100%, 100%} Down: {100%, 30%}
3	✓	✓	Up: {100%, 100%} Down: {100%, 18%}
4	✓	✓	Up: {100%, 100%} Down: {100%, 72%}
5	✓	✓	Up: {100%, 100%} Down: {100%, 74%}
6	✓	✓	Up: {100%, 100%} Down: {100%, 54%}
7	✓	✓	Up: {100%, 100%} Down: {100%, 59%}
8	✓	✓	Up: {100%, 100%} Down: {100%, 59%}
9a	✓	✓	Assumed not to be in use
9b	✓	✓	Up: {100%, 100%} Down: {100%, 52%}



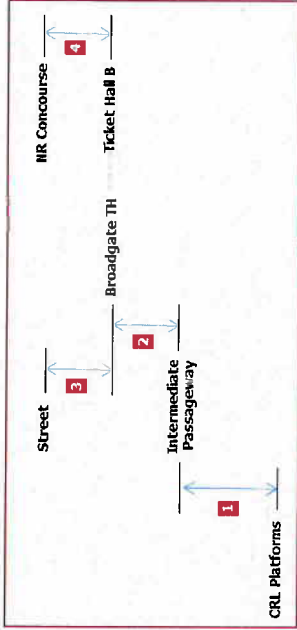
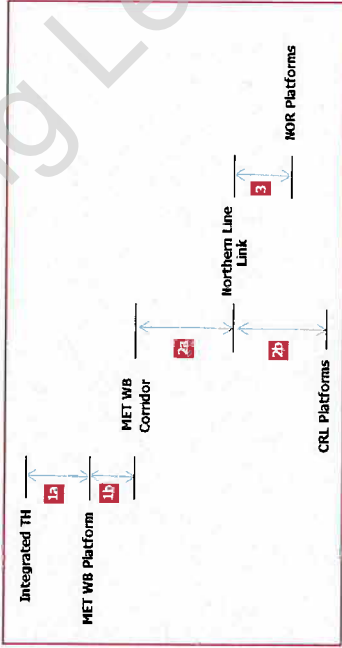
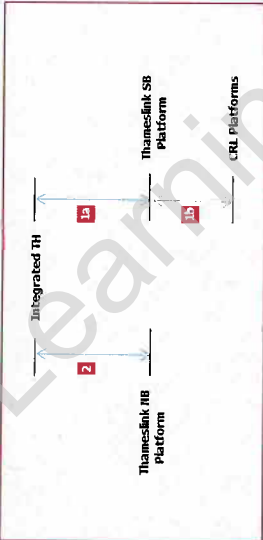
Meets PRM Types A, B, D and E static assessment

SHOPPING		AM peak	
8 Passengers by PRM Category		Entrance	Exit Av (Int)
A - Wheelchair		0.00	0.00
B - Physical mobility Impairment		0.19	0.16
C - Medium encumbrance		3.41	1.54
D - Large encumbrance		1.22	0.73
E - Buggy		0.04	0.03
Total		4.87	2.41

SHOPPING		PM peak	
8 Passengers by PRM Category		Entrance	Exit Av (Int)
A - Wheelchair		0.00	0.00
B - Physical mobility Impairment		0.27	0.22
C - Medium encumbrance		13.85	7.85
D - Large encumbrance		3.32	1.97
E - Buggy		0.06	0.12
Total		17.49	10.20

LIFT STATIC ASSESSMENTS (2 of 3)

2026+28% Demand Levels	Static Assessment assuming capacity of lift ~ 70% of plated capacity	
	AM	PM
1a	✓	✓
1b	✓	✓
2	✓	✓
2026+28% Demand Levels	Static Assessment assuming capacity of lift ~ 70% of plated capacity	
1a	✓	✗
1b	✓	✓
2a	✓	✗
2b	✓	✗
3	✓	✓
2026+28% Demand Levels	Static Assessment assuming capacity of lift ~ 70% of plated capacity	
1	✓	✓
2	✓	✓
3	✓	✓
4	✓	✓



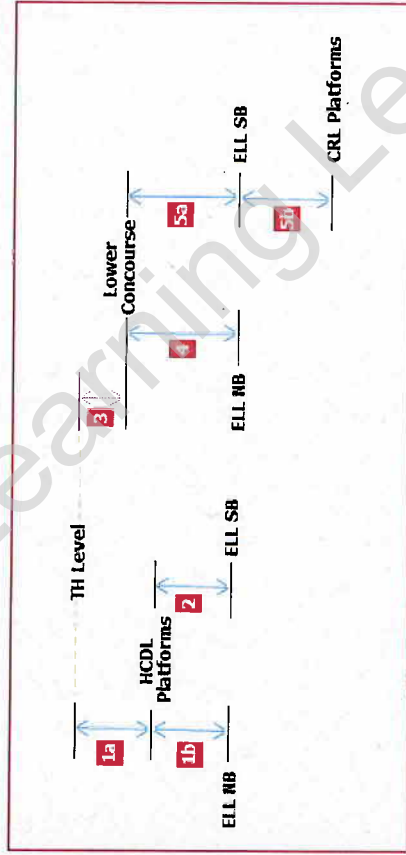
CITY	Passengers By PRM Category	PM peak		
		Entrance	Exit	Av (Int)
A	Wheelchair	0.00	0.02	0.00
B	Physical mobility Impairment	0.26	0.25	0.22
C	Medium encumbrance	2.23	5.92	7.89
D	Large encumbrance	2.05	1.46	1.97
E	Buggy	0.05	0.06	0.12
Total		10.67	7.75	10.20

CITY	Passengers By PRM Category	AM peak		
		Entrance	Exit	Av (Int)
A	Wheelchair	0.00	0.00	0.00
B	Physical mobility Impairment	0.21	0.21	0.16
C	Medium encumbrance	2.03	1.46	1.94
D	Large encumbrance	0.77	0.54	0.73
E	Buggy	0.04	0.04	0.09
Total		3.05	2.25	2.91

Meets PRM Types A,B,D and E static assessment



LIFT STATIC ASSESSMENTS (3 of 3)



WCL

2026+28% Demand Levels		Static Assessment assuming capacity of lift = 70% of plated capacity		
	AM	PM	AM	PM
1a	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 70%} Down: {100%, 48%}
1b	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 100%} Down: {100%, 100%}
2	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 100%} Down: {100%, 100%}
3	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 100%} Down: {100%, 100%}
4	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 100%} Down: {100%, 100%}
5a	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 35%} Down: {100%, 47%}
5b	✓	✓	Up: {100%, 100%} Down: {100%, 100%}	Up: {100%, 14%} Down: {100%, 38%}

{ % of PRM Types (A,B,D,E) that can be accommodated }
 { % of PRM Types (C) that can be accommodated }

INNER SIDEURB		AM Peak	
* Passengers by PRM Category	Entrance	Exit	Av (Int)
A - Wheelchair	0.00	0.00	0.00
B - Physical mobility Impairment	0.28	0.31	0.16
C - Medium encumbrance	1.65	2.02	1.54
D - Large encumbrance	0.62	0.77	0.73
E - Buggy	0.05	0.05	0.03
Total	2.64	3.19	2.91

✓ Meets PRM Types A,B,D and E static assessment

* NB: No Lift statics are shown for Barbican due to low usage expected at this end of Farringdon station. It can be assumed that there is sufficient lift capacity at 2026+28% demand levels.