Town and Country Planning Act 1990

Proof of Evidence

Site Address:
Custom House Station, Victoria Dock Road, Newham, London, E16 3BX

Planning Inspectorate References:
Xrail/5750/12/1; and
APP/G5750/A/12/2173991/NWF

London Borough of Newham References:
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PROOF OF EVIDENCE OF JONATHAN ROBERTS, JRC
IN SUPPORT OF LONDON BOROUGH OF NEWHAM

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TRANSPORT EVIDENCE

A INTRODUCTION, QUALIFICATIONS AND EXPERIENCE

1. Jonathan Roberts Consulting Ltd was appointed by the London Borough of Newham on 28th August 2012. It is the transport witness for the Borough in respect of the current appeal by Crossrail Ltd, which is against Newham's planning decision of 27th February 2012 on the proposed Custom House Crossrail station.

A.1 Qualifications

2. I am Jonathan Rosevear Sargent Roberts, Managing Director of Jonathan Roberts Consulting Ltd (JRC). I have a Diploma in Transport Studies from the University of London, and am a Fellow of the Royal Geographical Society and the Royal Society of Arts. I am a Member of the Chartered Institute of Logistics and Transport, the Chartered Institute of Public Relations, the Railway Study Association of the London School of Economics, and a life member of the Institute of Directors. I have a background in transport, human geography and public affairs, so focus on major projects and the project justification, logistics and politics.

A.2 Experience, current and recent clients

3. ***Experience***: I have 40 years' experience in working on international, national and local transport projects. JRC Ltd was formed in April 2009. In 2007-09 I headed the transport, local government and planning unit at Grayling Political Strategy, part of Huntsworth plc. Previously I was deputy managing director of Citigate Public Affairs. I led its transport, local government and planning portfolio in 1997-2007. I was a board member of Westminster Communications Ltd in 1990-97, covering similar functions, and had been a consultant with its predecessors in 1986-90. I was Assistant and then Deputy Director of the national environmental transport campaign, then known as Transport 2000, in 1980 to 1986. I was chairman of the North London Line Committee in 1975 to 1980, during which period the line was linked up via Hackney and Stratford to Custom House and North Woolwich.

4. I am an author on railways, with recent examples being:
   a. an analysis and critique of ORR station usage statistics (*Stations Count,* Modern Railways, July 2012);
   b. an assessment of the potential to extending the Bakerloo Line to SE and NW London (*Extending the Bakerloo,* Modern Railways, December 2011).

5. ***Current clients***: JRC is advising on various rail projects, and on other transport modes and topics. The rail projects include:
   a. **Authorisation and funding of a local service and third track on the Lea Valley main line**, for *Enfield Council* and *West Anglia Routes Group*. This was a JRC proposal in 2010 and is now included in the Government's High Level Output Statement for

investment in 2014-19. The project supports large scale area redevelopment in the Upper Lee Valley. Work includes definition of required outputs, outline scheme design to Network Rail's GRIP2 standard, and political project briefing and campaigning.

b. JRC is providing **transport project input and political advice on Old Oak Common transport interchange and the Park Royal Opportunity Area**. *Hammersmith & Fulham Council*: The proposal is a new interchange between Crossrail, High Speed Two, London Overground and a link to High Speed One. It is being developed in association with local development proposals for 40,000 jobs and 10,000 homes, where JRC is assisting on a combined transport and planning brief.
c. JRC is advising on **outline scheme design and the public policy case**, to *Luton Borough Council*, to support inclusion of Luton and Luton Airport in the East West Rail's central section project east from Milton Keynes to Cambridge.
d. **Rail links and rail capacity issues** arising with the proposed Thames Estuary airport schemes and alternative airport hub options, are being assessed by JRC for *Medway Council.*
e. *For Railfuture* and *Chingford Line Users Association*, JRC has developed a **public policy case to reopen Lea Bridge station**, and to support other Greater Anglia London area schemes. Lea Bridge station project is due to achieve go-ahead by end 2012.

6. ***Previous clients on rail topics**:* Some previous client work demonstrates knowledge of the locality and the Docklands area, and specialised experience relevant to the Custom House appeal. These include:
   a. *London Borough of Enfield* – Edmonton Green 'Access for All' project in 2011, which is separate from the work identified above. JRC drafted the main evidence for the Access for All bid, and conducted a station access survey to review the proportion of passengers with reduced mobility that use the station. The bid was subsequently approved by the Department for Transport.
   b. *London Borough of Southwark* – JRC undertook technical work in 2009 on the design of and the policy case for a new station entrance at Queen's Road Peckham station, to secure National Station Improvement Package (NSIP) funding, including the provision of a new ticket and information office and a lift from street-level to the island platform to achieve step-free access.
   c. *London Borough of Greenwich* – in 2005-07 I led the external public affairs advice for London Borough of Greenwich to secure a new Crossrail station at Woolwich, against the position of the Secretary of State for Transport who instructed Crossrail to oppose the proposal.
   d. *Canary Wharf Group* – I was an adviser in 2001-05 to help make the case in favour of a Crossrail main line to the Isle of Dogs and the Royals, which had not been included in the 1999 London East West Rail Study.
   e. *East London Line Group* – during 1992 to 2010 my team provided policy, technical and political advice for the 12-15 member association of London Local Authorities and the private sector and partnerships, including the East London Business Alliance, Canary Wharf Group and the London Borough of Newham, who campaigned for creation of an extended, orbital East London Line.
   f. *London Borough of Tower Hamlets* – 1992-93 lobbying on funding topics in support of the Jubilee Line Extension to the Isle of Dogs, Canning Town and Stratford.

g. *British Gas* – adviser to British Gas in 1989 in support of the Jubilee Line Extension route option via the Greenwich Peninsula instead of via Poplar.
h. *London Borough of Lewisham and London Docklands Development Corporation* – during 1989-93 I led the external public affairs advice which helped achieve inclusion of a DLR Lewisham Line Bill in Parliament and then its passage through Parliament.
i. *DLR City Extension Bill* – I was an adviser to Canary Wharf Group during 1986-87 for the DLR Bill which secured powers for an extension to Bank.
j. *British Railways Board* – I was an adviser on external relations and Parliamentary Bills including Hybrid Bills, from 1986 to 1995.

B SCOPE OF EVIDENCE

7. This transport evidence addresses:

C. The **site** for Custom House Crossrail station, in its existing form and outline intentions.

D. The **station's catchments** and points of relevance for the station's design, including assessment of locations such as ExCel and their impact on the station's operability with and without escalators.

E. The **approach to detailed design** and subsequent changes, adopted by Crossrail until RIBA Stage E and since at RIBA Stage F with value engineering, which have ultimately led to this planning appeal and Schedule 7.

F. **JRC's own assessment of station facilities**, with reference to the neighbouring DLR Custom House station and the ways in which passengers made use of the different choices of station facilities, particularly by people with reduced mobility.

G. **Further projected passenger flows** and growth in demand that may be stimulated by other projects, beyond those already discussed under the topics of station catchment and detailed design, and implications for the validity of the present station design within the planning appeal.

H. **Further assessment of the present station design from the perspective of passengers with reduced mobility (PRM)**, and whether the station is fit for use by PRM.

I. **Summary and conclusions**.

C THE SITE

C.1 Custom House Crossrail Station – existing layout and outline intentions

8. In the Custom House area, Crossrail will use the east-west route of a former main line railway which had existed since the 1840s. Latterly it was part of the North London Line. The railway's location in turn influenced the position of the Docklands Light Railway extension to Beckton when that was planned in the 1980s. Consequently there is now an available corridor between Victoria Dock Road to the north, and the DLR to the south, for Crossrail to re-use this route as a new express urban railway with a station in the locality.

9. The track formation and station platforms and buildings of this former railway remain in situ at Custom House. However the Crossrail station which replaces it will be to a fundamentally different design, and will be to standards set for a new station rather than an adaptation of existing premises.

10. This overall design solution has been required by Crossrail because it will be a much busier station than its predecessor and needs more passenger handling capacity in platforms and buildings. Because also the North London Line has been closed east of Stratford since December 2006, any works to the existing station premises would have to be to new standards from the start.

11. The Crossrail station will have a landlocked site, using this former railway formation. The positioning of the station tracks is on level ground between approach gradients to an existing tunnel eastwards under the Docks (known as the Connaught Tunnel) towards Silvertown and Woolwich, and approach gradients to new tunnels westwards at Victoria Dock portal, towards Canary Wharf and Central London.

12. Crossrail affirmed in March 2006 that the best location for the new station is on a straight and level alignment at Custom House, rather than by Prince Regent DLR station on a curve and gradient. The intended design also "exploits established links with ExCel and the high level walkway over the Royal Docks. It is also closer to residential areas than Prince Regent DLR station." [1]

D THE STATION CATCHMENT

D.1 Station catchment influenced by train services and capacities

13. The Crossrail project is to create a "world-class railway for London and the south-east" connecting "37 stations, including Heathrow airport and Maidenhead in the west with Canary Wharf, Abbey Wood and Shenfield in the east … The new stations will be on a scale not seen since the Jubilee Line Extension opened in 1999." [2]
Custom House will be one of those 9 new stations.

14. Stations will be some distance apart even in Central London, where Crossrail will have the characteristics of an express urban railway. This will be similar to travelling in Central Paris on the Reseau Express Regional (RER). It will result in faster journey times than one is used to on the conventional Underground, with competitive journey times (in minutes) from Custom House to: Canary Wharf and Woolwich (4 minutes each); Whitechapel (7); Liverpool Street (10); Farringdon (12); Tottenham Court Road (15); Bond Street (17); Paddington (20); and Heathrow T123 (43).[3]

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[1] Promoter's Response Document to Petition no.144 (LB Newham), response to Newham para.53, Crossrail's response pp. 62-63, March 2006.
[2] www.crossrail.co.uk/railway/ extracted 16.9.2012 from Crossrail website.
[3] www.crossrail.co.uk/railway/train-service/ extracted 16.9.2012 from Crossrail website.

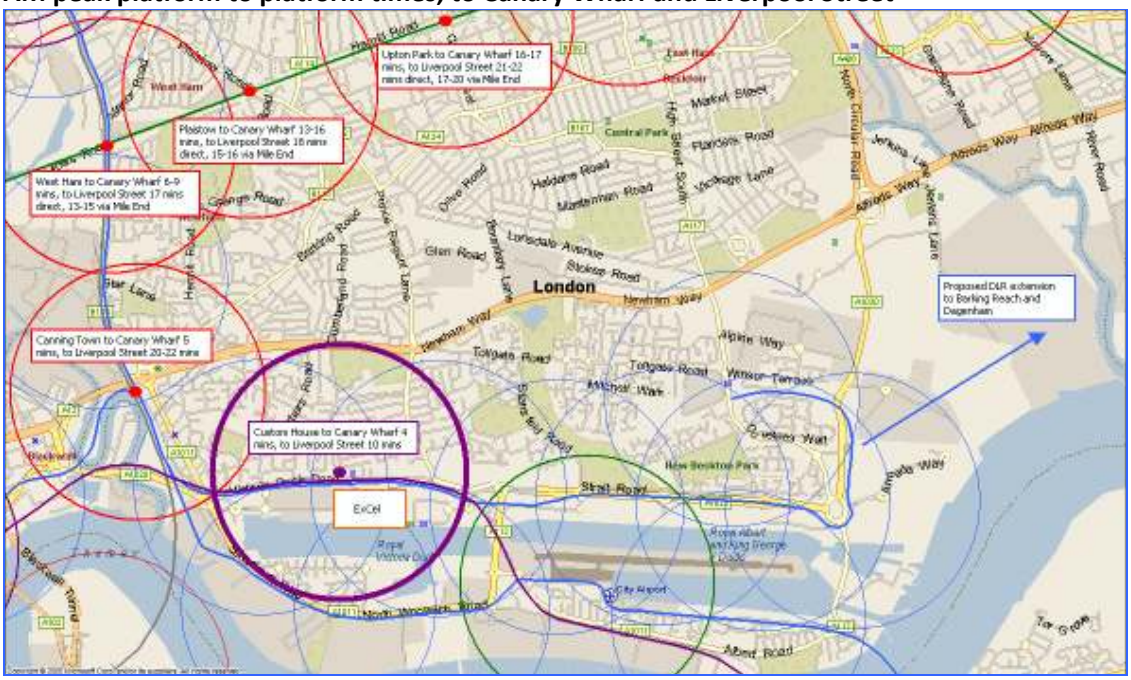
15. So it is reasonable to expect that some passengers will travel further from local catchments to access a Crossrail station, because of the overall journey time benefits that are gained.

16. The strategic location of Custom House station in the Royal Docks area is shown overleaf. The geography of Crossrail, other railways and Custom House station, in relation to the potential scale of catchment, is clear from the map.

17. Transport for London conventionally models an urban station as having greatest impact within an 800 metre zone, with access walking times of 80 metres per minute. This is approximately a 10 minute walking time if there were reasonably direct pavements and footpaths, longer if indirect access. [4]

18. Map 1 below plots an 800 metre radius from the intended Custom House station entrance location just NW of the Victoria Dock Road/Freemasons Road junction, and similar 800 metre zones from the DLR and other railway stations (Underground and main line). To show comparable journey times to key destinations, the TfL on-line website planning service [5] has been interrogated for AM peak 08:00 to show equivalent platform to platform times by existing transport modes to Canary Wharf and Liverpool Street.

MAP 1: 800 metre catchment from stations including Custom House Crossrail station: AM peak platform to platform times, to Canary Wharf and Liverpool Street



19. Custom House has the potential to be a major railhead for the Royals, particularly as it will be the only express urban railhead for the whole of the Royals, unless a station near

[4] JRC experience from current station and railway projects along the West Anglia lines
[5] http://journeyplanner.tfl.gov.uk/user/XSLT_TRIP_REQUEST2

Silvertown/London City Airport were built eventually (the green circle above is DLR's London City Airport station). There is passive provision for a Silvertown Crossrail station.

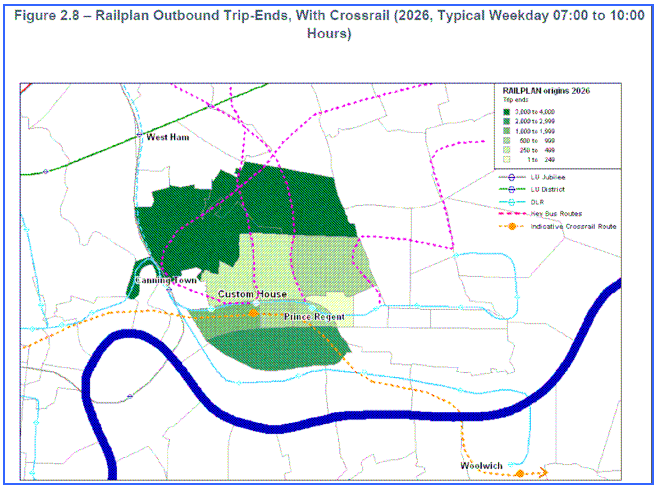
D.2 Local catchment demand

20. The walkable distance from the local catchment to alternative railway stations has to be assessed alongside the effective overall journey time to the desired destination. Taking the shortest walk to the nearest station may be less beneficial overall than a longer walk to a station with a direct rail service, more so with an express urban railway.

21. So an 800 metre radius is not the natural end of a local station catchment, it can be larger. With Custom House, for the travel destinations identified above, the local catchment is already enlarged by the savings in rail journey time. Focusing on Liverpool Street as a destination, for example, allows expansion of the Custom House catchment by at least 3 minutes towards West Ham using TfL's own walking time model, 5 minutes towards Plaistow, and 7 minutes towards Upton Park. There is then a further balancing distance before the effective catchments of Custom House and West Ham, and so on, meet each other. This is shown below visually.

MAP 2: Local catchment of Custom House Crossrail station for travel to Liverpool Street

MAP 3: Extract from Atkins catchment modelling [6]



22. The effective catchment boundary zone in this circumstance becomes the Barking Road, rather than Newham Way. This is just one example, and it serves to confirm the validity of the catchment zones modelled by Atkins for Crossrail, which are based on Railplan zones. These look beyond the Barking Road towards West Ham and the District Line, as shown in the extract above.

23. Atkins notes "It appears that once Crossrail services are introduced, there are significant numbers of trips to and from zones north of Newham Way … whereas previously there had been none. However, the greater parts of these zones are more conveniently

[6] Custom House Strategic Access Impact Report, Phase 2 Analysis of Change Report, Atkins, December 2009.

located for the District Line, and interchange with Crossrail at Whitechapel is more likely". [7]

24. Atkins has developed extensive modelling on the local potential for travel stimulated by Custom House Station, with foreseeable demand scenarios matching Crossrail's capacity planning dates. However Atkins in its Phase 3 Evaluation Report "does not set out to test the proposed Custom House station design, rather, recommendations are made for transport requirements for the interchange and its catchment area generally." [8]

25. Within the catchment, the key elements that drive variability in demand via Custom House Crossrail station and stimulate transport requirements are seen by Atkins as:
    - **Additional development areas** accessible to Custom House station.
    - **Bus interchange facilities** including a shuttle from **London City Airport**
    - **ExCel.**

26. Continuing with the local catchment, Atkins identified at a late stage in modelling additional development areas in the Custom House catchment at:
    - **Custom House West**, 1,000 homes and up to 2,000 sq. metres of retail, "this could generate up to 170 additional trips by 2016 and 2026" [9]
    - **Canning Town East**, up to 5,300 homes, 27,000 sq. metres of retail, and to 36,000 sq. metres of office space, "this could generate up to 520 additional interchange trips by 2016, 620 by 2026" [9]
    - **Canning Town North**, up to 1,100 residential units, 12,000 sq. metres of retail space, and 7,800 sq. metres of office space, "this could generate up to 40 additional interchange trips by 2016 and 2016". [9]

27. These trips are for a 3-hour peak period. Atkins comments that while the updated development assumptions point to an additional overall trip rate growth of "up to 37% by 2016 and 33% by 2026 in comparison to our original central case trip totals of 2,000 and 2,500 for those years … this is not very significant in comparison to the growth rates of our original central and high growth scenarios i.e. 224% and 492% respectively". [9]

28. There was also one continuing modelling uncertainty in the zone immediately south of Custom House, at 'Silvertown North', which was a "key potential growth area". Atkins reported that a Land Use Trip Ends (LUTE) model pointed to up to 3,000 future outbound public transport trips in the year 2016 from this zone. [10]

29. Atkins also noted that trips could be much lower than this, up to 50 outbound public transport trips, with other development assumptions. "Furthermore, trips from this zone are likely to be spread across Royal Victoria, Custom House and Prince Regent stations, and bus".

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[7] Op. cit, section 3.4, page 20.
[8] Custom House Strategic Access Impact Report, Phase 3 Evaluation Report Final, Atkins, December 2009.
[9] Phase 3 Evaluation Report, Atkins, op.cit, section 2.6, page 19.
[10] Phase 2 Analysis of Change Report, Atkins, op.cit, section. 2.3, page 11.

30. JRC draws attention to this major transport modelling discrepancy, as the Silvertown North developers contend in this appeal that "The connectivity of the site and the service of Crossrail in particular are absolutely vital to the success or otherwise of such a scheme". From the perspective of a developer seeking to achieve commercial vitality, the further point is also vital: "Our scheme alone will require a station of the highest quality, efficiency and accessibility to encourage brands and businesses to locate here".[11]

31. In its later Phase 3 report, Atkins observed that **"Custom House station will likely cope with demand levels under the original high-development scenario test, and copes adequately with current event demand from the ExCel" … "As such the implications of additional demand from these local developments are more likely to concern accessibility from key development zones, rather than capacity planning and requirements for the interchange (but not in the case where there is an ExCel event on at the same time)."** [12]

32. It should also be observed that all these Atkins reports and comments were framed in the context that Crossrail was at that stage still planning to install escalators as well as lift and stairs at Custom House station.

33. Are the comments in para.31 in relation to local development impacts on Custom House station – "will likely cope" – still applicable with the current station design? In my view, such phraseology might now turn towards "will less likely cope", if projects such as Silvertown North place increasing reliance on Crossrail.

34. The Census 2011 results are now emerging, and point to Newham having the largest population increase of all the London Boroughs, 64,000 up (26%) on 2001, to 308,000 people. [13] It was 12-30,000 above projections for 2011 made by the ONS only a year ago. The increase across Greater London as a whole was 14%, from 7.17 million to 8.17 million. Because Crossrail's forecasting has until now been aligned to 2001 data, it is possible that the sponsors' requirements for Custom House station passenger modelling or for the line as whole could now be increased.

35. While Newham has a rapidly growing population, many experience reduced mobility because of long term ill-health or disabilities. 26% of Newham's latest Household Panel Survey interviewees state they have a chronic health condition and 9% say they are disabled. [14]

D.3 Bus and DLR interchange

36. Atkins has modelled and proposed **bus interchange** facilities – these should include:
    - North side 2 stops/stands "likely to be adequate" for a **City Airport shuttle bus** [15]

[11] Letter from Sir Stuart Lipton, The Silvertown Partnership LLP, to The Planning Inspectorate, 13.9.2012
[12] Phase 3 Evaluation Report, Atkins, op.cit, section 2.6, page 20.
[13] 2011 Census first results, GLA Intelligence Unit, Intelligence Update 13-2012
[14] Understanding Newham 2011, Newham Household Panel Survey Wave 6, March 2012, 2011 fieldwork
[15] Phase 3 Evaluation Report, Atkins, op.cit, section 2.4.2, page 10.

