

Kensal accessibility analysis

Case study for Park Royal Transit benefits compared to rail

1. This analysis researches the difference in overall journey time between a Kensal station catchment (assuming a direct Crossrail service) and a Central London Crossrail station. Bond Street Crossrail platforms are taken as the destination.
2. The 'door to platform' journey time is faster on average with Park Royal Transit (PRT) to Old Oak Central than Crossrail, although the nominal time from 'platform to platform' appears quicker with Crossrail. This is because of the differences in station access and train waiting times with Crossrail if there is a single station entrance and a low frequency train service, compared with 3 local PRT stops located for maximum convenience for the new developments plus a high frequency Transit service.
3. There are also operational and commercial disbenefits for Crossrail to have an intermediate station between Old Oak and the Central London tunnel. These have become more severe as higher passenger volumes cause proposals for extra Crossrail train services on the Great Western main line and a new Crossrail NW line towards Watford and Milton Keynes.
4. In summary, the current situation faced at Kensal is that:
 - There is a better transport alternative available with Park Royal Transit offering three stops in Kensal.
 - Journey times from Kensal to Central London via Old Oak are quicker on average than via a direct Crossrail service, when access and waiting is considered.
 - PRT would be particularly attractive for the new Kensal development area, with significantly faster journey times.
 - Journey times to other parts of London will be helped by PRT to Old Oak interchange with its widespread connections.
 - The Crossrail service specification has changed from the original scheme on which a Kensal Crossrail station was devised.
 - A Kensal Crossrail station would only have 4-6 years existence as a reversing point before passenger demand required all Crossrail trains to run through to Old Oak for HS2 interchange. There would only be a basic service at Kensal afterwards, which would not be as good as the PRT service.
5. The London and South East Route Utilisation Strategy (published 28 July 2011) acknowledges stakeholder interest in a Kensal Crossrail station but says that a station is not consistent with the strategy for the Great Western Main line, set out in Chapters 7 and 8. *See LSE RUS para 8.3.14.*
6. Analyses are attached in the following sequence:
 - Bus or Transit services for Kensal and North Kensington
 - Factors affecting a Crossrail service.

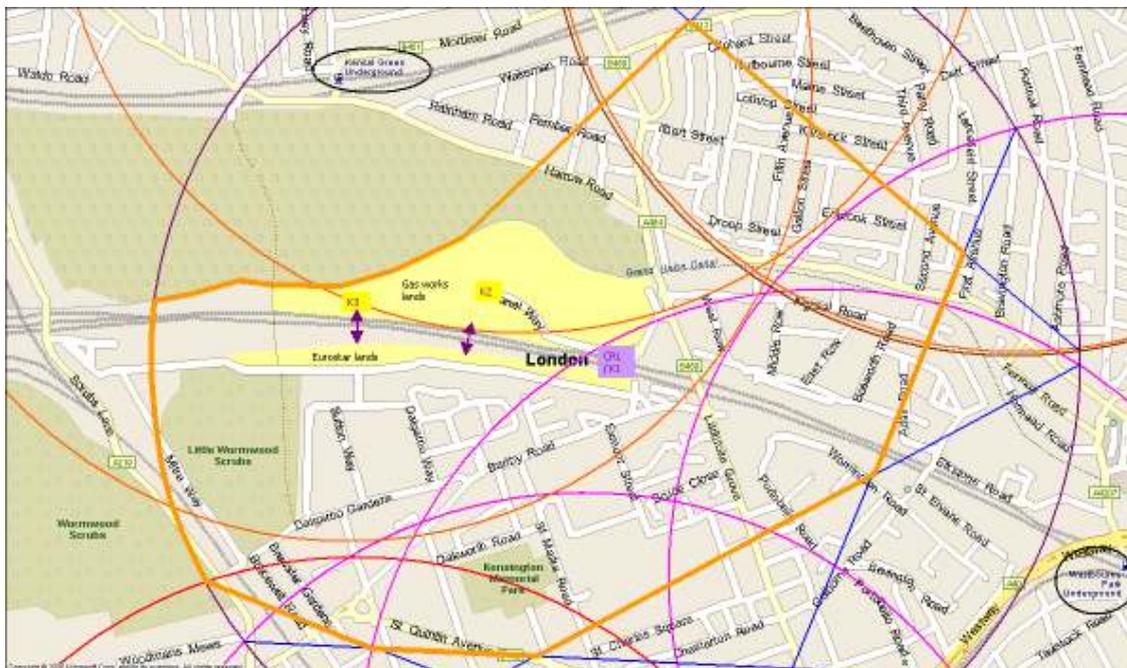
Serving Kensal and North Kensington

Bus or Transit services

1. A detailed analysis is attached. There are also spreadsheets available.
2. The key outcomes are that:
 - Bus in any form is slow, for example if focused on Paddington as the interchange point onto Crossrail, or to Ladbroke Grove or Queens Park, then the Underground.
 - Better pedestrian access to the nearby Kensal Green station (Bakerloo and Overground) is identified but not costed – it may be worth looking in more detail at this, which may require a tunnel under Kensal Green Cemetery.
 - Transit is competitive with a direct Crossrail service from Kensal.
 - A Transit service from multiple local stops within Kensal, taking passengers onto Crossrail at Old Oak Central, gives a faster journey than Crossrail on its own from Kensal.
 - This is because the local access and waiting times at Kensal are shorter, so the overall journey time is quicker.
3. The main priority for Transit between Kensal and Old Oak is to be quick and frequent. It could be Personal Rapid Transit such as used at Heathrow Terminal 5 or a