- West side 2 stops to serve 17½ buses per hour daytime on routes 147, 321, 325
- South side 2 stops to serve these routes in the opposite direction
- 2 stands as a reserve for route changes and for rail replacement/ExCel shuttles.

37. To the extent that such buses extend the local catchment, they add to the interchange flows. Atkins puts a possible 2026 morning peak 3 hour volume at 600 journeys with unaltered routes, about 24% of the modelled entries to Custom House station. Extending buses to Custom House which only serve Prince Regent DLR station currently could add another 400 passengers. [16]

38. Atkins also suggests there might be future scope for a Thames Gateway Transit bus service to serve Custom House, such as a modified Route ELT2 linking from Barking to the Royals. [16] The impact on passenger demand at Custom House station is not identified. My professional opinion is that there would be few point-to-point flows that might be diverted this way other than Barking to the wider South East London via Crossrail, as DLR already provides a cross-river link to Woolwich. Such a Transit route might be more use for local travel to ExCel and other Royals developments.

39. **In respect of DLR**, there is still the extensive catchment east of Custom House on the DLR Beckton branch to address, which is observable on Map 1 (page 8). Transport for London has modelled high interchange flows between DLR Beckton branch and Crossrail at Custom House station, which as sponsors TfL has then instructed Crossrail to plan into the Custom House station design to be accommodated in a 2026 design year scenario.

40. Crossrail made additional forecasting allowance for a planned DLR eastern extension from Gallions to Barking Reach and Dagenham Dock, on top of sponsors' requirements, and this has been built into the 'Crossrail Project Functional Requirements', for passenger flow design of Custom House interchange for the 2026 scenarios. [17]

41. This extension is not proceeding within the TfL business planning period ending on 31st March 2015. TfL is currently looking at a possible alternative extension of London Overground from Barking to Barking Reach. [18] However it is yet possible that a DLR extension might be taken forwards in later TfL business planning periods.

42. Crossrail has in this respect planned forward capacity for DLR expansion in its 2026 design scenarios. This capacity will be available for any alternative bus links or local bus route development, if the DLR extension did not proceed.

D.4 ExCel developments

43. **ExCel** is by far and away the most important source of additional rail demand, on top of local catchment flows. It is the scale of events and visitor flows, and the frequency and timing of those events, and ExCel's forward business plan for development, which above

[16] Phase 3 Evaluation Report, Atkins, op.cit, section 2.4.2, page 13.
[17] See for example Custom House Station Demand Forecasting and Legion Modelling Information, Document CRL1-XRL-T-QAP-CR145-50001, para. 3.2, page 5, Crossrail, 28 August 2012.
[18] Verbal advice from LB Barking officer to JRC, 11 September 2012

all transform Custom House station planning into a major logistical exercise. This directly affects the planned Level of Service at the station and in turn the required scale of station facilities.

44. Atkins undertook additional assessment on Excel, in a Phase 4 Technical Note, and this is summarised now. [19] The review "identified the potential to cause significant overcrowding and conflict at Custom House" because of "ExCel's sales forecasts and capacity expansion plans (50% uplift with more concert-style facilities) … This may not be of major concern if confined to a minority of days", however "If conflict and overcrowding occur on a regular basis this would inhibit the day-to-day functioning of this key Crossrail interchange, and potentially inhibit the smooth running of events at ExCel". [20]

45. TfL felt the topic was a "considerable risk and further analysis is required in conjunction with ExCel's team to understand the level of risk". [19]

46. Data sources were shared between ExCel and Atkins. These showed about 9 events at ExCel per month up to June 2009 (having declined slightly from 2006), and with peaks and troughs within that, and seasonality causing greatest risks during the early and late summer months. Despite fewer events, there was an upwards growth in average attendance on a 12 month moving average, at June 2009 between 125,000 and 150,000 per month. ExCel works on the general assumption of an 80/20 split public vs. private transport for access. Atkins considered that it was sensible to assume full ExCel attendance numbers to assess potential pressures on Custom House station. [21] ExCel was opening a Phase 2 extension in 2010, taking maximum venue capacity to 70,000 and increasing overall floor space by 50%.

47. Detailed assessment of different types of events, and opening and closing times, led Atkins to point out that up to 40,000 attendees could arrive in 2 x 1½ hour waves of exhibitors and delegates, partly arriving in the AM peak but also busy in the inter-peak, with PM peak return flows being largely by exhibitors. ExCel noted that its biggest current operational challenge was the Festival of Life, held twice-yearly, which "sees some 20,000 people arrive in approx. 2 hours in the evening (18:00-20:00) and depart between 05:00-07:00 the following morning". [22]

48. Atkins didn't reach definitive decisions in its Phase 4 report, but noted that under ExCel expansion, "numbers could increase significantly. This may require further controls on station entries and exits for safety reasons". [23] Also it recommended more liaison with event organisers about alternative services, eg buses/coaches, with DLR and Serco about DLR operations, and about using Prince Regent DLR station as part of passenger routeing with crowd control.

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[19] Custom House Strategic Access Impact Report, Phase 4 Additional Analysis of Future ExCel Demand, Atkins, 2.11.2009.
[20] Phase 4 Additional Demand Analysis of Future ExCel, op.cit. section 1.
[21] Phase 4 Additional Demand Analysis of Future ExCel, op.cit. section 2.2.
[22] Phase 4 Additional Demand Analysis of Future ExCel, op.cit. section 3.1.
[23] Phase 4 Additional Demand Analysis of Future ExCel, op.cit. section 3.2.

49. Following the Atkins' review, Crossrail's demand assumptions were altered and there was continuing modelling work to understand the impact of large flows to and from ExCel, to "inform the Operations and Management Strategy that will subsequently be agreed by DLR and Crossrail". [24]

50. A meeting on 10th June 2010 between Crossrail and DLR [24] agreed the following key points for station design and related station management to handle major events at ExCel:
(sequence of bullets is JRC order, not Crossrail)

h. "In planning the station, the planning numbers … are intended to reflect a reasonable planning assumption of what might be expected to happen on a number of occasions during a year, and for which the station should reasonably be expected to handle without significant passenger control measures to be put in place."

i. "Any modelling will recognise that in considering a split of mode between DLR and Crossrail, there will not be any attempt to determine ultimate destination, since it likely to vary wildly between events. Modelling will therefore need to reflect a variety of sensitivities."

a. "Passengers arriving for events can use either Custom House or Prince Regent to alight for the ExCel centre, although train announcements will encourage people to get off at Custom House."

b. "For scenarios departing from an event it is assumed that the DLR WB [westbound] passengers can board at Prince Regent **with a nominally non-stop service through Custom House during major events** [JRC bold emphasis]. **This is to avoid a large egress of people from DLR trying to interchange to Crossrail at the same time as some people are trying to board at Custom House**. This would potentially reduce the DLR throughput. However this control measure would only be required with extremes of demand. DLR EB [eastbound] and Crossrail passengers [from ExCel, is the implied context] will be allowed to board at Custom House but will be held at end of the footbridge by station management until it is safe to enter."

c-f. Train service modelling and capacities to allow for:
- some DLR trains starting and finishing at ExCel so with full capacity available at 660 passengers per train at full loading with 5 people standing per sq. metre
- Crossrail with 10-car trains with 1,700 passenger capacity (at 5 people standing per sq. metre), but Crossrail trains are not expected to be empty

g. The rail mode split between Crossrail and DLR is assumed to be a 60:40 respectively.

51. The document summarising the 10th June 2010 meeting [24] defined a forecasting demand 'overlay' for major ExCel events. This set out [and shown here in a sequence of increasing volume]:
- 3,750 in ½ hr (5,000 per hr 1800-1900), arrive for evening awards event
- 7,500 in ½ hr during 1800-1900, arrive for event, for Boxing (10k in 1 hour), Festival of Life (20k in 2 hours)
- 8,000 in ½ hr (20,000 leave daytime exhibition in 3 hrs), 80% on train
- 9,000 in ½ hr (arr 0900-1030, dep 17:00-18:30)

[24] Custom House: Event Planning & Modelling, Doc. No. C146-XRL-T3-RGN-CR146-50002, Crossrail, July 2010.

- 15,000 in ½ hr (leave 0500-0630), from Festival of Life (20k in 1 hour).

52. These flows need to be added to the normal flows set by sponsors for Custom House, particularly in the AM and PM peak periods. The ExCel flows are not specified by forecast year, and there is a possibility of more or larger-scale events in more distant years, as further business plans are developed by ExCel.

53. The Crossrail sponsors in the most recent forecasting for RIBA Stage F station design, [25] combined with Crossrail's uplift for DLR to Dagenham Dock, have specified a 9,000 passenger AM or PM peak 3 hour volume, with defined exit, entry and interchange movements. [26] This number is rounded up from the combination of sponsors' requirements (8,088 passengers) and Crossrail's inflation to 8, 640 passengers for a potential DLR Dagenham Dock extension.

54. I have taken the ExCel maximum forecast volumes as a fixed number. I have then added those to the Crossrail sponsors' flows, on the basis of 50% of the 3 hour peak period occurring in one hour (which is a transport planning norm), and 60% of that busiest hour in the busiest half-hour.

55. This is less extreme than the 75% of an hourly flow seeking to arrive or depart from an ExCel event during a half-hour (as accepted by Crossrail and DLR in the previous figures), but nevertheless recognises that there will be a peak within the peak hour, among ordinary passengers.

56. There is also Crossrail's other way of defining a worst case, also assumed to be an evening event coinciding with the usual PM peak demand. Here ExCel was assumed by Crossrail to have a capacity of 18,000 people of which 70% come by train (DLR and Crossrail) with an additional 12,000 passengers using the station during the PM peak, and further assumed that passengers attending that event would arrive within 90 minutes in the middle of the PM peak period. [27] Here I have assumed that, as with normal peak flows, 50% of the main flow arrives in a third of the time (i.e. 6,000 within a half-hour).

[25] Custom House Station, Demand Forecasting and Legion Modelling Information, Doc. No. CRL1-XRL-T-QAP-CR145-50001, Crossrail, printed/pdf'ed 28.8.2012 15:34.
[26] Demand Forecasting and Legion Modelling Information, op.cit, Table 2, page 6.
[27] Demand Forecasting and Legion Modelling Information, op.cit, section 3.3, page 7.

D.5 Modelling 2026 + Event, with 4 staircases + lift

57. Combining these different information sources, we see the following maximum 2026 forecast PM peak flows at Custom House station (ie, 2026 + Event), after adopting a 60:40 split between Crossrail and DLR as agreed by them on 10th June 2010:

Black/blue: based on Crossrail 10th June 2010 ExCel planning numbers
Red: based on Crossrail Demand Forecasting and Legion Modelling Information

Maximum flow numbers at Custom House Crossrail station, PM peak period, 2026 + Event							
	3 hours	1 hour	1 hour	½ hour	½ hour	½ hour	½ hour
		+ExCel	+ExCel	+ExCel	+ExCel	% DLR	% Crossrail
hourly ExCel flow, evening awards event		5,000				at 40%	at 60%
hourly ExCel flow, Boxing/Festival of Life			10,000			of ExCel	of ExCel
STATION EXIT VOLUME							
Non-ExCel users							
Core Crossrail to exit flow (EB and WB)	2,100	1,050	525	630	630		630
Core DLR to exit flow (EB and WB)	200	100	50	60	60	60	
ExCel							
5,000 per hr 1800-1900, arrive for evening awards event				3,750			
arrive for event, for Boxing (10k in 1 hour), Festival of Life (20k in 2 hours)					7,500	3,000	4,500
Total exiting				**4,440**	**8,190**	**3,060**	**5,130**
Alternative volume if 12,000 ExCel in 90 mins, if 50% in ½ hour					6,000	2,400	3,600
Total exiting					**6,690**	**2,460**	**4,230**
STATION ENTRY VOLUME							
Core entrance to Crossrail flow (EB and WB)	700	350	175	210	210		210
Core entrance to DLR flow (EB and WB)	150	75	38	45	45	45	
Total entering				**255**	**255**	**45**	**210**
INTERCHANGE FLOW							
Interchange Crossrail to DLR	4,500	2,250	1,125	1,350	1,350	1,350	1,350
Interchange DLR to Crossrail	1,350	675	338	405	405	405	405
Total interchanging				**1,755**	**1,755**	**1,755**	**1,755**
Total flows				**6,450**	**10,200**	**4,860**	**7,095**
Alternative total flow					**8,700**	**4,260**	**6,195**

58. For the Crossrail service, with trains intended every 5 minutes during the main PM peak (some options refer to up to 16 trains per hour, about every 3-4 minutes), these flows are an average of 1,040 passengers arriving in each 5 minutes at the Crossrail platform and needing to head for the upper level concourse in the June 2010 modelling scenario, or 890 passengers in the 'red' scenario.

59. To be comfortable with these passenger flows, the stairs and lift, or stairs, lift and escalators should accommodate all such passengers within 5 or at worst 15 minutes. The overall stair dimensions proposed by Crossrail are 2.4 metres clear between handrails, [28] and a one-way stairway is taken at 35 passengers per minute per metre width, at Level of Service D. [29] If the stairs are two-way, it is reduced to 28 passengers per minute per metre width, or, if shared equally, 14 passengers each way per minute per metre width.

60. The result of this modelling is a station working within margins when in maximum passenger flow conditions. The inwards passenger flow in the June 2010 and 'red'

[28] Julie Davies, Land Use Planning Manager, Crossrail, to Chris Gascoigne, Senior Development Manager, LB Newham, email 'Legion Modelling for Custom House station', 17.9.2012, 17:00.
[29] Demand Forecasting and Legion Modelling Information, op.cit, section 5.1, page 17.

scenarios is 615 passengers in a half hour, which also needs to be accommodated. In practice the Crossrail Event Planning and Modelling document [24] talks of either running westbound DLR trains nominally non-stop through Custom House station, or of holding entry passengers back at the end of the footbridge by station management until it is safe to enter, if there is insufficient capacity on the stairs or platforms. The exiting passengers have priority.

61. Looking at the two flows separately, the 615 inwards passengers onto the Crossrail platforms are equivalent to 103 per 5 minutes. They are capable of being accommodated on 30% of a shared stairway (at a total of 336 passengers per 5 minutes) or on a single way-in stairway of their own (at 420 passengers capacity per 5 minutes).

62. The 1,040 passengers in the June 2010 scenario require 2.6 stairways with 2 with-flow stairways and a share of one 2-way stairway, or 2.5 stairways if all 3 stairways are one-way. The Fruin requirements to avoid platform congestion are met by distributing exiting and Crossrail to DLR interchange passengers on either 3 or all 4 stairways. It is possible to use all 4 in an exit mode provided that one is shared with the inwards flow, to accommodate the predicted 30% of shared flow requiring entry and for interchange from DLR to Crossrail.

63. There is a little less pressure in the 'red' scenario, with fewer peak exit passengers modelled. The 890 passengers would require 2.2 stairways including sharing one as 2-way, or just over 2.1 if all in way-out mode, so there is an improved operating margin when combined with the entry flow.

64. Overall, the modelling shows that a 4 stairways + lift combination will address the requirements of the two different 2026 PM Peak + Event scenarios which have been posed by Crossrail, if all passengers were able to use the stairs. **This sets aside the topic of passengers with reduced mobility (PRM), which is discussed below.**

D.6 Modelling 2026 + Event, with 2 escalators, 2 staircases + lift

65. Looking at the RIBA Stage E alternative of 2 stairways + 2 escalators + lift, this is in theory better because of the higher passenger handling capacity of the escalators. The standard passenger flow rate used by London Underground is 100 passengers per minute. [30] These would accommodate 1,000 of the June 2010's 1,040 passengers in 5 minutes, if both were operated in the way-out direction, leaving only 40 to use the stairs, though in practice some other passengers would be expected to use the stairs for a 6 metre vertical height.

66. With the 'red' scenario, the 2 escalators if both used in the way-out direction would have an operational margin of 110 passengers in a 5 minute period.

[30] Station Planning Standards and Guidelines, Guidance Document G371A, Issue No. A3, LUL, July 2012, section 3.10 Access and interchange, page 58.

67. Crossrail has confirmed [31] that their event modelling in document reference [25] has both escalators operating in the up [way-out] direction.

68. While the attractiveness of the escalators could cause some localised temporary crowding around the access point to the escalators, compared to dispersing passengers across 3 or 4 stairways in the without-escalators option, the dispersal is a consequence of the stairways' inefficiency and lack of appeal for passengers. Temporarily gathering around the base of 'up' escalators is a phenomenon which London commuters face frequently. The escalators would satisfactorily accommodate the passenger flow within less time than the stairs, so within the 5 minute interval between trains.

69. So it remains that passengers will prefer escalators, and the escalators would absorb the volumes adequately. LUL's Station Planning Standards and Guidelines document [32] observes that while a stairway is the preferred means of accommodating a 3 to 5 metre rise, an escalator is worthwhile if benefits are justifiable. Above 5 metres, a stairway is not presented as an option by LUL. There should be an escalator or lift.

70. It is also worth noting that the outline station management arrangements discussed in June 2010 between Crossrail and DLR, will themselves risk failing to provide adequate level of amenity. Issues include:
    - Holding back entry passengers from the local catchments, London City Airport and from ExCel
    - Non-stopping westbound DLR trains (or at least nominally stating that) with failure to offer DLR-Crossrail interchange from the eastern Royal Docks catchments
    - Risk of the station failing to accommodate total exit flows with any substantial increase in local catchment and London City Airport passenger volume above the 2026 + Event scenario
    - Risk of the station not accommodating flows for passengers with reduced mobility (PRM) in the event of the lift failing to work for whatever reason.

71. Crossrail has also modelled 2026+ 28%, which is stated to be a 2076 planning scenario. Trains would run at 30 tph on the central London section, but maintain 12 tph on the line through Custom House. [33] Because the 28% is applied on an even scaling-up across 2026 modelled flows, but is not modelled with a high volume ExCel event, the station is operating at half or less of the volumes seen with a major event, so accommodates all passengers straightforwardly. It is the high volume Event scenario which is the make or break assessment.

[31] Julie Davies, Land Use Planning Manager, Crossrail, to Chris Gascoigne, Senior Development Manager, LB Newham, email 'Further Questions Response', 18.9.2012, 17:02.
[32] Station Planning Standards and Guidance, op.cit, page 50.
[33] CRL Operations, Pedestrian Modelling Guidelines, CRL1-XRL-T3-GUI-CR080_Z-50001, 1.11.2007, section 1.3.2, page 12

D.7 London City Airport (LCA)

72. London City Airport is the local business airport for London, with a growing range of premium services to over 25 European and domestic destinations. Its passengers require high quality facilities and high quality access.

73. In 2011 the airport handled 2.4 million passengers. It has consulted on a Master Plan which was published in November 2006. [34] Phased growth was set out as:
- Phase 1, up to 3.5 million passengers per annum (mppa) by 2015
- Phase 2, developments allow LCA to handle up to 6 mppa between 2015 and 2025
- Phase 3, further developments allow LCA to handle 8 mppa by 2030 with 4,130 jobs.

74. 76% of passengers used public transport to access London City Airport in 2003, while approximately 64% drive to work with only 33% on public transport. 85% of passengers are forecast to use public transport in 2015, with 40% using DLR with its planned improvements, and amounting to 9% of overall DLR passenger volume.

75. LCA is "committed to a policy of maximising the proportion of passengers and staff accessing the Airport by public transport in general and in particular the DLR." [35] It would be challenging to change the proportion of staff using a car, unless hours of operation of rail systems were longer.

76. By 2015 around 880 passengers would use DLR in the morning peak, rising to 1,600 passengers by 2030 (890 inbound and 710 outbound) in the absence of Crossrail.

77. "LCA is a key supporter of the Crossrail scheme … its presence would widen LCA's catchment area and make the Airport even more accessible from Central and West London … At LCA check-in time for all flights is 10 minutes. Along with accessibility, this is a substantial attractive feature for business travellers and simply cannot be replicated at Heathrow". [36]

78. Overall, it can be seen that Crossrail can expand the London City Airport marketplace in competition with Heathrow, and possibly with Gatwick. In my view the critical element in enlarging this market for London City Airport will be the quality of the interchange and the shuttle bus service at Custom House.

79. The past history of shuttle bus links is that they have achieved 5% of passenger volume in a number of examples, but find it hard to exceed 10%. That would point to a potential market by 2025 of 300-600,000 passengers annually via Crossrail, which converts to a daily volume of about 1-2,000 passengers allowing for LCA's weekend flight restrictions, and 125-250 passengers in the busiest hours. A frequent mini-coach connection would be a plausible link with Custom House Crossrail station, which is only 5 minutes and 1.4 miles distant. The combination of a short 5 minute link and an express urban railway can be attractive providing the interchange is up to scratch.

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[34] Master Plan, London City Airport, November 2006.
[35] Master Plan, London City Airport, op.cit, page xi.
[36] Master Plan, London City Airport, op.cit, page 60.

80. High value passengers will not be satisfied by a poorer than desired interchange, nor also by the risk that, on returning to the UK from a business day abroad, one is delayed at Custom House in a queue of passengers waiting for an event crowd taking unknown minutes to pass by, before being able to board a Crossrail train.

D.8 Summary of Station Catchment section

81. Custom House is an exceptional station, within Crossrail and within London. It is not an average suburban station. This is for a number of reasons:

- Crossrail provides an express urban railway, which gives competitive journey time savings which in turn enlarge the effective catchment.
- Custom House will be the main railhead for the whole of the Royals area, which is nearly 3 miles long and over a ½ mile wide, plus the existing communities within the larger zone extending to Newham Way and beyond. In practice it will have its own feeder network of the DLR Beckton route and local buses.
- Via Crossrail, it will be the railhead from West London and the West End for London City Airport, which is London's local airport focused on business travel.
- The scale of the developments being achieved and planned in the Royals are important within the London Plan and for realising the Mayor's economic growth and regeneration objectives, such as the plans for Silvertown Quays.
- Custom House is the primary station for ExCel, which is London's multi-award winning £560m international venue. ExCel is the largest and most versatile venue in London with 100,000 square metres of available space and hosts the International Conference Centre. It was a major host for the Olympics and Paralympics. In the next 3 years, visitor numbers are projected to grow to more than 4 million a year. Taking ExCel alone, this generates in excess of £2 billion in economic impact for London and supports thousands of jobs.

82. The catchment of Custom House Crossrail station is much larger than the conventional TfL modelling distance of 800 metres. This is because of the train service's express urban characteristics which enlarge the local catchment and because it will be the only major, high capacity railhead within the Royal Docks area.

83. Effectively the DLR Beckton route and local buses will partly become feeders to Crossrail from the wider catchment of the Royal Docks. Consultants Atkins have recognised the importance of feeders to Crossrail, in their catchment modelling. This increases the importance of the interchange quality at Custom House.

84. Crossrail itself has factored into its demand modelling the potential for the DLR Beckton route to be extended to Barking Reach and Dagenham, so further enlarging the catchment of the Crossrail station.

85. In relation to the existing local population, Newham has recently reported high levels of poor health (26% of sample population) and disability (9%).

86. The Royal are a focus for major area regeneration and economic growth with the London Plan and local development proposals. Atkins have researched the impact of

that on the foreseeable demand and required passenger handling objectives for Custom House station.

87. There are still areas of uncertainty about the impact of future development growth on station requirements, particularly in relation to Silvertown North where forecasting offers two extremes of demand, as seen by Atkins.

88. London City Airport provides a specific traffic growth point linked to its expansion plans set out for 2006 to 2030. Crossrail will enable LCA to target West London and the West End effectively, providing there is a high quality and trusted link between the airport and Custom House station. It is Custom House station and the interchange quality and reliability which could be the weak link with Crossrail's current station plans.

89. ExCel is the greatest influence on passenger handling and station capacity requirements at Custom House. Extensive liaison with ExCel and DLR, and modelling of scenarios, has led Crossrail to the view that the worst case to be planned for is a major evening event at ExCel whose audience arrives at Custom House largely during the London commuting PM peak.

90. This has caused advance planning from 2009, 10 years before Crossrail opens, to try to anticipate the foreseeable demands and station management requirements. It is a sensitive and important issue.

91. My interpretation of the several ways that Crossrail has tried to model this demand, is that the station in its revised format (RIBA Stage F) will accommodate the forecast passenger numbers in a maximum demand scenario. However if crowd control measures had to be adopted for some major ExCel events, then there would be a reduced level of amenity for local catchment passengers, DLR interchanging passengers and London City Airport passengers.

92. Such forecasting excludes the potential of other passenger growth from the local catchment, such as Silvertown North if stimulating high passenger volume, and other sources of general and specific passenger growth on Crossrail which are discussed later.

93. The higher passenger flows accommodated on escalators compared to stairs in high flow scenarios, would in my opinion assist the handling of large crowds in such scenarios. Intervention with station crowd control would be required less often. Escalators would therefore be of general benefit to the level of amenity available to all passengers, leaving or entering the station, during major events at ExCel.

E APPROACH TO DESIGN UNTIL RIBA STAGE E, AND CHANGES IN RIBA STAGE F

94. Station design is influenced by location, train service volume, catchment and interchange requirements, and station functionality and legally required elements.

95. The underlying context for Newham's planning decision in February 2012, to require an escalator review clause, was as the result of a change of mind by Crossrail about the station design. Throughout the pre-Bill consultation, the Hybrid Bill, and subsequently

after the Crossrail Act 2008 through 2009, Crossrail had publicly stated its intention to have escalators, as well as lifts and stairs, between the new Custom House station platform and the passenger circulating area in the proposed upper level station building.

96. Consequently while Newham had raised a number of topics in its petition to the House of Commons' Select Committee, during the passage of the Crossrail Bill, the risk of losing the proposed escalators had not been raised. Nor was it a topic during the Lords' Select Committee, where Newham focused on the lack of step-free access at Maryland and Manor Park stations.

97. Indeed Crossrail made positive responses during the Hybrid Bill on a number of relevant topics. The points are summarised below from the House of Commons' Select Committee petitioning by Newham: [37]

- *Petition para.33 – adequacy of modelling and capacity of new stations:* Crossrail response included: "There may be opportunities to introduce … improvements at the stations to further improve passenger access and interchange with other modes … There could also be … new facilities to be introduced to improve wider passenger links to Crossrail stations".
- *Petition para.37 – facilities for people with disabilities:* Crossrail confirmed the intention to provide access for people with disabilities at Custom House station.
- *Petition para.53 – improvements to bus interchange arrangements:* Crossrail accepted that the bus network will play an important role in providing access to and from Crossrail at Custom House, though it was too early to define what this network might be.
- *Petition para.54 – assurances on simple and convenient DLR interchanges:* Crossrail confirmed that simple and convenient interchanges with the DLR will be available when the Crossrail station at Custom House is constructed. The proposed Crossrail ticket hall will provide controlled entry and exit to both the Crossrail and DLR platforms with access to all platforms provided by lift, escalator or stairs.

98. The simple starting fact is that up to and including RIBA Stage E station design in 2010, Crossrail was explicitly planning to have a combination of 2 escalators, a lift and 2 stairways to link the upper level station concourse (which is also the DLR interchange, the start of the ExCel walkway and the exit northwards) with the Crossrail island platform below.

99. The station design functioned adequately in RIBA Stage E with these facilities, based on the forecast passenger flows, and indeed mirrored the quality of the DLR station which has 2 escalators, 2 lifts and one wide stairway.

100. That it was the 'value engineering' exercise, and only that, which stimulated Crossrail to take out the escalators and some other features, is made clear in Crossrail's RIBA Stage F Legion Modelling Report where it is stated that: "The Atkins/Arup Design Team has been appointed under contract C146 to develop the design of Custom House station from the

[37] Crossrail Bill, House of Commons Select Committee, Petition No. 144: London Borough of Newham, Promoter's Response Document, March 2006.

existing SD3 Station Design to RIBA Stage F. The design is presently being developed at RIBA Stage F, following the implementation of a number of value engineering opportunities which have been **instructed** following the completion of RIBA Stage E". [38] [JRC bold emphasis]

101. Even after that date, Transport for London was displaying a split personality. In Modern Railways' Crossrail update article on October 2011, TfL was promoting the benefits of escalators: "Finally, commuters are now benefiting from new escalators at Custom House [DLR] station which have been delivered as part of the flurry of spending designed to make east London public transport fit for the 2012 Olympics. Transport for London Rail Chief Operations Officer Howard Smith described the two new 77-step escalators as a legacy for Crossrail as they will provide an interchange between the Docklands Light Railway and Crossrail. Costing £2.7 million, the new escalators are said to have increased the capacity of the [DLR] station from 157 to 270 passengers a minute." [39]

102. It is paradoxical, that it will be the DLR station which will have the better range of access and interchange facilities, served by 3-car trains with a maximum loading capacity of 660 people per train at up to 24 trains per hour (tph), so a maximum of 15,840 passengers one-way per hour. The so-called 'world-class' Crossrail station will load up to 27,200 passengers one-way per hour (though some passengers will stay on the train to other destinations). This is with up to 16 tph in high volume Excel scenarios, and a maximum loading capacity of 1,700 per train. [40] As noted already at para.50g above, Crossrail and DLR agreed the rail mode split between their services as 60: 40 respectively for a high volume ExCel event. But the Crossrail platforms are now proposed to have no escalators, and to operate instead with 4 stairways and one lift.

E.1 Location

103. The North London Line was a double-track railway, latterly singled east of Custom House station, but the station remained double-track with narrow side platforms north and south of the tracks. The new Crossrail station replaces that with a new island platform with tracks either side, to maximise platform space and passenger handling capacity.

104. Access to the station from the local catchment will be organised from the north of Victoria Dock Road, rather than the extant station entrance to the south (which is currently in use just for DLR). There will be a high level walkway from a new station entrance NW of the junction of Freemasons Road and Victoria Dock Road, north of the station, to the main station area.

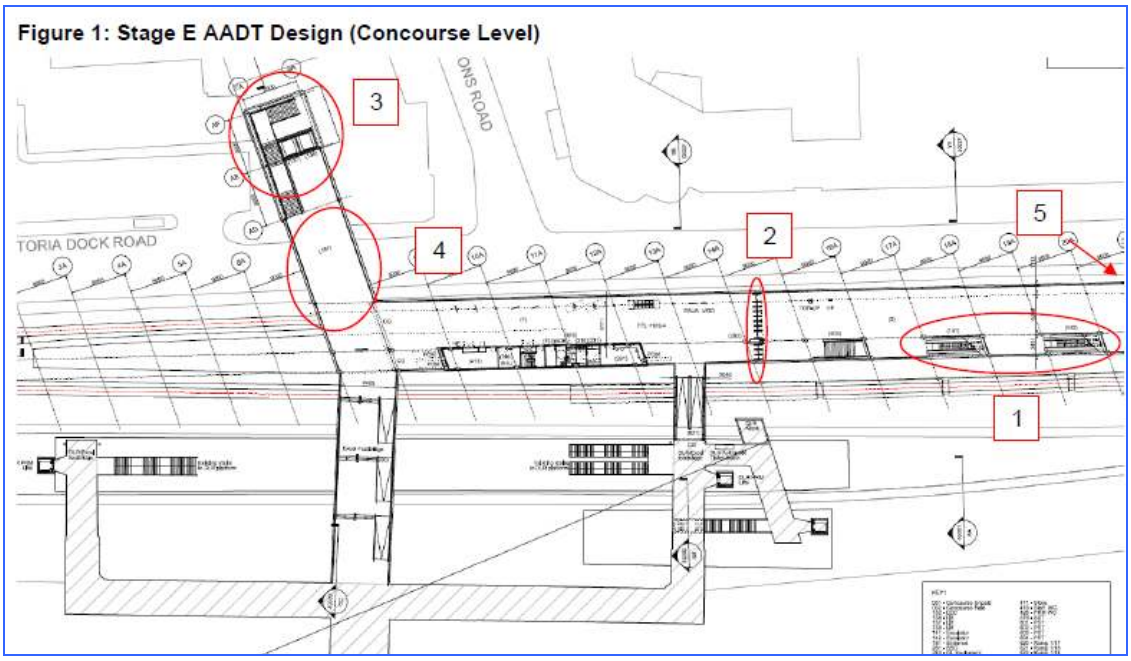
105. The extant station entrance takes up valuable space south of Victoria Dock Road. Consequently there will be a new station concourse over the Crossrail tracks, with connections to the existing DLR eastern walkway. Removing all unnecessary elements

[38] Design Package C146 Custom House Station, RIBA Stage F Legion Modelling Report C146-ATK-Z-XMO-CR145-00003, Crossrail, 4.11.2010, section 1.1, page4.
[39] Crossrail Update, Dan Harvey, Modern Railways, October 2011, page 98, quoting Howard Smith, TfL
[40] Custom House Event Planning and Modelling, op.cit, section 2, pages 1-2.

off the platform allows the maximum possible island platform width for Crossrail, with its eastbound track alongside Victoria Dock Road and its westbound track alongside the eastbound DLR track.

106. Vertical connections between the walkway and the platform were originally proposed by stairways, lift and escalator, and these were developed to RIBA Stage E. There would have been 2 escalators just west of the centre of the island platform, with the escalator base opposite cars 4 and 5 of a 10 car train facing west, with car 1 at the front). They would have been flanked both to the east and west by one stairway, opposite cars 3 and 6. The lift was planned to be further east, opposite car 7. See abbreviated plan below, the escalators are circled as **1**, and the lift is arrowed off plan as **5**:

Figure 1: Stage E AADT Design (Concourse Level)



From Crossrail RIBA Stage F Legion Modelling Report C146-ATK-Z-XMO-CR145-00003, 4.11.2010, page 4.

107. To and from ExCel, the existing high level would be extended, a new direct route created from the Crossrail concourse, and space provided to allow crowd management during occurrences of high passenger flows between either or both railways and the exhibition centre. Crossrail and DLR agreed high level operational arrangements for crowd management, and these have been highlighted already in this report, at para.50.

E.2 Train service volume

108. The intended service on the SE section of Crossrail between Whitechapel, Canary Wharf, Custom House, Woolwich and Abbey Wood is a commuter peak service with a maximum of 12 trains per hour (tph) – approximately one train in each direction every 5 minutes. This will dovetail with 12 tph on the Shenfield line, making 24 tph across Central London.

109. In the original Crossrail scheme, the service in West London would reduce to 10 tph west of Paddington, with 14 tph terminating from the east at Paddington (operationally,

trains would reverse at Westbourne Park), and then return east. The 10 tph west would be 4 tph Heathrow, 4 tph Maidenhead and 2 tph West Drayton or Slough.

110. The peak train service would run on weekdays from 7:45 to 9:15 and from 16:45 to 18:15. During the peak shoulders there would be 20 tph in Central London, implying 10 tph through Custom House. A 16 tph (implies 8 tph via Custom House) would operate for much of the remainder of the daytime, evenings and weekends. [41]

111. Train services would reduce at other times of day and week through Custom House station though could be reinstated to cater for exceptional flows at ExCel. The June 2010 operational discussion between Crossrail and DLR for ExCel event planning references modelling for up to 16 tph on Crossrail through Custom House. [42]

112. Taken together with the service frequency information above, it implies that the Crossrail service via Custom House could be doubled to 16 tph when ExCel has a major event on, when the Shenfield route is operated at 8 tph during the off peak. I expect the operational cap would be 24 tph through Central London, so that the Custom House service could be 24 tph less whatever the prevailing Shenfield route frequency is.

113. Crossrail's train design has to be a compromise between high standing capacity and limited seating for the inner urban zone, and more seats for longer journeys. The intended design will have about 450 seats [43] and peak capacity for up to 1,700 passengers per train at 5 passengers standing for square metre, and this is used by Crossrail's station planning for Custom House station with events [24] though most public statements refer to up to 1,500 passengers [43]

114. This capacity will be in 10 x 20 metre long cars, with an overall length including carriage connections of 205 metres.

115. There is passive provision in Crossrail's infrastructure designs for increasing to 30 tph and 12-car trains, which for Custom House would add 50% to potential hourly line capacity and to passenger handling requirements at stations. However nothing will physically be built to deliver this, except for unused space set aside for platform extensions alongside the tracks. 30 tph is used in the 2026 + 28% scenario modelling.

E.3 Interchange requirements

116. The effective operation of Custom House station as an interchange is fundamental to Crossrail serving the whole of the Royal Docks area efficiently and achieving the maximum accessibility and economic impact with this catchment.

117. Custom House station as noted in para.81 will be the main railhead for the whole of the Royals area. So Crossrail's consultants Atkins have identified opportunities for better

[41] Crossrail Information Paper A2, Service Pattern, v1, 9.12.2005. This may evolve as forecasts change.
[42] Custom House: Event Planning & Modelling, Doc. No. C146-XRL-T3-RGN-CR146-50002, Crossrail, July 2010, para.2c, page 1.
[43] http://www.crossrail.co.uk/assets/download/4962

connectivity with bus routes, and have specified an improved bus stopping arrangement at Custom House centred on the new station entrance north of Victoria Dock Road.

118. Crossrail themselves have made additional provision in their station passenger flow estimates, for possible additional interchange flows between Crossrail and DLR, if DLR were to extend the Beckton route to Barking Reach and Dagenham Dock.

119. In the AM peak, these combined flows are a high volume, set out below:

Custom House interchange	**Projected AM peak volume**	
2026 forecasts or those available	**Extra passengers in 3 hours**	**Source**
Buses		
Unaltered routes	600	Atkins
Routes extended from Prince Regent	400	Atkins
Thames Gateway Transit, eg ELT2	no estimate	Atkins
London City Airport shuttle	125-250 per hr, ? 250-500 peak	JRC
DLR		
Beckton route i/c with Crossrail	4,500	Sponsors
Extension to Barking Reach, Dagenham	562	Crossrail
figure above is net change from		
Sponsors' Requirements to	**TOTAL**	
Crossrail Functional Project Requirements	**6,312-6,562**	

120. This is over 3,000 passengers in the busiest hour inconvenienced by lack of escalators, in one direction of interchange or the other. Scaled up, this is close to 4 million passengers a year. If cumulatively this volume of passengers saved only a ½ minute in generalised journey time through improved amenity, by having two escalators at the Crossrail platforms, this would be worth £280,000 a year in time savings in current value. [44] This topic is explored further below.

121. The London Borough of Newham had expressed concern about the adequacy of the facilities at Custom House station on several occasions.

122. In its main petition (no. 144) to the Crossrail Hybrid Bill's Commons Select Committee, Newham in paragraph 33 raised the topic of transport modelling in relation to the capacity of all new stations within the Borough. Newham were particularly concerned to ensure that Crossrail took the opportunity to make the best possible provisions for interchange between Crossrail and other existing lines and that the stations were designed to cater for projected passenger growth in the future.

[44] The average value of time for TfL passengers is put at £8.38 per hour or 13.97 pence per minute in TfL's Business Case Development Manual, issued May 2008, and referenced in LUL's Station Modelling with Legion Best Practice Guide, v2, 3.7.2009, section 5.2, page 10.

123. Crossrail had responded in March 2006 (Promoter's Response Document to the House of Commons Select Committee) [45] that:
"2. **There may be opportunities to introduce** measures that can be carried out for the benefit of road users and pedestrians **and improvements at the stations to further improve passenger access and interchange with other modes**. These could include minor highway alterations, relocation of bus stops, taxi bays and provision of new or relocated pedestrian and cycle facilities at or near stations. **There could also be** opportunities for other measures such as revised bus services or **new facilities to be introduced to improve wider passenger links to Crossrail stations**. These opportunities would be progressed in discussion with stakeholders, and would require the commitment of a number of stakeholders, including the petitioner." [JRC bold emphasis]

124. Newham sought assurances from Crossrail in petition paragraph 54 that "irrespective of the exact location of the Crossrail station in the Royals, there will be **simple and convenient interchanges with the DLR**, particularly in the context of an extension of the Beckton branch of the DLR into Barking Reach".

125. Crossrail replied:
"1. The Promoter can confirm that simple and convenient interchanges with the DLR will be available when the Crossrail station at Custom House is constructed. The proposed Crossrail ticket hall will provide controlled entry and exit to both the Crossrail and DLR platforms with access to all platforms provided by lift, escalator or stairs." [46]

E.4 Station functionality

126. Crossrail's functional modelling at station elements at RIBA Stage E and Stage F have demonstrated the functionality of both station designs, with and without-escalators, on the assumptions and planning parameters adopted.

127. I question the validity of the planning parameters used for people with reduced mobility. However this point is addressed later in section H. In other respects both designs work, though with slender operating margins and the need already to plan for crowd control, years ahead of this part of the railway opening.

128. My assessment in sections D.5 and D.6 show that escalators offer the greater operating margin. This may prove to be important if passenger usage of Crossrail grows faster than the sponsors have considered. This is also discussed below in section G.

129. Detailed design work for the station, as for other new stations, is informed by a tiered sequence:
- Design expectations for Crossrail as a whole and for this station.
- Planning standards for different elements of the station and station operations.
- Minimum requirements for passenger flow.
- Passenger and staff safety requirements.

[45] Crossrail Bill, House of Commons Select Committee, Petition No. 144: London Borough of Newham, Promoter's Response Document, March 2006, response to petition para.33, page 39.
[46] Promoter's Response Document, op.cit, response to petition para.54, page 64.

- Other factors such as fitting into the locality, and environmental requirements.
- All this is influenced by the anticipated total passenger flows by year and time of day.
- A suite of complex formulae and computer modelling then assigns projected flows into Levels of Service (LoS) for different parts of the station, with minimum LoS required for different elements.
- Not untypically, we can see passenger flow assessment by 15 minute periods at projected busy times of day.
- 'Legion' modelling software is used to define and validate the necessary size of passageways, space for ticket machines, stairways, platform widths and so on.
- For passenger congestion, a 'Fruin' index can be defined through computer modelling which shows the Cumulative Mean Density of passengers at specified locations. (Professor Fruin devised the index, initially for use in airports, in 1971.)
- Again there are 'Fruin' standards for Level of Service, which can be used as benchmarks.
- Separate standards have been developed by London Underground and others, for how to allocate the use of different station facilities such as stairways, escalators and lifts, by passengers with reduced mobility (PRM).

130. A lot of this process is 'plug and play' driven by formulae and complex computer programs. However it is also hugely dependent on the primary assumptions about passenger usage during specific projected years, and use of sensitivity tests to show a sufficient degree of robustness in the forecasting not just during the year the station opens, but well into the future.

131. Also there should be awareness about the foreseeable primary roles of the station in relation to its catchment and other factors. Crossrail's Custom House is not a standard suburban station; it is an exceptional station, as set out in para.81.

E.5 How Crossrail made design changes between RIBA Stage E and Stage F

132. The design for Custom House station was changed following value engineering by Crossrail. Crossrail's sponsors, the Department for Transport (DfT) and Transport for London (TfL), sought large scale cost reductions in the project to make the overall costs and project risks acceptable to HM Treasury. Ultimately that exercise achieved an overall project capital cost reduction of £1.4bn, from £15.9bn to £14.5bn. Treasury has since signed-off the key Stage 4 assessment which entitles the current main project sponsor, TfL, to proceed with procurement and construction, and these are under way.

133. The main focus of value engineering was to review the costs and relevance of each major element and its proposed components. For some types of work such as station boxes and tunnels, this could involve entire redesign. For other work the need for specific facilities and the scale of those facilities was re-evaluated.

134. The station layout at Custom House was already tightly constrained by the overall space available and the need to dovetail with existing walkways to and from Excel. Therefore

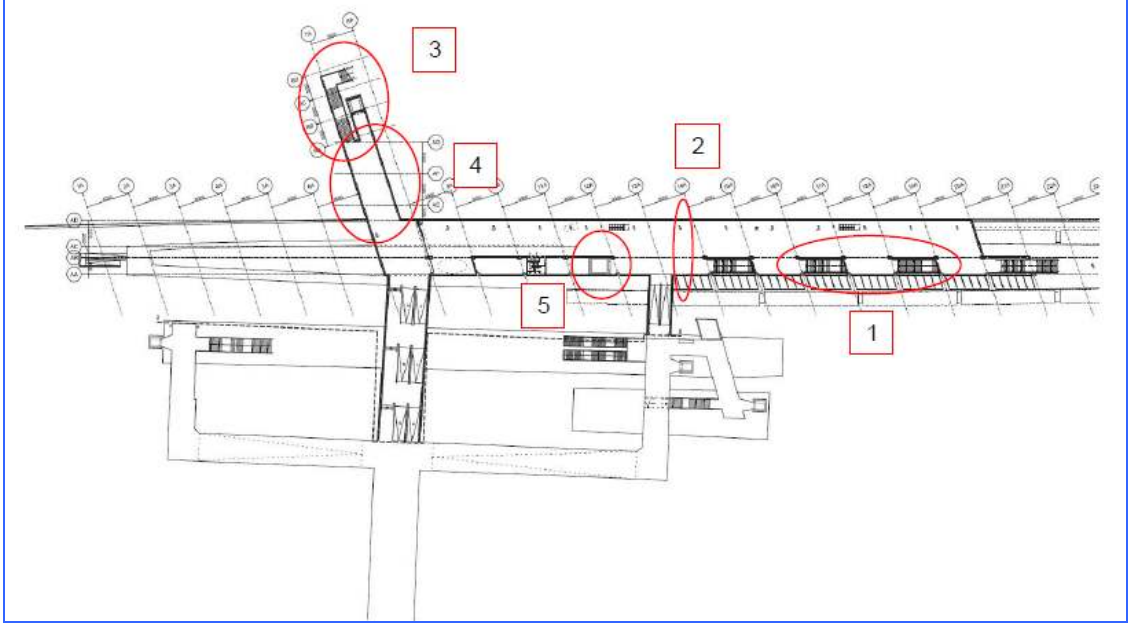
the main scope for cost reduction at Custom House was in the need for and the scale of all elements between the station platform and the external world:

- the stairs lifts and escalators that were planned to link the platform and the upper level station concourse
- size of the concourse and walkways and the facilities offered
- staff accommodation
- facilities at the proposed new northern entrance to the station.

135. The Stage E design included 2 escalators, 1 lift and 1 staircase between the island platform and the station upper level, and 1 staircase and 2 lifts at the Victoria Dock Road north entrance. See the Stage E plan, below para.106.

136. The Stage F design removes the 2 escalators between the island platform and the station upper level, and substitutes 2 staircases (**1**) on the plan below, making 4 staircases and 1 lift in total. 1 of the 2 lifts is removed at the Victoria Dock Road entrance (**3**), reducing this access to 1 staircase and 1 lift, to serve both Crossrail and DLR local access including from the expanding local community and interchange with local buses and a London City Airport shuttle link:

Figure 2: Stage F AADT Design (Concourse Level)



From Crossrail RIBA Stage F Legion Modelling Report C146-ATK-Z-XMO-CR145-00003, 4.11.2010, page 4.

137. There are other important changes:

- Removal of a physical ticket gateline and inclusion instead of ticket validators (eg, click-in click-out but without obstructions to passenger flow), which allows the staircases (and, currently, passive provision for escalators) to be moved further west and thus closer to the Victoria Dock Road and ExCel entrances/exits (**2**).

- Because of a reduction in station staff accommodation, it is now feasible to relocate the lift between the station upper level and the platform, to the western part of the platform (approximately alongside car 1 counting from the front, of a 10 car train heading west), instead of being opposite car 7 further east along the platform (**5**). This is much closer to the main ExCel entrance/exit and the access for Victoria Dock Road.
- Crossrail says "this provides considerable journey time savings and significantly shorter walk distances for PRMs (up to 200m shorter distance)". [47]

E.6 Does the station function better in RIBA Stage F?

138. I have concerns about the new location of the lift, as PRM passengers will need to make their way to the western end of the Crossrail platform against the flow of passengers heading for the stairs and or escalators. However the general shortening of intra-station and interchange distances by removing the gateline, is beneficial, by enabling all accesses to be shifted west towards the main walkways to ExCel and the Victoria Dock Road entry/exit. Value engineering therefore can achieve some benefits to passengers.

139. Such a general relocation will help both options for a Stage F outcome: a design with escalators, as well as a design without escalators. In both instances, set against the previous Stage E design with station facilities located further east, passenger flow times will be shorter, which is beneficial, and capital costs should be lower for the upper level passenger and staff accommodation areas.

140. As a result of this exercise Crossrail did judge that the station will function adequately. In some modelling it considered that the station will function better, without rather than with escalators compared to the pre value engineering design. This is covered in Crossrail's note on Custom House Passenger Number Predictions. [48]

141. This says "the model shows that [in a 2076 scenario, ie 2026 + 28%, with 30 tph] where escalators are introduced congestion occurs at the foot of the up escalator as passengers alight from incoming trains onto the platforms. Having four stairs and no escalators, which is Crossrail's current and preferred design solution for the station, means that alighting passengers spread more evenly between the stairs rather than favouring the **single up escalator**, so localised queueing is reduced". [JRC bold emphasis].

142. The note continues: "The omission of escalators does not therefore reduce the ability of the station to clear large volumes of passengers during events; on the contrary it will lead to a reduction in congestion and a more even flow of passenger movements and improved interchange between Crossrail and DLR".

143. This key feature of this note is the modelling of a **single up escalator** for 2026 + 28%. The consequent congestion round just a single escalator heading in the peak flow

[47] Design Package C146 Custom House Station, RIBA Stage F Legion Modelling Report C146-ATK-Z-XMO-CR145-00003, Crossrail, 4.11.2010, section 1.1, page4.
[48] Custom House Passenger Number Predictions, Crossrail, 17.5.2011, page 2.

direction is scarcely surprising. Most train operators including DLR are ready to reverse the flows of escalators to address peak directions of passenger flow, and DLR undertakes this at Custom House as required. LUL also does this at busy stations.

144. Crossrail has since confirmed (18th September 2012) that at least some of its modelling has both escalators operated in the peak flow direction, for example in CRL1-XRL-T-QAP-CR145-50001 rev 1 (Demand Forecasting and Legion Modelling Information), Fig.13, page 23. This particular modelling is for a 2026 + Event scenario so it is busy and congested but works with 2 escalators and 2 stairways and a lift, as does Fig.14 for the same scenario but this time with 4 stairs and a lift. "The modelled event scenarios have shown that the platform will clear before the next train". [49] [50]

145. The point made in Crossrail's 17th May 2011 note about 2076 modelling (ie 2026 + 28%) is therefore not accepted, once modelling is undertaken with two escalators, and this point is also discussed at paras. 67-69.

146. Overall, I find that the answer to the question posed, does the station function better with RIBA Stage F compared to Stage E, is in general yes. I have expressed a reservation about the lift and PRMs and expand on this topic in section H. I also have the observation that Crossrail's current-day modelling, which has two escalators operating in the peak flow direction, shows that both design options, of a with or without escalator Stage F station, function adequately in the 2026 + Event and 2026 + 28% scenarios. Indeed Crossrail is content to make passive provision in its without-escalator Stage F design, to accommodate escalators at a later date. It surely wouldn't have done that unless it was satisfied that escalators were feasible and operationally viable.

E.7 Current status of the station design

147. Since Crossrail developed its Stage F scheme with only passive provision for escalators, Newham has considered its position on Crossrail's detailed planning application, in early 2012. The Council was not satisfied that the removal of escalators between the platform and the upper level station concourse was a justified change.

148. Nevertheless it was mindful of trying to support Crossrail's overall progress with the project, and decided not to reject the application but inserted a precautionary 'escalator review clause' whose terms and purpose is set out in Chris Gascoigne's proof of evidence as Senior Development Officer for Newham.

149. Crossrail is now appealing against the imposition of this condition, under various headings.

150. Meanwhile there is a failure to maintain the previously proposed level of amenity, so this effectively sets aside the benefit/cost arguments of retaining directly beneficial passenger amenities – the 2 escalators.

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[49] Demand Forecasting and Legion Modelling Information, CRL1-XRL-T-QAP-CR145-50001 rev 1, Crossrail, page.23.
[50] See reference [31].

151. Passengers interchanging via buses have also faced a loss of a second lift, between the upper level walkway/station concourse and Victoria Dock Road. Only one lift is to be kept there, and Crossrail has euphemistically said that "The lift is not required from a passenger flow perspective and management strategies will be employed if the remaining lift is out of service." [51]

152. Overall the loss of two escalators, to say nothing of the Victoria Dock Road second lift, demonstrates a failure of project strategy – a world class railway – to be maintained for front-line passenger facilities in the face of financial pressures.

153. This 'double whammy' will cause further loss of amenity and journey time penalties for those who have reduced mobility, as well as causing direct or indirect journey penalties for able-bodied passengers who might have benefited from the escalator or been less hindered by others.

F JRC CUSTOM HOUSE STATION SURVEY 2nd September 2012

154. To establish an evidential baseline about the revealed preference of passengers, comparing the choices between escalator and lift, and between lift and stairs, JRC undertook, at Newham's request, a survey of the DLR Custom House station facilities on Sunday 2nd September 2012, between 07:00 and 17:00 during the Paralympics.

155. The purpose was not to define absolute volumes of use, but relative proportions of use between the different station facilities, as this was a major spectator and participation event and therefore representing one type of ExCel output, with the volume of spectators and officials providing a large sample size.

156. The summary of the JRC survey report (JRC 517, 17th September 2012) is set out below, and the full report is attached as **Annex A**.

157. A summary table showed the revealed preference of passengers with reduced mobility (PRM), is extracted from the JRC report and set out below.

158. Because the station largely operated with a one-way flow during the day, it is possible to see the way PRM users made their choices at the eastern exit (escalators or lift) and at the western exit (stairs or lift). Among the able-bodied, the proportions were 74% escalators and 26% stairs, similar to the pushchair user proportions.

[51] Design Package C146 Custom House Station, RIBA Stage F Legion Modelling Report, Doc. No. C146-ATK-Z-XMO-CR145-00003, Crossrail, 4.11.2010, para.1.2.3, page 4.

Distribution of passengers with reduced mobility (PRM) between station facilities by passenger type - this was effectively a revealed preference survey				
	Custom House western exit		Custom House eastern exit	
	Choice between lifts and stairs		Choice between lift and escalators	
	Lift	Stairs	Lift	Escalators
Wheelchair users	100%	0%	93%	7% (none stair-adapted)
Pushchair / pram etc users	86%	14%	25%	75%
Encumbered with baggage	56%	44%	0%	100%
Infirm walking passengers	54%	46%	0%	100%
Other users	100%	0%	-	-

159. This provides clear evidence that, given a choice, there is a 3 : 1 ratio in favour of escalators vs stairs among large volumes of users: the able-bodied and the ambulant PRMs with pushchairs and accompanying passengers. The pushchair PRMs and those accompanying amounted to half of all surveyed PRM numbers, with 785 of 1,569 people.

F.1 Summary of JRC survey at DLR Custom House

160. The survey of persons with reduced mobility (PRM) on Sunday 2nd September 2012 revealed that 9.3% of arrivals between 7AM and 5PM, an estimated 1,569 people, had reduced mobility or accompanied such persons. Some would head for the local catchment, but the vast majority were attending the Paralympics.

161. When given an option, the majority of people who could use an escalator conveniently, used it. Hence 75% of pushchair users on the eastern escalators vs 25% via lift. When faced with a choice of lift or 6 metre stairs, most (86%) opted for the lift, but the eastern exit demonstrated that it wasn't the preferred option.

162. Among the mobility impaired and persons encumbered by baggage, there was only one choice if escalators were available – no-one used the lift. When presented with stairs or a lift, just under half (44-46%) opted for stairs.

163. Wheelchair users went wholly for the lift at the western exit, vs stairs, but the Paralympics were also about the Extraordinary, and 7% used the escalators at the eastern end.

164. There were high proportions of accompanying passengers, with, at the western exit which was primarily used by spectators, nearly 7 passengers for every 4 wheelchair users, and 9 people accompanying every 4 pushchairs. There were 10 accompanying to 4 pushchairs at the eastern exit (ie, 2 to 3 people with each push chair). This may not have been anticipated by transport planners. It is understood from Crossrail that it does not explicitly plan for accompanying passengers with PRM. [52]

[52] Julie Davies, Land Use Planning Manager, Crossrail, to Chris Gascoigne, Senior Development Manager, LB Newham, email 'Further Questions Response', 18.9.2012, 17:02. Crossrail does not explicitly plan for accompanying passengers with PRM users but considers that the model has other ways in which it compensates for that, such as extra space around wheelchairs, and that with Crossrail's AM/PM peak modelling, PRM were likely to be travelling singly. See fuller discussion in this Proof of Evidence, Section H.

165. In terms of the station's capacity to cope, it was very well furnished overall, with two lifts, two escalators and wide stairs. In the busiest general arrival hour, 10:00-11:00, 14% of passengers were PRM or accompanying. During the busiest PRM arrival hour (10:30-11:30), nearly 20% of all PRM arrived, 308 people. And despite all the investment beforehand, 43 PRM and accompanying passengers experienced delay using the western lift in that busiest hour.

166. Within-station journey times generally showed up escalators as best performing and coping with large numbers of passengers per minute when required, with stairs a close competitor at low passenger flows but slower as flows intensified. Having two escalators in the peak flow direction was effective.

167. This DLR survey shows that even with a wide range of facilities to support intensive passenger flows at ExCel events, a high level of amenity was not always achieved on the day. The proportion of pushchair usage at each end of the station demonstrates the disparity at the western exit, only equipped with stairs and lift. The survey quantified that there were regular waits for a later lift at the western lift exit, during the busiest arrival period.

G FURTHER PROJECTED PASSENGER FLOWS

168. There may be further projected passenger flows to be taken into account in the assessment of fitness for purpose and level of amenity of the proposed Crossrail station.

169. These might apply before or from Crossrail's opening year, or during later years up to the 2026 modelling date, or beyond towards the 2026 + 28% (notional 2076) growth scenario.

170. Elements already identified as risks for the present station modelling and set out above are discussed below.

G.1 Census 2011 and its consequences

171. Newham saw an unprecedented 26% increase in its Census 2011 population, 64,000 people, to 308,000, compared to Census 2001. This was the fastest increase among all London boroughs.

172. Crossrail's sponsors had based their forecasts on 2001 census data, [53] so the new outputs from the Office of National Statistics (ONS) may cause Crossrail's sponsors to issues upwards revisions to the flows which Crossrail has to base its station designs on.

173. If this does not happen, then stations may be under capacity pressure sooner. This may not matter at most stations relying on the 2026 + 28% scenario to see them through, but with Custom House the 2026 + high volume Event scenario is the one to worry about,

[53] Demand Forecasting and Legion Modelling Information, CRL1-XRL-T-QAP-CR145-50001 rev 1, Crossrail, section 3.2, page 5. "This uses an updated version of LTS (version B5.4), and the most up to date census data (2001) to inform the Railplan modelling for years 2026".

not 2026 and some long date in the future. Failing to issue updated forecasts for Custom House may be unwise for Crossrail's operations and for the actual level of amenity provided.

G.2 Silvertown North local development

174. This is worth ca. 9,000 direct jobs by the final phase, a significant number of indirect jobs, and £260 million Gross Value Added to the London economy. [54] Atkins reported that a Land Use Trip Ends (LUTE) model pointed to up to 3,000 future outbound public transport trips in the 3 hour AM peak in the year 2016 from this zone [55], though they also reported that its impact might be as little as 50 trips in that period.

175. My opinion is that the scale of GVA reported by Sir Stuart Lipton to this appeal , and the potential volume of jobs to be secured, point in the direction of the LUTE 3,000 trips rather than the 50 or so. This would be delivered by the 2020s, I believe. The equivalent hourly and ½-hourly maximum peak flows would be ca. 1,500 and 900 respectively, if the LUTE projections were correct.

G.3 London City Airport (LCA)

176. I have shown in section D.7 that there is a good basis for a proportion of London City Airport passengers to be attracted to Crossrail via Custom House station, providing that a 5 minute shuttle bus link and the Custom House interchange are of high quality.

177. My modelling based on LCA Master Plan projections to 2025 and 2030 is that a flow between LCA and Custom House Crossrail station could be 125-250 passengers in the busiest hours.

G.4 ExCel further growth

178. ExCel has a forward plan to grow its yearly visitor volume to 4 million per annum, within 3 years, so even before Crossrail opens for business. Time will show whether there are further opportunities for growth.

179. The success of the 2012 Olympics is potentially a pointer, because ExCel notified Crossrail in its liaison with Atkins in 2009 that "based on event scheduling, ExCel understands that 3 arrival and departure [visitor] cycles could be possible in one day. Once tested and delivered, this will influence ExCel's confidence in operating more overlap and time controlled events. Access and egress onto onsite stations would be crucial, along with appropriate train scheduling". [56] No-one so far in the railway planning process appears to have allowed for this possibility.

180. Because it is ExCel's high volume events and overall visitor numbers which are the major controlling factor for the operability and design capacity of Custom House station's facilities, any further projected increase in ExCel's total throughput which impacted on

[54] Letter from Sir Stuart Lipton, The Silvertown Partnership LLP, to The Planning Inspectorate, 13.9.2012.
[55] Phase 2 Analysis of Change Report, Atkins, op.cit, section. 2.3, page 11.

commuter peak times, could make a station without escalators inoperable on a number of days in the year even before it opened for the first Crossrail train. This would be a fundamental failure by Crossrail to offer an adequate level of amenity.

G.5 High Speed 2 (HS2), and Old Oak interchange and development

181. JRC is directly involved in this project as the rail adviser to the London Borough of Hammersmith & Fulham. HS2 Ltd, the Department for Transport, TfL, Crossrail, Network Rail and neighbouring boroughs are all involved in this project due to be delivered to the government's timetable in 2026 (HS2 Phase 1) and 2033 (HS2 Phase 2).

182. The government's adoption in January 2012 of the HS2 railway project has led to current planning for a full 24 trains per peak hour Crossrail service west as far as an interchange with HS2 at Old Oak Common, in place of the original Crossrail service specification of 10 tph operating in peak periods west of Paddington, with another 14 reversing at Westbourne Park sidings.

183. HS2 will offer up to 14 trains per hour in its phase one to Birmingham and links to the North West, due to open in 2026. In Phase 2 there will be direct trains to the North West and towards Yorkshire and the North East, and there will be up to 18 trains per hour. [57]

184. All HS2 trains are planned to stop at Old Oak Common to allow direct interchange with Crossrail, indeed this is the primary reason set by the Department of Transport for an interchange at Old Oak, to relieve passenger pressures on Euston and to create a more attractive and direct route for HS2 passengers to/from Heathrow, the City, Canary Wharf and the Docklands economic growth centres such as ExCel and Stratford.

185. TfL has modelled that roundly 33% (a range of 25-40%) of HS2 passengers will interchange there for those purposes. Trains that can or are already planned to call there include: all HS2 trains, the full Crossrail service, some or all Great Western trains, London Overground and Southern trains.

186. The flow volumes that are being analysed by TfL are pointing to the potential for Crossrail to be overloaded against its planning design standards, eastbound in the morning peak, even before the passengers flows stimulated at Old Oak interchange by a 40,000 jobs and 10,000 homes plan are taken into account. This is pointing towards 2026 + 28% during Crossrail's early years, not in 2076.

187. Overall, the new Old Oak interchange, to be included in the HS2 Hybrid Bill in Autumn 2013, promises to be one of the top 20 busiest stations in Britain when it is fully open, based on JRC passenger flow modelling. The consequential passenger impacts for Crossrail, so far as these are relevant for Docklands and Custom House station, are:

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[56] Custom House Strategic Access Impact Report, Phase 4 Additional Analysis of Future ExCel Demand, Atkins, 2.11.2009, section 2.2.4, page 6.

[57] www.HS2.org.uk website for full details

- More passengers from within North and West London (or from the Northwest and West London suburbs via Old Oak) finding Crossrail to be the preferred route across Central London to Docklands locations including ExCel and London City Airport.
- A change in the pre-planned proportions of passengers using Crossrail or DLR to exit high volume ExCel events, away from a Crossrail : DLR 60:40 split towards 70:30 as more of London and longer-distance passengers find Crossrail to be the cross-London route of choice. This on its own account could breach the planned passenger handling capabilities at Custom House Crossrail without an escalator.
- It will be the TfL Railplan numbers which define the potential outcomes and the impacts on sponsors' current projections. If those projections change upwards, then the consequences on station design could be significant. Adding 2 escalators might be the starting point, not the end.

G.6 Crossrail expansion in Heathrow, Great Western, and West Coast corridors

188. Network Rail's study into short and long term route capacities in the London and Home Counties areas up till 2031 was set out in a July 2011 report called the London and South East Route Utilisation Strategy (RUS). [58]

189. The RUS included assessment of Crossrail and its relationship with the increased passenger demand forecast on the Great Western Main Line from Paddington to Reading and beyond, in Chapters 7 and 8. It concluded that there was a strong requirement by the 2020s for Crossrail to take over all the local GW suburban services as far as Reading, and for Crossrail to take over all peak time passenger services to Heathrow including Heathrow Express. This is currently the subject of discussions involving BAA who own the Heathrow Express service. [59]

190. A further expansion of Crossrail is currently being considered by TfL and Network Rail in association with HS2, DfT and the Old Oak interchange project, to take up to 8 Crossrail trains per hour beyond Old Oak Common towards Watford and Milton Keynes and take over the local commuter services that currently run out of Euston. This is linked to projected commuting forecasts, and to relieving Euston terminus as part of the HS2 project. This is also covered in the RUS Chapters 7 and 8. [58] If this project were taken forwards, it would need to be completed ahead of HS2 serving Euston in 2026.

G.7 Crossrail extension beyond Abbey Wood

191. There is also a long term aspiration, now safeguarded by Government, to extend Crossrail southeast from Abbey Wood, east of Custom House, through Dartford to Ebbsfleet International. This is also covered in the RUS, Chapter 8.

[58] London & South East Route Utilisation Strategy, Network Rail, 28 July 2011, Chapter 7. http://www.networkrail.co.uk/browseDirectory.aspx?dir=%5CRUS%20Documents%5CRoute%20Utilisation%20Strategies%5CRUS%20Generation%202%5CLondon%20and%20South%20East

[59] Personal communication

G.8 Consequences of some or all new projects taking place

192. Cumulatively the extent and scale of these changes is massive for the existing Crossrail project. It could even invoke some of the passive design precautions which are being built in to Crossrail, of operating not 24 but 30 trains per hour in the core section.

193. The alternative, intermediate update option, of the same frequency service but longer 12 car trains is not favoured by TfL.[60] There are more passenger and London wide benefits to be gained by having higher frequency services, if there had to be a choice on how to increase capacity. This would not increase train frequency on the line through Custom House, based on present Crossrail thinking which is to run the increased service on the Shenfield line rather than the Abbey Wood line (see para.71). However the overall growth would instead increase loadings per train, so raising the passenger volumes which had to be accommodated every 5 minutes at the Crossrail platform.

194. Overall, it is unreasonable to assume that all these projects will happen, or happen quickly. However it is also unreasonable to think that none or only a few will happen. The intense focus on extra infrastructure capacity that is been prioritised by the current government will ensure that much may happen but over a timescale limited by affordability and competition between projects for priority. There are plenty of other projects competing for funding and go-ahead.

195. The present situation is that Crossrail's greatest risk of additional pressure from the general volume of passenger flows, remains in relation to the 2026 + Event scenarios. Outline modelling as shown in paras.50-69 suggests that (after allowing a margin for Fruin space requirements around platform exits by stairs or escalators), there will be no more than one stairway's worth, 420 passengers per 5 minutes, available as a margin with very little then to spare in the 'red' scenario, and with less capacity than that in the June 2010 scenario.

196. 420 might sound a lot in 5 minutes, but every passenger in the opposite direction would reduce the available capacity by another one, so we could be looking at no more than 210 passengers per 5 minutes, or no more than 1,260 in a half hour. This is less than one train's worth among six trains each with 1,500 passengers, or 12% of six trains each with 1,700 passengers.

197. I conclude this section by noting that the scale of flows that could be stimulated by some of the growth projects described above could easily require Crossrail's sponsors to revise and update the required passenger flows sometime during the rest of this year, and in successive years, from various causes.

198. For example, decisions on HS2 planning are required within the next two months, as definitive design work must then proceed on the project including the layout of Old Oak interchange, in time for the HS2 Hybrid Bill to be deposited in Parliament in Autumn 2013. This will commit the Government, Department for Transport, and bodies such as Transport for London and Network Rail to new service specifications for Crossrail and

[60] Personal communication

other rail routes. It is plausible that there will be new sponsors' requirements given to Crossrail. Similarly the consequences of Census 2011 will need to be assessed and may lead to new requirements.

199. If new requirements are issued by the sponsors, Crossrail will have to reassess the validity of the passenger flows at stations such as Custom House, and the viability of the station's detailed design. On the evidence above, any new requirements are likely to point towards more passenger flow capacity or more station operational flexibility being desirable, not less.

200. Overall, this raises the risk of more passengers having to be catered for at Custom House station and interchange. As already deduced, escalators offer greater margins for handling high passenger flows than stairs. It is not possible to conclude from the information in this section that the RIBA Stage F design for Custom House station is inherently flawed in its present form. However it is a clear basis for concluding that Newham's 'escalator review clause' is an eminently sensible planning condition to uphold and thereby protect the level of amenity, in the context of foreseeable mutations to the Crossrail project within the next few years.

H ASSESSMENT OF THE PRESENT STATION DESIGN, FOR PEOPLE WITH REDUCED MOBILITY (PRM)

201. A primary purpose of the JRC survey of the DLR Custom House station on 2nd September 2012 was to observe the revealed preference among PRM on how they used facilities in the station when given different choices. The practical choice at the eastern end of the DLR station was between escalators and lift, and at the western end between stairs and lift.

202. A further reason was to identify the proportions of different types of users, because this could tell us something about how PRM ridership responded to the stimulus of a major ExCel event, which might differ from other contexts for PRM data.

H.1 Sources of PRM ridership proportions and modelling rules

203. There are several sources of generalised data on how to model PRM ridership on railways in London:

- Crossrail's PRM proportions.
- London Underground's PRM proportions in its 'Station modelling with Legion Best Practiced Guide' of 2009 [61], which also sets out rules for estimating the movement speed of PRM passengers and how people are allocated between use of different station facilities in this modelling.
- Transport for London's use of 2010 research by Steer Davies Gleave on 'Access for All, Benefits Research, Final Report' [62]

[61] Station Modelling with Legion Best Practice Guide, v2, London Underground Ltd., 3.7.2009, Vol.III: Generic Station Modelling Parameters, section 4, Persons with Restricted Mobility, pages 5-9.
[62] Access for All, Benefits Research, Final Report, Steer Davies Gleave, August 2010.

- Original JRC station count for an Access for All bid by London Borough of Enfield, at Edmonton Green in Outer NE London, May 2011
- The results of the JRC count at DLR Custom House station on 2nd September 2011, which surveyed the revealed preference of passengers about different types of station facilities (so could be contrasted with the LUL model), and the total proportions of different types of PRM who were travelling, which can be compared with PRM proportions from other sources.

204. The combined sources of information can be contrasted and assessed, and an assessment then drawn up about the benefit and amenity to PRM passengers of Crossrail's current RIBA Stage F station design at Custom House, which excludes escalators.

H.2 Crossrail's PRM proportions and approach to PRM modelling

205. Crossrail used the following PRM proportions in existing Crossrail base models, updated to March 2010: [63]

Crossrail PRM standard assumptions				**Routeing allocated in model**				
Passenger Type	Diameter, metres (space occupied)	Speed metres/sec	AM Peak % users	Escalators	Stairs	Lifts	Normal ticket gates	Wide Access Gates
STD Standard	0.332	1.53	96.29%	Y	Y		Y	
PRM total			**3.71%**					
A Wheelchair user	0.933	0.58	0.01%			Y		Y
B Disabled/Elderly Impaired	0.359	0.8	0.92%	Y if lift busy	Y if lift busy	Y		Y
C Medium Luggage	0.707	1.53	2.02%	Y	Y		Y	
D Large Luggage	0.846	1.32	0.41%	Y if lift busy	Y if lift busy	Y		Y
E Adults with Young Child	0.932	1.37	0.35%	Y if lift busy	Y if lift busy	Y		Y
Assumptions are based on LUL research in 2007.								
Cycle times for lifts should assume a stop time per floor of 40 seconds and a vertical speed of 1.4 m/s.								
Lift occupancy to be metered depending on capacity.								

206. JRC cross-checked this data with a separate Crossrail modelling report, 'Custom House Passenger Number Predictions' [64], and the output figures agreed with the input data above. This confirms that this is the correct model to review for Crossrail PRM planning. The output data, including interpolation of that by JRC, is shown to the right:
The red-coloured rows relate to PRM categories A to E as shown in para.205 above.

Applied to Custom House platform stairs by Crossrail			
ref 11.5.2011 CRL report	**AM peak pax 2026**	**AM peak pax 2076 (+ 28%)**	**Excel event**
	8,650	11,072	18,806
STD total	8,329	10,661	18,108
PRM total	**321**	**411**	**698**
Avge. pax/min	48	62	104
Avge. PRM/min	**1.8**	**2.3**	**3.9**
	1	**1**	**2**
Red =	**80**	**102**	**173**
Values	**175**	**224**	**380**
interpolated	**35**	**45**	**77**
by JRC	**30**	**39**	**66**
Lift to be 1 x 26 persons platform to concourse			
2nd lift ditto, concourse to street level			
Lift required to be 98% reliability			

[63] CRL Operations, Pedestrian Modelling Guidelines, Doc. No. CRL1-XRL-T3-GUI-CR080_Z-50001, Crossrail, revised from last update in June 2009, amended with new sponsor requirements February 2010, and changes to key assumptions agreed with LUL from the Assumptions Method note, March 2010.
[64] Custom House Passenger Number Predictions, Crossrail, 17.5.2011, page 1.

207. Some immediate points can be drawn from this modelling.

208. It is based on AM peak only for input data, but is then applied without adjustment to a high volume ExCel event which is a very different audience profile to standard AM peak commuters.

209. The notion that by 2076 there will still be 2010 PRM usage levels on public transport, and current public attitudes to using rail by PRM passengers, and the same limitations on step-free availability at railway stations, is not credible.

210. The Mayor's Transport Strategy, Transport for London's 2011 report on 'Taking forward the Mayor's Transport Strategy Accessibility Implementation Plan', [65] the Department for Transport's own determination to press forward with Access for All step-free projects across England, and the policies arising from the 2012 Paralympics and their legacies, will ensure that there is a fundamental shift in rail usage well before 2076, and before 2031 if the Mayor and TfL have anything to do with it.

211. Through the Accessibility Implementation Plan, the Mayor and TfL are focusing on a 'whole journey approach', "ensuring the transport system is accessible from the start to the end of the journey, by overcoming the barriers that exist for some users, will enable more 'spontaneous' travel that will benefit the economy and help overcome some pressing social problems." [66]

212. The Olympic and Paralympic Legacy Action Plan [67]aims for:
- "A physical legacy, in terms of the new infrastructure provided for the Games. This includes more accessible infrastructure, notably in the area around the Olympic Park in east London, where supplementary planning guidance is being drafted to help shape future development."
- "An operational legacy, in terms of new or different ways transport operators provide services. This could include the way services are provided by staff, for example, disabled people."
- "A behavioural legacy, in terms of the way in which people choose to travel, for example in a more healthy way. This could include, for example, more enlightened attitudes to disability".
- Action 13 to help maximise the legacy is for TfL to "raise awareness and improve people's attitudes towards each other and to disabled people in particular, to ensure that the travelling environment does not present a barrier to travel during and after the Paralympic Games".

213. There is already in East London a new culture for accessibility unleashed by the DLR and the Jubilee Line Extension, throughout those railways' catchments. Stand on a DLR platform at any time of day and you will find PRMs – a steady flow over a relatively short

[65] Taking forward the Mayor's Transport Strategy Accessibility Implementation Plan, Draft, Mayor of London & TfL, June 2011
[66] Op.cit, section 6, page 32.
[67] In final version of reference 65 above

time. Modelling originating from LUL may not be the right starting context for a station which is to be a major East London railhead and the Crossrail's flagship in the Royal Docks' development zone. In East London, and particularly in 'DLR-land' such as Custom House, rail is accessible and part of life's daily routines whether with pushchair, wheelchair, walking disability or other impairment. The imagery and physical presence of the Paralympics in East London reinforces that bond.

214. Turning this issue into hard numbers, it means that the PRM modelling used by Crossrail to estimate PRM passenger volumes at Custom House station is not fit for purpose, whether it is to assess a lift-only station (I acknowledge that most DLR stations are lift-only) or one with lifts and escalators.

215. It might appear from the modelling set out above that there could be a further flaw in the estimates, because there appears to be no allowance made for variability of passenger volumes during the AM peak, whereas most modellers would take 50%, or thereabouts, of the 3 hour peak as occurring in the busiest hour, and then the busiest 30 and 15 minutes. Instead I have assumed that Crossrail will have employed LUL's criteria to proportion these 3 hour flows (45% in the busiest hour, and 27% of that in the busiest 15 minutes). [68] So I do not raise that as an issue to address.

216. In case Custom House station was provided with some specialised PRM modelling because of its unique catchments including ExCel and London City Airport, or was classified under the LUL station location system (Outer Suburb/Inner Suburb etc.), LB Newham asked Crossrail to clarify matters.

217. Crossrail in its 18th September 2012 response to further questions by LB Newham, [69] advises that:

- "Crossrail used the PRM proportions that were current at the time of modelling and presented in "Mobility Impaired Passengers an Army Ignored", LUL Nov 2007. This document was best practice at the time of the building of the model (This 2007 Guidance does not split stations into types)."
- "The impact of changing these assumptions to those shown in the Best Practice Guidance (BPG) (2009) (using the average PRM % which is the same for inner and outer suburban stations) would be very small. In the Crossrail modelling lifts are assumed to be used by PRM types ABDE See section 4.1 (BPG 2009). This has a total lift usage of 1.68%. With an assumption of 50% of type DE using lifts the usage is 1.55% with BPG 2009."
- "The higher % of PRM in the 2009 guidance tables is due to the increase in PRM type C in the PM peak. The Guidance 2007 and 2009 assume that these passengers do not use the lifts. They move at the same speed as normal passengers but are slightly larger and are therefore modelled on that basis".

[68] Station Planning Standards and Guidelines, Guidance Document G371A, Issue No. A3, LUL, July 2012, section 3.11 Platforms, page 66.

[69] Julie Davies, Land Use Planning Manager, Crossrail, to Chris Gascoigne, Senior Development Manager, LB Newham, email 'Further Questions Response', 18.9.2012, 17:02.

218. This aligns with the source data defined above in paras. 205 and 206. The reference to the increase in PRM type C in the PM peak is a consequence of the LUL modelling allowing for passengers returning from outwards trips with extra baggage, eg shopping. [70]

219. So Crossrail has confirmed that:
- It has not modelled PRM passenger characteristics other than those projected by LUL for the AM-only peak based on a standardised station type
- There has been no consideration for the specialised passenger requirements of Custom House station, neither for able-bodied passengers nor for PRM, except in respect of the generalised need to plan for high volume ExCel events.

220. I consider that this situation is very unsatisfactory, for a unique and exceptional station which will cater for:
- one of the largest off-peak visitor flows in London, comparable in some ways to North Greenwich with the O_2
- an existing and growing usage by high value business passengers whether going to ExCel or flying via London City Airport (when large baggage might be an additional issue)
- a large and growing development catchment worth £ billions GVA each year, served by an express urban railhead with fast journey times to Central London, Heathrow etc.
- the strong East London accessibility culture, described above.

H.3 Alternatives to Crossrail's PRM modelling

221. How then should we seek to rectify our understanding of what Custom House might face in PRM usage, and might offer in return to PRM passengers, on a more realistic basis?

222. A good place to start is the 2010 modelling by Steer Davies Gleave [71] which was used without alteration in Transport for London's Access for All bids to the Department for Transport in May 2011. A number of schemes were awarded Government funding on the strength of this bidding.

223. This PRM modelling did not discriminate between times of day or between areas of London. Instead of minutely modelling each part of the station design, (in most of the Access for All project the access change would be a modest variation to an existing station rather an entirely new station), a generalised time saving per trip was defined as a proxy for the net benefit of the journeys that were advantaged. This effectively turned round the modelling into a benefit/cost calculation rather than a component of station design. However the initial modelling is directly relevant, since it has been used by TfL London Rail for London's main line railway stations, and Crossrail will be a large version of an urban main line railway.

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[70] Station Modelling with Legion Best Practice Guide, v2, London Underground Ltd., 3.7.2009, Vol.III: Generic Station Modelling Parameters, section 4, Persons with Restricted Mobility, tables by type of Underground station and time of day, page 8

[71] Access for All, Benefits Research, Final Report, Steer Davies Gleave, August 2010.

224. TfL London Rail used the following Steer Davies Gleave proportions in their Access for All bidding models, based on SDG's August 2010 report. This is contrasted with the Crossrail AM peak data:

PRM assumptions	Crossrail, 2010	Steer Davies Gleave, 2010
Passenger Type	AM Peak % users	All week PRM users average %
STD Standard	96.29%	94.34%
PRM total	**3.71%**	**5.66%**
A Wheelchair user	0.01%	0.05%
B Disabled/Elderly Impaired	0.92%	0.85%
B Sight		0.16%
B Hearing		0.08%
C Medium Luggage	2.02%	4.52%
D Large Luggage	0.41%	
E Adults with Young Child	0.35%	
LUL Category B PRM split into 3 categories by SDG.		
LUL Categories C, D and E PRM merged by SDG.		

225. There is an evident increase in forecast PRM volume, of 53%. The SDG figure is also more robust, though at a generic level, because it summarises demand over an all-week period not just a commuting peak. This reveals more baggage and pushchairs (though here all bundled together) compared to a peak-only snapshot. The volume of wheelchairs, though still small, is five times the AM peak only estimate.

H.4 Alternatives to Crossrail's PRM modelling – defining the right specification

226. It is not realistic to apply this PRM model just to the peak forecasting which Crossrail uses, as this would create another set of inexactitudes. It is necessary to define off-peak and weekend flows as well, and for Custom House as a development catchment station and for the extra impact of ExCel in its various modes (which themselves will vary the PRM proportions).

227. Thus we need a complex PRM model for a complex station, with the user proportions varying depending on period of week and nature of events.

H.5 Alternatives to Crossrail's PRM modelling – comparisons of modelling and outputs

228. Four other surveys are added to this model to show a wider spread of information:

- London Underground's 2009 PRM proportions for a Terminus, as this will have some analogies with London City Airport.
- London Underground's 2009 PRM proportions for the Inner Suburbs, as a broad comparator for the mix of an existing high density catchment which experiences significant deprivation, alongside new high value redevelopments.
- JRC's PRM survey of Edmonton Green station in May 2011, an outer suburban working class suburb with significant deprivation and an adjoining bus station, which offered a bulk of day survey from 06:25 to 20:15 weekday and 06:55 to 18:15 on Saturday.

- JRC's 2nd September Sunday Paralympic survey of Custom House station which showed a high volume ExCel event focused on spectators and with significant usage also by participants and officials.

229. The complete tables are set out below, grouped into:- all week / AM & PM peak / interpeak and weekend:

PRM comparison, all week surveys	LUL Best Practice 2009, Terminus	LUL Best Practice 2009, Inner Suburb	JRC, Edmonton Green, 2.9.2012	Steer Davies Gleave, 2010	
Passenger Type	All week PRM % , entry < > exit %	All week PRM % , entry < > exit %	Mon-Sat PRM % , average %	All week PRM users average %	
STD Standard	90.22%	92.25%	92.32%	94.34%	
PRM total	9.71% < > 9.85%	7.00% < > 8.51%	**7.68%**	**5.66%**	
A Wheelchair user	0.00% < > 0.00%	0.00% < > 0.00%	0.05%	0.05%	
B Disabled/Elderly Impaired	0.41% < > 0.43%	0.48% < > 0.53%	1.93%	0.85%	
B Sight / Other			0.02%	0.16%	
B Hearing			0.08%	0.08%	
C Medium Luggage	7.18% < > 7.24%	4.98% < > 6.10%	5.60%	4.52%	
D Large Luggage	1.99% < > 2.00%	1.36% < > 1.68%			
E Adults with Young Child	0.13% < > 0.18%	0.19% < > 0.19%			
LUL Category B PRM split into 3 categories by SDG.			No hearing survey		
LUL Categories C, D and E PRM merged by SDG.			No lift = no w/chair		
			Both taken as SDG %		

PRM comparison, AM & PM peak period	Crossrail, 2010	LUL Best Practice 2009, Terminus	LUL Best Practice 2009, Inner Suburb	LUL Best Practice 2009, Terminus	LUL Best Practice 2009, Inner Suburb
Passenger Type	AM Peak % users	AM Peak % users, entry < > exit %	AM Peak % users, entry < > exit %	PM Peak % users, entry < > exit %	PM Peak % users, entry < > exit %
STD Standard	96.29%	96.38%	97.09%	87.37%	90.12%
PRM total	**3.71%**	3.59% < > 3.65%	2.64% < > 3.19%	12.56% < > 12.70%	8.90% < > 10.87%
A Wheelchair user	0.01%	0.00% < > 0.00%	0.00% < > 0.00%	0.00% < > 0.00%	0.00% < > 0.00%
B Disabled/Elderly Impaired	0.92%	0.24% < > 0.25%	0.28% < > 0.31%	0.33% < > 0.34%	0.38% < > 0.43%
B Sight / Other					
B Hearing					
C Medium Luggage	2.02%	2.38% < > 2.40%	1.65% < > 2.02%	9.67% < > 9.76%	6.71% < > 8.22%
D Large Luggage	0.41%	0.91% < > 0.92%	0.62% < > 0.77%	2.47% < > 2.48%	1.68% < > 2.09%
E Adults with Young Child	0.35%	0.06% < > 0.08%	0.09% < > 0.09%	0.09% < > 0.12%	0.13% < > 0.13%

PRM comparison, inter peak and weekend	LUL Best Practice 2009, Terminus	LUL Best Practice 2009, Inner Suburb	LUL Best Practice 2009, Terminus	LUL Best Practice 2009, Inner Suburb	JRC, DLR Custom House, 2.9.2012
Passenger Type	InterPeak % users, entry < > exit %	InterPeak % users, entry < > exit %	Weekend % users, entry < > exit %	Weekend % users, entry < > exit %	Sunday PRM users exit % + accompany
STD Standard	90.90%	92.65%	85.59%	88.64%	90.61%
PRM total	9.02% < > 9.18%	6.66% < > 8.05%	14.30% < > 14.52%	10.25% < > 12.47%	**9.39%**
A Wheelchair user	0.00% < > 0.00%	0.00% < > 0.00%	0.00% < > 0.00%	0.00% < > 0.00%	2.05%
B Disabled/Elderly Impaired	0.65% < > 0.68%	0.75% < > 0.84%	0.42% < > 0.44%	0.49% < > 0.55%	2.10%
B Sight / Other					0.11%
B Hearing					0.08%
C Medium Luggage	6.32% < > 6.38%	4.38% < > 5.37%	10.85% < > 10.95%	7.52% < > 9.23%	0.39%
D Large Luggage	1.88% < > 1.89%	1.28% < > 1.59%	2.81% < > 2.82%	1.91% < > 2.38%	
E Adults with Young Child	0.17% < > 0.23%	0.24% < > 0.24%	0.22% < > 0.31%	0.32% < > 0.32%	4.66%
					No hearing survey
					Taken as SDG %

230. The spread of PRM users is much clearer when disaggregated, with the lowest percentages of PRM and the highest percentages of able-bodied being during the AM peak across all survey examples. The PM peak was closer to typical inter-peak and weekend volumes, as by then most other types of passengers were around, and people had gone shopping or to events, or were making the most of London in other ways.

231. There is some consistency in the highest PRM volume by period of week 4 times out of 5 being the LUL Best Practice Guide's Terminus data. This was heavily influenced by luggage, as was the frequent runner-up, the Inner Suburbs.

232. There were some striking differences in percentages between different PRM types. The JRC survey of DLR Custom House showed a very high wheelchair percentage, possibly not surprising since it was the Paralympics, but the overall total volume of PRM was quite low, and the biggest single group, about half the total PRM, were pushchairs and accompanying passengers. People moved around as family or colleague groups. This could be a feature of some types of ExCel events in general. Pushchairs appear to be a low percentage elsewhere, and the high DLR usage may be part of the East London accessibility culture.

H.6 Alternatives to Crossrail's PRM modelling – Best Practice specification

233. Crossrail Information Paper E5 confirms (Version 1, 09.12.05) that "1.1 The Crossrail project aims to **minimise any undue effort by, or special treatment of, passengers with restricted mobility**. Where new platforms are used exclusively by Crossrail trains, Crossrail will cater for People with Restricted Mobility (PRM) by providing independent, step free access from street level to platform."

234. Annex 1 to Information Paper E5 notes that at Custom House, where there will be interchange with Docklands Light Rail, there will be "Full PRM provision from street and Excel entrance to platforms".

235. It can be observed that it is unwise to base station design for PRM flows around reliance on AM peak data, even though that is often the conventional modelling source for general station design requirements. Among the full volume of passengers, the AM peak is generally more intense than the PM peak when commuters stagger their return times.

236. It is more important, for PRM planning, to adopt the highest absolute flows that are capable of being observed, and then add a further factor to allow for the likelihood that, over the life of a PRM infrastructure investment, there will be more PRM users than now. This is because of:
- longer life expectancy in the population
- more willingness to be mobile in later life despite reduced mobility
- attitudinal changes to disabilities
- increasing volume of investment in making the railways accessible alongside public transport generally.

237. Based on the tables above, this would point to the strong influence of luggage volume, though this is lower on space-taking (75-90% of the area) compared to wheelchairs where nearly 1m diameter is allowed in station design and effective lift capacity. The trends in provision for PRM may, on DLR, have reached that tipping point when many more wheelchair and pushchair PRM use the network on a frequent, possibly daily basis.

238. Because the Custom House station facilities are to be shared between Crossrail and DLR users, and with interchange between the two, it is plausible to adopt the highest levels of accessibility to benefit the level of amenity of all users, for DLR as well as Crossrail passengers. PRM modelling at Custom House needs to reflect the different ridership of both railways, not just Crossrail.

239. Custom House station has ExCel with up to 19,000 passengers per event allowed for in Crossrail's own planning. Also JRC's Custom House survey shows nearly 5% of all passengers (almost all for ExCel) being pushchair PRM and accompanying groups, which are just one PRM type. It points strongly to the need to plan for exceptionally high levels of PRM usage at this station linked to ExCel events. There is also the extent of wheelchair usage. Was the 2nd September data a one-off or not, in that respect, because of the DLR network?

240. ExCel exhibitions will also generate baggage, either with urgent stand boards, brochures etc. inwards, or with bags of brochures and stand goodies carried away! The wider Royals catchment will generate an inner suburban level of shopping and other impedimenta in various ways, while the high deprivation and impaired health levels among the existing local population merit priority attention as well, if Crossrail is to be world-class in its approach to their needs.

241. In summary, this is an exceptional station serving a unique catchment, and its PRM modelling and PRM provision both need to be world-class, which they are demonstrably not in Crossrail's present approach.

H.7 Worked example of higher PRM percentage at Custom House, with 2026 + Event

242. The 2026 + Event scenario modelling discussed in paras. 50-68 above identifies, on Crossrail's own figures, an average of 1,040 passengers arriving in each 5 minutes at the Crossrail platform and needing to head for the upper level concourse in the June 2010 modelling scenario, or 890 passengers in the 'red' scenario.

243. If 10% of passengers were modelled as PRM, as in the LUL Inner Suburb PM peak, then the 26-passenger lift would not cope in the 5 minutes between trains during an ExCel event, for example on the following assumptions:

- Crossrail standards of a 40 second stop time per floor, and 1.4 metres/second vertical speed, which gives 96.8 seconds for a round trip
- Significant numbers of encumbered PRM with baggage returning in the PM peak, plus some wheelchairs and pushchairs, as well as ExCel attendees possibly carrying less baggage, so that on average each lift cycle only accommodates 20 passengers in the peak flow direction
- The lift would just have completed its fourth cycle in 5 minutes, and would have uplifted only 80 passengers, leaving 24 to be joined by the next trains' worth, in the June 2010 scenario, and 9 passengers left behind in the 'red' scenario. This isn't just a lower level of amenity; it becomes a total loss of amenity.
- There is also considerable journey time delay and diminution of amenity built into such reliance of lifts, over 6 minutes for passengers to exit the lift area, in the worst case with the first train modelled. The delay increases as queues build up, though no

doubt at some point, as LUL has observed in its Best Practice Guide, some of PRM categories B, D and E would eventually opt to use the stairs.

- Even in the ideal of 26 passengers fitting in the lift each time – impossible because of baggage, pushchairs, wheelchairs and space for the infirm – it only just accommodates all passengers with none left behind, in the June 2010 scenario.

H.8 PRM shortcomings with Custom House lifts for DLR during 2nd September

244. The 17 passenger lift installed last year at the western exit of DLR Custom House, smaller than Crossrail's but with an observed lift cycle of 1 minute which is faster than Crossrail's, failed on 2nd September to cater for all passengers in its first lift cycle after an eastbound DLR train arrival. This occurred on 9 occasions during the busiest arrival hour, and inconvenienced 43 passengers. The lift also failed to meet demand on a further 10 occasions during the survey day, with a total of 131 passengers inconvenienced during the whole survey, 8.3% of all estimated PRM users between 7AM and 5PM.

245. This is a low estimate as it does not count the frequency or volume of inconvenience arising at the eastern lift, where extensive queueing was observed but not quantified.

H.9 Escalators as well as lifts – the PRM revealed preference

246. However focusing just on the lifts misses the other main point. The lifts were not the most favoured route off the DLR platform for people with reduced mobility, and those accompanying them. It was the escalators which were used with high frequency.

247. Pushchair PRM and accompanying passengers opted 3 to 1 to use escalators rather than the lift at the DLR eastern exit. There were 454 pushchair PRM, and 341 used the escalators. If there had been no escalators, there would have been a different story to tell, because the story at the western exit (331 pushchair PRM) was that 86% of those opted for the lift, and only 14% tried the 6m high stairs.

248. Re-calibrating those eastern exit numbers to conform to the western proportions, and assuming there were 2 stairways instead of 2 escalators, would have resulted in a total of 680 pushchair PRM trying to use the lift (where the Crossrail 26-passenger lift broadly equates to the two DLR lifts of 8 and 17 passengers). Only 105 passengers would have attempted the stairs. There would have been a disbenefit in the level of amenity for these 680 passengers.

249. The same is true for all PRM encumbered with luggage etc, and all mobility impaired, as none of those used the lift when an escalator was available. Where there was no escalator, nearly half used the stairs in spite of the western lift being modern and reasonably capacious. This would be another 420 PRM. In turn the 345 wheelchair passengers who genuinely had to use the lift (assuming only one was available, as proposed for the Crossrail platform) would have been inconvenienced by all these other passengers wanting to use the lift as well.

250. These revealed preferences are what passengers do in the real world, irrespective of whether LUL chooses to model that preference in its own categorisation of passenger preferences between its PRM categories A to E.

251. All able-bodied passengers and 65% of the PRM passengers (based on the proportions in JRC's revealed preference survey at Custom House) would, from their choice, benefit from escalators at Crossrail's Custom station. This would allow the lift to focus on the 35% of users who really need to use the lift, instead of it being saturated with others who were given no choice and poor amenity. The proportions might change by type of ExCel event, but the core issue remains – the lift, and the lack of escalators, have been specified on the basis of unrealistic PRM modelling.

H.10 Summary of assessment of the present station design for PRM use

252. In my opinion, Crossrail is proceeding on an unjustified path by persisting with outdated values of PRM usage of the London rail system. It is clearly out of alignment with Transport for London's own use of PRM evidence as demonstrated by the TfL London Rail 2011 bids to the Department for Transport for Access for All funding for step-free facilities, at stations lacking those. TfL London Rail will be the client for the Crossrail franchise from 2015.

253. Using several station categories from LUL's own Best Practice Guide, or by using JRC's DLR Custom House evidence, points towards PRM percentages of 10% to 15% at times of day and week other than the AM peak which Crossrail has stuck with.

254. I conclude that there is sufficient genuine evidence to be satisfied that the lift proposed at Custom House Crossrail station is not fit for purpose in the case of a high volume ExCel event. It will impair and indeed prevent the amenity of PRM passengers, quite apart from failing to conform to Crossrail's own standards for station functionality.

255. Consequently the station design is flawed. It may be illegal under accessibility laws, and this point should be explored.

256. It needs to be reconsidered, for the benefit of DLR as well as Crossrail, for the benefit of all businesses residents and visitors to the Royals catchment, and to sustain and support the regeneration and economic growth in Custom House's catchment.

257. The faster generalised journey times that can be achieved on the escalators compared to stairs, particularly in high flow conditions, are a strong amenity gain for a station where is it foreseeable that there will many new pressures for additional passenger growth.

258. The revealed preference of different types of PRM passengers when faced with the different choices of escalators vs lift, or stairs vs lift, point clearly to the overwhelming desire for escalators not just lifts.

I SUMMARY AND CONCLUSIONS

I.1 Summary of previous sections and their findings

C. The **site** for Custom House Crossrail station, in its existing form and outline intentions.

259. In the Custom House area, Crossrail will use the east-west route of a former main line railway which had existed since the 1840s. Latterly it was part of the North London Line. The railway's location in turn influenced the position of the Docklands Light Railway extension to Beckton when that was planned in the 1980s. Consequently there is now an available corridor between Victoria Dock Road to the north, and the DLR to the south, for Crossrail to re-use this route as a new express urban railway with a station in the locality.

260. The new station will be much busier than its predecessor and needs more passenger handling capacity in platforms and buildings. Because also the North London Line has been closed east of Stratford since December 2006, any works to the existing station premises would have to be to new standards from the start.

261. Crossrail affirmed in March 2006 that the best location for the new station is on a straight and level alignment at Custom House. The intended design also exploits established links with ExCel and the high level walkway over the Royal Docks. It is also closer to residential areas than Prince Regent DLR station.

D. The **station's catchments** and points of relevance for the station's design, including assessment of locations such as ExCel and their impact on the station's operability with and without escalators.

262. Custom House is an exceptional station, within Crossrail and within London. It is not an average suburban station. This is for a number of reasons:

- Crossrail provides an express urban railway, which gives competitive journey time savings which in turn enlarge the effective catchment.
- Custom House will be the main railhead for the whole of the Royals area, which is nearly 3 miles long and over a ½ mile wide, plus the existing communities within the larger zone extending to Newham Way and beyond. In practice it will have its own feeder network of the DLR Beckton route and local buses.
- Via Crossrail, it will be the railhead from West London and the West End for London City Airport, which is London's local airport focused on business travel.
- The scale of the developments being achieved and planned in the Royals are important within the London Plan and for realising the Mayor's economic growth and regeneration objectives, such as the plans for Silvertown Quays.
- Custom House is the primary station for ExCel, which is London's multi-award winning £560m international venue. ExCel is the largest and most versatile venue in London with 100,000 square metres of available space and hosts the International Conference Centre. It was a major host for the Olympics and Paralympics. In the next 3 years, visitor numbers are projected to grow to more than 4 million a year.

Taking ExCel alone, this generates in excess of £2 billion in economic impact for London and supports thousands of jobs.

263. The catchment of Custom House Crossrail station is much larger than the conventional TfL modelling distance of 800 metres. This is because of the train service's express urban characteristics which enlarge the local catchment and because it will be the only major, high capacity railhead within the Royal Docks area.

264. Effectively the DLR Beckton route and local buses will partly become feeders to Crossrail from the wider catchment of the Royal Docks. Consultants Atkins have recognised the importance of feeders to Crossrail, in their catchment modelling. This increases the importance of the interchange quality at Custom House.

265. Crossrail itself has factored into its demand modelling the potential for the DLR Beckton route to be extended to Barking Reach and Dagenham, so further enlarging the catchment of the Crossrail station.

266. In relation to the existing local population, Newham has recently reported high levels of poor health (26% of sample population) and disability (9%).

267. The Royal are a focus for major area regeneration and economic growth with the London Plan and local development proposals. Atkins have researched the impact of that on the foreseeable demand and required passenger handling objectives for Custom House station.

268. There are still areas of uncertainty about the impact of future development growth on station requirements, particularly in relation to Silvertown North where forecasting offers two extremes of demand, as seen by Atkins.

269. London City Airport provides a specific traffic growth point linked to its expansion plans set out for 2006 to 2030. Crossrail will enable LCA to target West London and the West End effectively, providing there is a high quality and trusted link between the airport and Custom House station. It is Custom House station and the interchange quality and reliability which could be the weak link with Crossrail's current station plans.

270. ExCel is the greatest influence on passenger handling and station capacity requirements at Custom House. Extensive liaison with ExCel and DLR, and modelling of scenarios, has led Crossrail to the view that the worst case to be planned for is a major evening event at ExCel whose audience arrives at Custom House largely during the London commuting PM peak.

271. This has caused advance planning from 2009, 10 years before Crossrail opens, to try to anticipate the foreseeable demands and station management requirements. It is a sensitive and important issue.

272. My interpretation of the several ways that Crossrail has tried to model this demand, is that the station in its revised format (RIBA Stage F) will accommodate the forecast passenger numbers in a maximum demand scenario. However if crowd control

measures had to be adopted for some major ExCel events, then there would be a reduced level of amenity for local catchment passengers, DLR interchanging passengers and London City Airport passengers.

273. Such forecasting excludes the potential of other passenger growth from the local catchment, such as Silvertown North if stimulating high passenger volume, and other sources of general and specific passenger growth on Crossrail which are discussed later.

274. The higher passenger flows accommodated on escalators compared to stairs in high flow scenarios, would in my opinion assist the handling of large crowds in such scenarios. Intervention with station crowd control would be required less often. Escalators would therefore be of general benefit to the level of amenity available to all passengers, leaving or entering the station, during major events at ExCel.

E. The **approach to detailed design** and subsequent changes, adopted by Crossrail until RIBA Stage E and since at RIBA Stage F with value engineering, which have ultimately led to this planning appeal and Schedule 7.

275. The starting point is that up to and including RIBA Stage E station design in 2010, Crossrail was explicitly planning to have a combination of 2 escalators, a lift and 2 stairways to link the upper level station concourse (which is also the DLR interchange, the start of the ExCel walkway and the exit northwards) with the Crossrail island platform below. There would be 1 staircase and 2 lifts at the Victoria Dock Road north entrance.

276. The station design functioned adequately in RIBA Stage E with these facilities, based on the forecast passenger flows, and indeed mirrored the quality of the DLR station which has 2 escalators, 2 lifts and one wide stairway.

277. Crossrail was then instructed by its sponsors, the Department of Transport and Transport for London, to undertake value engineering, effectively cost reduction on a best outcome for low cost basis. This led to a RIBA Stage F design which removes the 2 escalators between the island platform and the station upper level, and substitutes 2 staircases, making 4 staircases and 1 lift in total. 1 of the 2 lifts is removed at the Victoria Dock Road entrance, reducing this access to 1 staircase and 1 lift, to serve both Crossrail and DLR local access including from the expanding local community and interchange with local buses and a London City Airport shuttle link.

278. There are other changes:
- Removal of a physical ticket gateline and inclusion instead of ticket validators.
- This allows the staircases (and, currently, passive provision for escalators) to be moved further west, so closer to the Victoria Dock Road and ExCel entrances/exits.
- With smaller accommodation for staff, it is now feasible to relocate the lift between the station upper level and the platform, to the western part of the platform. This is much closer to the main ExCel entrance/exit and the access for Victoria Dock Road.

- Crossrail says “this provides considerable journey time savings and significantly shorter walk distances for PRMs (up to 200m shorter distance)”.

279. The question to address in this section is whether the revised station design at RIBA Stage F functions better than the previous design shown at RIBA Stage E. The question of whether the Stage F design just has stairs and a lift, or adds escalators as well, as a separate topic.

280. I have concerns about the new location of the lift, as PRM passengers will need to make their way to the western end of the Crossrail platform against the flow of passengers heading for the stairs and or escalators. However the general shortening of intra-station and interchange distances by removing the gateline, is beneficial, by enabling all accesses to be shifted west towards the main walkways to ExCel and the Victoria Dock Road entry/exit. Value engineering therefore can achieve some benefits to passengers.

281. Such a general relocation will help both options for a Stage F outcome: a design with escalators, as well as a design without escalators. In both instances, set against the previous Stage E design with station facilities located further east, passenger flow times will be shorter, which is beneficial, and capital costs should be lower for the upper level passenger and staff accommodation areas.

282. As a result of this exercise Crossrail did judge that the station will function adequately. In some modelling it considered that the station will function better, without rather than with escalators compared to the pre value engineering design. This is covered in Crossrail’s note on Custom House Passenger Number Predictions.

283. This says “the model shows that [in a 2076 scenario, ie 2026 + 28%, with 30 tph] where escalators are introduced congestion occurs at the foot of the up escalator as passengers alight from incoming trains onto the platforms. Having four stairs and no escalators, which is Crossrail’s current and preferred design solution for the station, means that alighting passengers spread more evenly between the stairs rather than favouring the **single up escalator**, so localised queueing is reduced”. [JRC bold emphasis].

284. This key feature of this note is the modelling of a **single up escalator** for 2026 + 28%. The consequent congestion round just a single escalator heading in the peak flow direction is scarcely surprising. Most train operators including DLR are ready to reverse the flows of escalators to address peak directions of passenger flow, and DLR undertakes this at Custom House as required. LUL also does this at busy stations.

285. Crossrail has since confirmed (18th September 2012) that at least some of its modelling has both escalators operated in the peak flow direction. They confirm that those modelled event scenarios have shown that the platform will clear before the next train.

286. The point made in Crossrail’s 17th May 2011 note about 2076 modelling (ie 2026 + 28%) is therefore not accepted, once modelling is undertaken with two escalators.

287. Overall, I find that the answer to the question posed, does the station function better with RIBA Stage F compared to Stage E, is in general yes. I have expressed a reservation about the lift and PRMs, and expand on this topic in section H.

288. I also have the observation that Crossrail's current-day modelling, which has two escalators operating in the peak flow direction, shows that both design options, of a with or without escalator Stage F station, function adequately in the 2026 + Event and 2026 + 28% scenarios. Indeed Crossrail is content to make passive provision in its without-escalator Stage F design, to accommodate escalators at a later date. It surely wouldn't have done that unless it was satisfied that escalators were feasible and operationally viable.

289. Since Crossrail developed its Stage F scheme with only passive provision for escalators, Newham has considered its position on Crossrail's detailed planning application, in early 2012. The Council was not satisfied that the removal of escalators between the platform and the upper level station concourse was a justified change.

290. Crossrail is now appealing against the imposition of this condition, under various headings.

291. The absence of escalators means there is a failure to maintain the previously proposed level of amenity, because the value engineering instruction effectively overrode any benefit/cost arguments of retaining directly beneficial passenger amenities – the 2 escalators.

292. Passengers interchanging via buses have also faced a loss of a second lift, between the upper level walkway/station concourse and Victoria Dock Road. Only one lift is to be kept there, and Crossrail has euphemistically said that "management strategies will be employed if the remaining lift is out of service."

293. Overall the loss of two escalators, to say nothing of the Victoria Dock Road second lift, demonstrates a failure of project strategy – a world class railway – to be maintained for front-line passenger facilities in the face of financial pressures.

294. This 'double whammy' will cause further loss of amenity and journey time penalties for those who have reduced mobility, as well as causing direct or indirect journey penalties for able-bodied passengers who might have benefited from the escalator or been less hindered by others.

F. **JRC's own assessment of station facilities**, with reference to the neighbouring DLR Custom House station and the ways in which passengers made use of the different choices of station facilities, particularly by people with reduced mobility.

295. This summary is already in Annex 1 to this proof of evidence, which is the main JRC report on the DLR Custom House station survey. It is also attached in section F above. For completeness, it is re-attached now, with some preliminary remarks.

296. The survey's purpose was to establish an evidential baseline about the revealed preference of passengers, comparing the choices between escalator and lift, and between lift and stairs. The survey was undertaken rapidly following instructions, on Sunday 2nd September 2012, between 07:00 and 17:00 during the Paralympics.

297. A summary table shows the revealed preference of passengers with reduced mobility (PRM), and is extracted from the JRC report and set out below.

298. Because the station largely operated with a one-way flow during the day, it is possible to see the way PRM users made their choices at the eastern exit (escalators or lift) and at the western exit (stairs or lift). Among the able-bodied, the proportions were 74% escalators and 26% stairs, similar to the pushchair user proportions.

Distribution of passengers with reduced mobility (PRM) between station facilities by passenger type - this was effectively a revealed preference survey

	Custom House western exit		Custom House eastern exit	
	Choice between lifts and stairs		Choice between lift and escalators	
	Lift	Stairs	Lift	Escalators
Wheelchair users	100%	0%	93%	7% (none stair-adapted)
Pushchair / pram etc users	86%	14%	25%	75%
Encumbered with baggage	56%	44%	0%	100%
Infirm walking passengers	54%	46%	0%	100%
Other users	100%	0%	-	-

299. This provides clear evidence that, given a choice, there is a 3 : 1 ratio in favour of escalators vs stairs among large volumes of users: the able-bodied and the ambulant PRMs with pushchairs and accompanying passengers. The pushchair PRMs and those accompanying amounted to half of all surveyed PRM numbers, with 785 of 1,569 people.

300. The survey of persons with reduced mobility (PRM) on Sunday 2nd September 2012 revealed that 9.3% of arrivals between 7AM and 5PM, an estimated 1,569 people, had reduced mobility or accompanied such persons. Some would head for the local catchment, but the vast majority were attending the Paralympics.

301. When given an option, the majority of people who could use an escalator conveniently, used it. Hence 75% of pushchair users on the eastern escalators vs 25% via lift. When faced with a choice of lift or 6 metre stairs, most (86%) opted for the lift, but the eastern exit demonstrated that it wasn't the preferred option.

302. Among the mobility impaired and persons encumbered by baggage, there was only one choice if escalators were available – no-one used the lift. When presented with stairs or a lift, just under half (44-46%) opted for stairs.

303. Wheelchair users went wholly for the lift at the western exit, vs stairs, but the Paralympics were also about the Extraordinary, and 7% used the escalators at the eastern end.

304. There were high proportions of accompanying passengers, with, at the western exit which was primarily used by spectators, nearly 7 passengers for every 4 wheelchair users, and 9 people accompanying every 4 pushchairs. There were 10 accompanying to

4 pushchairs at the eastern exit (ie, 2 to 3 people with each push chair). This may not have been anticipated by transport planners. It is understood from Crossrail that it does not explicitly plan for accompanying passengers with PRM, though it considers that its modelling provides some margin for that.

305. In terms of the station's capacity to cope, it was very well furnished overall, with two lifts, two escalators and wide stairs. In the busiest general arrival hour, 10:00-11:00, 14% of passengers were PRM or accompanying. During the busiest PRM arrival hour (10:30-11:30), nearly 20% of all PRM arrived, 308 people. And despite all the investment beforehand, 43 PRM and accompanying passengers experienced delay using the western lift in that busiest hour.

306. Within-station journey times generally showed up escalators as best performing and coping with large numbers of passengers per minute when required, with stairs a close competitor at low passenger flows but slower as flows intensified. Having two escalators in the peak flow direction was effective.

307. This DLR survey shows that even with a wide range of facilities to support intensive passenger flows at ExCel events, a high level of amenity was not always achieved on the day. The proportion of pushchair usage at each end of the station demonstrates the disparity at the western exit, only equipped with stairs and lift. The survey quantified that there were regular waits for a later lift at the western lift exit, during the busiest arrival period.

G. **Further projected passenger flows** and growth in demand that may be stimulated by other projects, beyond those already discussed under the topics of station catchment and detailed design, and implications for the validity of the present station design within the planning appeal.

308. There may be further projected passenger flows to be taken into account in the assessment of fitness for purpose and level of amenity of the proposed Crossrail station. These might apply before or from Crossrail's opening year, or during later years up to the 2026 modelling date, or beyond towards the 2026 + 28% (notional 2076) growth scenario.

309. The main elements are:
- Census 2011 and its consequences
- Silvertown North local development
- London City Airport (LCA)
- ExCel further growth
- High Speed 2 (HS2), and Old Oak interchange and development
- Crossrail expansion in Heathrow, Great Western, and West Coast corridors
- Crossrail extension beyond Abbey Wood.

310. Cumulatively the extent and scale of these changes is massive for the existing Crossrail project. It could even invoke some of the passive design precautions which are being built in to Crossrail, of operating not 24 but 30 trains per hour in the core section.

311. The alternative, intermediate update option, of the same frequency service but longer 12 car trains is not favoured by TfL. There are more passenger and London wide benefits to be gained by having higher frequency services, if there had to be a choice on how to increase capacity. This would not increase train frequency on the line through Custom House, based on present Crossrail thinking which is to run the increased service on the Shenfield line rather than the Abbey Wood line (see para.71). However the overall growth would instead increase loadings per train, so raising the passenger volumes which had to be accommodated every 5 minutes at the Crossrail platform.

312. Overall, it is unreasonable to assume that all these projects will happen, or happen quickly. However it is also unreasonable to think that none or only a few will happen. The intense focus on extra infrastructure capacity that is been prioritised by the current government will ensure that much may happen but over a timescale limited by affordability and competition between projects for priority. There are plenty of other projects competing for funding and go-ahead.

313. The present situation is that Crossrail's greatest risk of additional pressure from the general volume of passenger flows, remains in relation to the 2026 + Event scenarios. Outline modelling as shown in paras.50-69 suggests that (after allowing a margin for Fruin space requirements around platform exits by stairs or escalators), there will be no more than one stairway's worth, 420 passengers per 5 minutes, available as a margin with very little then to spare in the 'red' scenario, and with less capacity than that in the June 2010 scenario.

314. 420 might sound a lot in 5 minutes, but every passenger in the opposite direction would reduce the available capacity by another one, so we could be looking at no more than 210 passengers per 5 minutes, or no more than 1,260 in a half hour. This is less than one train's worth among six trains each with 1,500 passengers, or 12% of six trains each with 1,700 passengers.

315. The scale of flows that could be stimulated by some of the growth projects described above could easily require Crossrail's sponsors to revise and update the required passenger flows sometime during the rest of this year, and in successive years, from various causes.

316. For example, decisions on HS2 planning are required within the next two months, as definitive design work must then proceed on the project including the layout of Old Oak interchange, in time for the HS2 Hybrid Bill to be deposited in Parliament in Autumn 2013. This will commit the Government, Department for Transport, and bodies such as Transport for London and Network Rail to new service specifications for Crossrail and other rail routes. It is plausible that there will be new sponsors' requirements given to Crossrail. Similarly the consequences of Census 2011 will need to be assessed and may lead to new requirements.

317. If new requirements are issued by the sponsors, Crossrail will have to reassess the validity of the passenger flows at stations such as Custom House, and the viability of the station's detailed design. On the evidence above, any new requirements are likely to

point towards more passenger flow capacity or more station operational flexibility being desirable, not less.

318. Overall, this raises the risk of more passengers having to be catered for at Custom House station and interchange. As already deduced, escalators offer greater margins for handling high passenger flows than stairs. It is not possible to conclude from the information in this section that the RIBA Stage F design for Custom House station is inherently flawed in its present form. However it is a clear basis for concluding that Newham's 'escalator review clause' is an eminently sensible planning condition to uphold and thereby protect the level of amenity, in the context of foreseeable mutations to the Crossrail project within the next few years.

H. **Further assessment of the present station design from the perspective of passengers with reduced mobility (PRM)**, and whether the station is fit for use by PRM.

319. There are several sources of generalised data on how to model PRM ridership on railways in London:
- Crossrail's PRM proportions.
- London Underground's PRM proportions in its 'Station modelling with Legion Best Practiced Guide' of 2009, which also sets out rules for estimating the movement speed of PRM passengers and how people are allocated between use of different station facilities in this modelling.
- Transport for London's use of 2010 research by Steer Davies Gleave on 'Access for All, Benefits Research, Final Report'.
- Original JRC station count for an Access for All bid by London Borough of Enfield, at Edmonton Green in Outer NE London, May 2011.

320. Crossrail's modelling has been analysed, and checked further with Crossrail to understand several modelling queries. On the basis of this information, and particularly an informative email Crossrail of 18th September 2012 [72], I can be clear that Crossrail has not modelled PRM passenger characteristics other than those projected by LUL for the AM-only peak based on a standardised station type. The AM peak produces very low PRM values compared to every other period of the weekday and weekend.

321. Also there has been no consideration for the specialised passenger requirements of Custom House station, neither for able-bodied passengers nor for PRM, except in respect of the generalised need to plan for high volume ExCel events.

322. I consider that this situation is very unsatisfactory, for a unique and exceptional station which will cater for:
- one of the largest off-peak visitor flows in London, comparable in some ways to North Greenwich with the O_2

[72] Julie Davies, Land Use Planning Manager, Crossrail, to Chris Gascoigne, Senior Development Manager, LB Newham, email 'Further Questions Response', 18.9.2012, 17:02.

- an existing and growing usage by high value business passengers whether going to ExCel or flying via London City Airport (when large baggage might be an additional issue)
- a large and growing development catchment worth £ billions GVA each year, served by an express urban railhead with fast journey times to Central London, Heathrow etc.
- the strong East London accessibility culture, described above.

323. The results of the JRC count at DLR Custom House station on 2nd September 2011, which surveyed the revealed preference of passengers about different types of station facilities (so could be contrasted with the LUL model), and the total proportions of different types of PRM who were travelling, which can be compared with PRM proportions from other sources.

324. In my opinion, Crossrail is proceeding on an unjustified path by persisting with outdated values of PRM usage of the London rail system. It is clearly out of alignment with Transport for London's own use of PRM evidence as demonstrated by the TfL London Rail 2011 bids to the Department for Transport for Access for All funding for step-free facilities, at stations lacking those. TfL London Rail will be the client for the Crossrail franchise from 2015.

325. Using several station categories from LUL's own Best Practice Guide, or by using JRC's DLR Custom House evidence, points towards PRM percentages of 10% to 15% at times of day and week other than the AM peak which Crossrail has stuck with. A sample assessment, under not very onerous conditions, shows that using a 10% PRM proportion for a high volume ExCel event having visitors arriving at the same time as the PM peak, causes the proposed lift to be unable to accommodate all the forecast PRMs before the next train arrives. There would be an increasing backlog of passengers.

326. I conclude that there is sufficient genuine evidence to be satisfied that the lift proposed at Custom House Crossrail station is not fit for purpose in the case of a high volume ExCel event. It will impair and indeed prevent the amenity of PRM passengers, quite apart from failing to conform to Crossrail's own standards for station functionality.

327. Consequently the station design is flawed. It may be illegal under accessibility laws, and this point should be explored.

328. It needs to be reconsidered, for the benefit of DLR as well as Crossrail, for the benefit of all businesses residents and visitors to the Royals catchment, and to sustain and support the regeneration and economic growth in Custom House's catchment.

329. The faster generalised journey times that can be achieved on the escalators compared to stairs, particularly in high flow conditions, are a strong amenity gain for a station where is it foreseeable that there will many new pressures for additional passenger growth.

330. The revealed preference of different types of PRM passengers when faced with the different choices of escalators vs lift, or stairs vs lift, also point clearly to the overwhelming desire for escalators not just lifts.

I.2 Conclusions

331. Passengers expect and deserve an experience at railway stations, through service, facilities and access, which adds to their end-to-end journey experience.

332. Transport for London, in setting out its 2011 Transport Strategy Accessibility Implementation Plan, emphasises the need for a 'whole journey' approach.

333. Custom House will be a station serving a unique area of London, a priority regeneration area delivering £ billions GVA annually and which is being further developed on a large scale, with international standard facilities including the ExCel centre and Silvertown North. The catchment also has high levels of deprivation among the existing population.

334. The station will be:
- An express metro railhead for the whole of the Royals.
- An express metro railhead for London City Airport.
- A proposed bus interchange, including the potential to serve catchments further along the Thames Gateway north bank, in the absence for the time being of a DLR extension to Barking Reach and Dagenham.
- An interchange for the DLR Beckton branch, and potentially in future a DLR Barking Reach and Dagenham branch, as well as an access point in its own right for the DLR services.
- The transport umbilical between the internationally important and growing ExCel centre and Heathrow, Old Oak (High Speed 2), Paddington, the West End, City, Liverpool Street, East London Overground and Canary Wharf.

335. I have reviewed the station's catchments, and the critical relationship between the station and ExCel, where the station's operability and adequacy of capacity is much under pressure in the scenario of a major, evening ExCel event at the same time as the PM peak.

336. It is possible to get the station to work in those circumstances, but the margins of operability will be tight. The absence of escalators will lead to stresses and reduce amenity, for passengers entering the station or interchanging at the same time as ExCel crowds leave the station. In some circumstances westbound DLR trains might not be able to call.

337. This is essentially driven by the tight capacity margins with stairs, compared to two escalators operating when necessary in the peak flow direction which can offer a greater capacity and tolerance from exceptional flows. This will preserve the station amenity better.

338. The foreseeable growth in Crossrail usage, above that now planned for and set out in sponsors' instructions to Crossrail, comes from numerous possible sources such as High

Speed 2, the 2011 Census, various current Crossrail extension projects and large-scale catchment developments such as expansion at London City Airport and Silvertown North.

339. While not everything may be authorised quickly , there is a clear momentum under way. Again escalators will provide a greater margin of resilience than just stairs, to accommodate increases in passenger demand and particularly at times of high peak and ExCel traffic. Once again the amenity will be preserved while the area, and Crossrail, will not gain a reputation for congestion and poor quality travel experiences.

340. JRC has surveyed how passengers and particularly people with reduced mobility (PRM) use different elements of the DLR station when presented with the options of escalator or lift, or stairs or lift. Escalators are the clear passengers' choice, and were used by 65% of all PRM passengers in the JRC survey.

341. Escalators gives PRM the closest level of equivalent journey convenience and amenity compared to able-bodied and unencumbered passengers. There was a clear 'voting' by PRM. Journey times between the station platform and the upper walkways were quicker by escalator particularly in conditions of high passenger flow. While this benefited all passengers, it also maintained the amenity for PRM on an equivalent basis.

342. I was concerned by the findings from my research into how Crossrail has defined and applied the principles and detail of modelling for PRM usage. Crossrail has adopted a modelling basis (an AM peak only scenario) which produces the least estimates of PRM, and has gone on to apply the outcomes in other ways which disadvantage PRM and the extent to which their needs are catered for.

343. By applying credible modelling formulae from other sources embracing Transport for London and London Underground, and from consultancy work including some JRC findings on Custom House, I conclude that there is sufficient genuine evidence to be satisfied that the lift proposed at Custom House Crossrail station is not fit for purpose in the case of a high volume ExCel event. It will impair and indeed prevent the amenity of PRM passengers, quite apart from failing to conform to Crossrail's own standards for station functionality.

344. Consequently the station design is flawed. It may be illegal under accessibility laws, and this point should be explored.

345. It needs to be reconsidered, for the benefit of DLR as well as Crossrail, for the benefit and amenity of all businesses residents and visitors to the Royals catchment, and to sustain and support the regeneration and economic growth in Custom House's catchment.

346. The faster generalised journey times that can be achieved on the escalators compared to stairs, particularly in high flow conditions, are a strong amenity gain for a station where is it foreseeable that there will many new pressures for additional passenger growth.

347. I find that the escalator review condition set by the London Borough of Newham is a vital safety valve for the Crossrail project and for local amenity, and should be upheld.

ANNEX A

17 September 2012 – JRC 517

JRC Station user survey at DLR Custom House station, Sunday 2nd September 2012

Report purpose

1. JRC was asked by the London Borough of Newham to survey the usage of DLR Custom House station, as part of the fact-finding work for Crossrail's appeal against Newham's planning decision of 27th February 2012. That had determined an annual review for the first five years of the station's operation on whether escalators were necessary at the station.

2. The JRC survey would review the ways in which passengers with reduced mobility (PRM) chose to use the station. This could provide evidence about how people would use the facilities when faced with different access choices, a subject of direct concern for Newham with the Custom House Crossrail station and the appeal.

3. The height difference between platform and the upper level walkways at the DLR station was comparable to Crossrail's plans. The adapted DLR/ExCel walkways would be used as part of the Crossrail station's overall passenger flow and connect to the proposed passenger concourse over the Crossrail platform.

Practicalities for the survey

4. Newham commissioned JRC on 28th August, and the survey was undertaken on Sunday 2nd September, from 07:00 to 17:00. DLR and Serco Docklands kindly gave permission.

5. DLR has an 'auto count' system installed. This counts persons passing specific locations, including each stairway, lift and escalator. This meant the JRC survey could focus on how passengers with reduced mobility (PRM) chose to exit the station during one of the main Paralympics days.

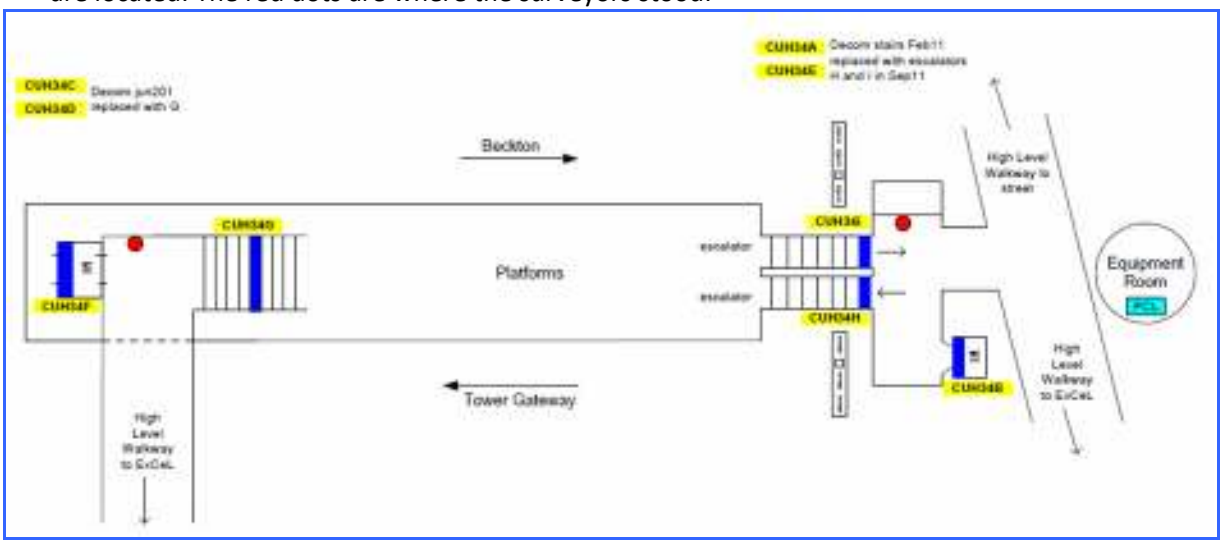
6. There was active station flow management in place. DLR Custom House was advertised as one-way into ExCel and DLR Prince Regent as one-way out of ExCel. There was a little informal flow inwards, but the main in-flow was by competitors, staff and volunteers, all allowed to use the station two-way. This caused occasional delay at the low-capacity eastern lift.

7. The choices that exiting passengers had were:
   - ***eastern end*** near the public exit to Victoria Dock Road and several ExCel entrances (one for competitors, staff and volunteers; another for visitors via the ExCel walkway): **two escalators or an 8-person lift**
   - ***western end*** with another route to the ExCel walkway: **a wide staircase or a 17-person lift**.

8. The escalators were both put into one-way upwards mode, from soon after 07:00. Many staff were in attendance to assist passengers. The volume of exit passengers (DLR counted

over 20,000 during the day, and over 16,800 during the JRC survey period) enabled large-scale sampling, to assess their preferences and priorities between escalators or lift, versus stairs or lift, particularly among the 1,500+ passengers with reduced mobility.

9. A plan of the DLR station is set out below. The blue bars are where the DLR 'auto counters' are located. The red dots are where the surveyors stood:



JRC survey data collected

10. Two people were deployed. Both were familiar with identifying people with reduced mobility, having undertaken a similar survey previously at Edmonton Green for an Access for All project. It was known that not all types of impairment would be recognised, such as those with poor hearing and people with mild levels of lower limb arthritis. To that extent the count would be an under-estimate, despite high levels of sampling.

11. Surveying was conducted from 07:00 to 17:00 with the exception of one 15 minute break at 9:50 and a lunchtime break during a period of lesser passenger flow. Cautious interpolation was undertaken for those periods, with the DLR auto-counts available to provide a guide for proportioning.

12. One of the surveyors is a physiotherapist with a Harley Street and Dorset practice. This person stood at the top of the escalators at the eastern exit, as there was a shorter time to recognise medical symptoms of mobility impairment as people left the escalators, compared to those making their way up the stairs at the western exit. The identification of wheelchairs, pushchairs and people with significant luggage was straightforward.

13. What also emerged from early during the survey was a large number of family and colleague groups who accompanied people with reduced mobility. This is not a normal circumstance for passenger flows during conventional commuting periods, but it was a strong feature of ExCel that Sunday, and can be expected as a feature at other event-type functions at ExCel and elsewhere.

Distribution of persons with reduced mobility surveyed

14. The totals of passenger numbers surveyed is set out below.

Passengers with reduced mobility (PRM), via stairs, lifts or escalators DLR Custom House station 2.9.2012									
Wheelchair + group		Pushchair + group		Walking impair + group		Baggage + group		Other users	
Wheelchair users	Others in group	Pushchair users	Others in group	Impaired mobility	Others in group	Encumbered	Others in group	Various causes	Segway user
143	202	226	559	302	52	66	0	18	1
Survey from 07:00 to 17:00		PRM	755	Others in group		814		Total	1,569

15. Overall there was at least 1 person accompanying a person with reduced mobility during the JRC survey. However this was mostly with the wheelchair and pushchair users:
    - 4 people accompanied every 3 wheelchair users, on average.
    - There were greater variations between the eastern and western lifts, with less than 1 person accompanying every wheelchair user at the eastern exit, and nearly 7 people accompanying every 4 wheelchair users at the western exit.
    - JRC considers that the cause of this variation was not the lift size (although that prevented people from sharing the lift easily, they re-joined each other at the upper level). Rather it was the ability for some solo persons to proceed at once into the ExCel secure zone.
    - High levels of accompanying passengers were also identified with pushchair users: more than 9 people accompanying every 4 pushchairs at western exit, and more than 10 for every 4 pushchairs at the eastern exit (ie, 2 to 3 people with each pushchair).
    - This is the same order of magnitude as the western lift's results for wheelchairs.
    - These findings arise from JRC's detailed survey counts which are summarised at Annex 1.

Distribution of PRM preferences between escalators or lifts, versus stairs or lifts

16. The proportions with which different types of PRM used the facilities is set out below:

Distribution of passengers with reduced mobility (PRM) between station facilities by passenger type - this was effectively a revealed preference survey				
	Custom House western exit		Custom House eastern exit	
	Choice between lifts and stairs		Choice between lift and escalators	
	Lift	Stairs	Lift	Escalators
Wheelchair users	100%	0%	93%	7% (none stair-adapted)
Pushchair / pram etc users	86%	14%	25%	75%
Encumbered with baggage	56%	44%	0%	100%
Infirm walking passengers	54%	46%	0%	100%
Other users	100%	0%	-	-

17. There is an explicit preference, when they are available, for escalators rather than stairs, compared to the option of lifts. When given the choice, pushchairs and their accompanying groups opted 3 : 1 in favour of escalators, though if faced with a lift vs stair option (at least on the 6m stair rise at Custom House) then only 14% used stairs.

18. Even a few wheelchair users favoured the escalators. The 'voting' preference was also clear among those with baggage and among the infirm walking passengers – all used the

escalators when they were available (including one person with a 'rollator' which is a zimmer frame on wheels), and nearly half used stairs even when a lift was to hand.

19. Jonathan Roberts' own personal experience is relevant - severely injured in a May 2005 car accident, commuting again from September 2005 between Somerset and London, initially on crutches until 2006 and a stick until 2008. As soon as use of the tube's escalators was practicable again, the improvement in mobility through stations was immense and satisfying because there was much more convenient and faster progress, and in the normal company of other passengers. Lifts, if available at all and often themselves not on a direct line of route, were then avoided if possible.

Distribution of PRM across different types of mobility impairment

20. The actual numbers identified on 2nd September 2012 at Custom House using the options of escalators, stairs or lifts are set out below:

PRM passenger assignment between different station facilities, observed at DLR Custom House during 07:00-17:00 on 2.9.2012

Figures incl accompanying passengers & estimated passengers during survey breaks	Choice between lifts and stairs		Choice between lift and escalators		Total	% all user exit flow
	Lift	Stairs	Lift	Escalators		7AM-5PM 2/9/2012
Wheelchair users	273	0	68	5	346	2.05%
Pushchair / pram etc users	288	43	113	341	785	4.66%
Encumbered with baggage	4	5	0	57	66	0.39%
Impaired walking passengers	78	61	0	215	354	2.10%
Other users	16	0	0	2	18	0.11%
Facility users 7AM-5PM	659	109	181	620	1,569	< JRC manual count
Total users exiting 7AM-5PM	599	4,145	187	11,912	16,843	< DLR auto-count
	110.0%	2.6%	96.8%	5.2%	9.3%	< % PRM & accompany
All day count	651	4,665	251	14,493	20,060	< DLR auto-count

1 Segway user was counted within wheelchairs in this table, counted elsewhere as 'other'.

Assessment of busiest flow times	All users	Busiest time	Flow volume	% of 7AM to 5PM all user volume	
	Highest hourly flow	10:00-11:00	2,352	14.0%	< DLR auto-count
	Next highest hourly flow	11:00-12:00	2,211	13.1%	< DLR auto-count
	Persons with reduced mobility (PRM)			% of 7AM to 5PM PRM volume	
	Highest hourly flow	10:30-11:30	308	19.6%	< JRC manual count
	Highest half-hourly flow	11:00-11:30	166	10.6%	< JRC manual count
			13.1%	< PRM % of 10:00-11:00 all user	
	PRM highest hourly flow as % of all user highest hourly flow:		13.9%	< PRM % of 11:00-12:00 all user	

21. There was good correlation between the JRC manual counts and DLR auto-counts for use of the lifts, with a maximum variance of 10%. There were observed proportions of PRM passengers by type of PRM impairment (including accompanying passengers), total 9.32%:
    - 4.66% pushchair users – these were approximately half the total PRM visitors
    - 2.10% impaired walking
    - 2.05% wheelchair – this appeared low considering that this was the Paralympics events
    - 0.39% encumbered with baggage
    - 0.11% other users.

22. The sequence of start times for events at ExCel on 2nd September was: Boccia 09:00, Sitting Volleyball 09:00, Table Tennis 09:30, then a gap until 12:00 Powerlifting, then during the afternoon 14:00 Sitting Volleyball, 15:00 Powerlifting, 15:30 Boccia, 16:30 Table Tennis, then in the evening 18:00 Powerlifting, 19:00 Sitting Volleyball. Gold Medal sessions underlined.

Analysis of peak time PRM arrivals and their experience of the lift service

23. The busiest arrival period was between 10AM and noon, which is to be expected for a series of events where tickets are valid for the whole day so visitors are incentivised to turn up as

soon as they can. People could attend any event at any time, and not have to be there at the start.

24. In the busiest general arrival hour, 10:00-11:00, 14% were PRM or accompanying. During the busiest PRM arrival hour (10:30-11:30), nearly 20% of all PRM arrived, 308 people.

25. Station facilities were busy, with for example the western lift operating upwards on 26 occasions in the maximum PRM hour. There were 9 separate occasions in that hour of PRM users being delayed for a second round trip of the lift, inconveniencing 43 passengers, and one occasion of a third round trip after an eastbound train arrival, further inconveniencing 4 of those 43 passengers. Delays were also observed but not quantified at the eastern lift.

26. The western lift delays arose with 1 in 2 of the DLR eastbound trains in that hour's period (9 out of 18 trains). There was close correlation between PRM and accompanying passengers who had to wait for a lift at some occasion during the day, and higher than average general passenger flows.

27. Out of 19 observed occasions when PRM and accompanying passengers had to wait for a later lift, 2 were when the general flow off eastbound trains and up the western stairs was at least 11% under average for the half hour, 5 when that flow was within 10% +/- of average, and 12 occasions when the flow was over 10% above average.

Differences between within-station journey times

28. JRC undertook within-5 second timings between eastbound train arrivals (the main source of exiting passengers) and the arrival of the first and last passengers up the western stairs and the western lift. Short test surveys gave the up-escalator times for the eastern exit. The eastern lift was an obsolete design so journey times were not considered relevant for future planning, whereas the western lift was recently installed in 2011.

29. The western exit survey detail is attached in a separate Excel spreadsheet, along with the eastern exit survey detail and analytical assessments.

30. Part of the disadvantage of using lifts compared to escalators is the potential additional journey time, particularly when a queue develops for lifts. The following data was derived for the western lifts compared to the western stairs:

Journey time (mins : secs) from eastbound DLR train arrival, 2.9.2012			
Route: platform > upper level	**Low passenger volume (eg up to 40 pass/train)**	**Medium passenger volume (eg 70 pax/train)**	**Notes**
Western stairs [with DLR stair width]	01:08	01:38	Average time per passenger volume, from JRC W exit survey
Western lift	01:15-01:35	01:15-01:35	**First lift cycle**, average all lift users, with 10-30% in wait forlater lift
Western lift		02:15-02:40	**Second lift cycle**
	NB lift cycle is for DLR western lift, ca. 1 min round trip in practice, max 17 passengers per lift		

31. These times can be contrasted with the times observed in sample use of the eastern escalator: 13 seconds on the escalator, 3+ secs exiting to the walkway, and a variable time

along the platform and joining the escalator. The escalator was generally as quick as stairs for able-bodied people in conditions of low passenger volume, and was increasingly quicker in conditions of high passenger volume as the variety of passengers became more impeded on the stairs.

32. The escalators also accommodated more passengers per minute, and the two escalators working together in the direction of peak passenger flow were effective crowd clearers. Apart from occasional early lift arrivals when its passengers were quick off the mark, the eastern escalators were the faster for passengers.

Summary of results

33. The survey of persons with reduced mobility (PRM) on Sunday 2nd September 2012 revealed that 9.3% of arrivals between 7AM and 5PM, an estimated 1,569 people, had reduced mobility or accompanied such persons. Some would head for the local catchment, but the vast majority were attending the Paralympics.

34. When given an option, the majority of people who could use an escalator conveniently, used it. Hence 75% of pushchair users on the eastern escalators vs 25% via lift. When faced with a choice of lift or 6 metre stairs, most (86%) opted for the lift, but the eastern exit demonstrated that it wasn't the preferred option.

35. Among the mobility impaired and persons encumbered by baggage, there was only one choice if escalators were available – no-one used the lift. When presented with stairs or a lift, just under half (44-46%) opted for stairs.

36. Wheelchair users went wholly for the lift at the western exit, vs stairs, but the Paralympics were also about the Extraordinary, and 7% used the escalators at the eastern end.

37. There were high proportions of accompanying passengers, with, at the western exit which was primarily used by spectators, nearly 7 passengers for every 4 wheelchair users, and 9 people accompanying every 4 pushchairs. There were 10 accompanying to 4 pushchairs at the eastern exit (ie, 2 to 3 people with each push chair). This may not have been anticipated by transport planners. It is understood from Crossrail that it does not explicitly plan for accompanying passengers with PRM. [73[1]]

38. In terms of the station's capacity to cope, it was very well furnished overall, with two lifts, two escalators and wide stairs. In the busiest general arrival hour, 10:00-11:00, 14% of passengers were PRM or accompanying. During the busiest PRM arrival hour (10:30-11:30), nearly 20% of all PRM arrived, 308 people. And despite all the investment beforehand, 43 PRM and accompanying passengers experienced delay using the western lift in that busiest hour.

39. Within-station journey times generally showed up escalators as best performing and coping with large numbers of passengers per minute when required, with stairs a close competitor

[73[1]] Verbal advice from Crossrail to LB Newham, 14th September 2012, to be confirmed in writing.

at low passenger flows but slower as flows intensified. Having two escalators in the peak flow direction was effective.

40. This DLR survey shows that even with a wide range of facilities to support intensive passenger flows at ExCel events, a high level of amenity was not always achieved on the day. The proportion of pushchair usage at each end of the station demonstrates the disparity at the western exit, only equipped with stairs and lift. The survey quantified that there were regular waits for a later lift at the western lift exit, during the busiest arrival period.

Annex 1					Passengers with reduced mobility (PRM), via stairs, lifts or escalators DLR Custom House station 2.9.2012									
					Wheelchair + group		Pushchair + group		Walking impair + group		Baggage + group		Other users	
					Wheelchair users	Others in group	Pushchair users	Others in group	Impaired mobility	Others in group	Encumbered	Others in group	Various causes	Segway user
					143	202	226	559	302	52	66	0	18	1
		Total passengers by time of day			Survey from 07:00 to 17:00			PRM	755		Others in group	814	Total	1,569
		Total: reduced mobility pax.	Person with reduced mobility	Others in group										
07:00	07:30	Combined exits	2	0	0	0	0	0	2	0	0	0	0	0
		Eastern exit			0	0	0	0	2	0	0	0	0	0
		Western exit			0	0	0	0	0	0	0	0	0	0
07:30	08:00	Combined exits	12	12	3	4	2	6	6	2	1	0	0	0
		Eastern exit			0	0	1	4	5	0	1	0	0	0
		Western exit			3	4	1	2	1	2	0	0	0	0
08:00	08:30	Combined exits	30	30	5	10	6	15	17	5	2	0	0	0
		Eastern exit			2	7	2	3	9	0	0	0	0	0
		Western exit			3	3	4	12	8	5	2	0	0	0
08:30	09:00	Combined exits	41	33	10	16	6	17	16	0	1	0	8	0
		Eastern exit			2	2	4	15	15	0	1	0	0	0
		Western exit			8	14	2	4	3	0	0	0	8	0
09:00	09:30	Combined exits	36	33	8	2	12	29	13	2	3	0	0	0
		Eastern exit			6	2	4	10	8	0	3	0	0	0
		Western exit			2	0	8	19	5	2	0	0	0	0
09:30	10:00	Combined exits	38	38	10	9	11	23	12	6	3	0	2	0
		Eastern exit			3	1	3	6	6	0	3	0	0	0
		Western exit			7	8	8	17	6	6	0	0	2	0
10:00	10:30	Combined exits	51	64	8	10	22	51	15	3	5	0	1	0
		Eastern exit			4	1	12	27	15	0	5	0	1	0
		Western exit			4	9	10	24	2	3	0	0	0	0
10:30	11:00	Combined exits	67	75	12	20	18	41	29	14	8	0	0	0
		Eastern exit			0	0	10	30	15	0	8	0	0	0
		Western exit			12	20	8	11	14	14	0	0	0	0
11:00	11:30	Combined exits	68	98	15	31	28	61	19	5	5	0	1	1
		Eastern exit			4	4	17	39	10	0	5	0	1	1
		Western exit			11	27	11	22	9	5	0	0	0	0
11:30	12:00	Combined exits	57	82	11	14	22	68	19	0	5	0	0	0
		Eastern exit			0	0	14	49	7	0	4	0	0	0
		Western exit			11	14	8	19	12	0	1	0	0	0
12:00	12:30	Combined exits	38	37	8	8	10	22	16	7	4	0	0	0
		Eastern exit			6	6	7	15	12	0	3	0	0	0
		Western exit			2	2	3	7	4	7	1	0	0	0
12:30	13:00	Combined exits	30	29	6	8	7	21	15	0	2	0	0	0
		Eastern exit			2	1	6	18	15	0	2	0	0	0
		Western exit			4	7	1	3	0	0	0	0	0	0
13:00	13:30	Combined exits	34	24	6	4	7	20	18	0	3	0	0	0
		Eastern exit			2	1	6	18	15	0	2	0	0	0
		Western exit			4	3	1	2	3	0	1	0	0	0
13:30	14:00	Combined exits	47	48	8	17	12	31	25	0	2	0	0	0
		Eastern exit			0	0	6	19	25	0	1	0	0	0
		Western exit			8	17	6	12	2	0	1	0	0	0
14:00	14:30	Combined exits	60	70	8	15	21	48	27	7	2	0	2	0
		Eastern exit			2	0	14	27	18	0	2	0	0	0
		Western exit			6	15	7	21	9	7	0	0	2	0
14:30	15:00	Combined exits	41	42	7	11	12	31	14	0	6	0	2	0
		Eastern exit			3	6	6	13	13	0	6	0	0	0
		Western exit			4	5	6	18	1	0	0	0	2	0
15:00	15:30	Combined exits	22	21	2	2	7	19	10	0	3	0	0	0
		Eastern exit			1	1	5	15	6	0	3	0	0	0
		Western exit			1	1	2	4	4	0	0	0	0	0
15:30	16:00	Combined exits	32	32	5	7	9	25	11	0	7	0	0	0
		Eastern exit			1	0	1	2	11	0	6	0	0	0
		Western exit			4	7	8	23	0	0	1	0	0	0
16:00	16:30	Combined exits	18	20	3	2	7	17	6	1	2	0	0	0
		Eastern exit			0	0	5	11	5	0	1	0	0	0
		Western exit			3	2	2	6	1	1	1	0	0	0
16:30	17:00	Combined exits	31	26	8	12	7	14	12	0	2	0	2	0
		Eastern exit			2	0	4	8	9	0	1	0	0	0
		Western exit			6	12	3	6	3	0	1	0	2	0
			Usage interpolated 9:50 to 10:05 and 12:15-13:15											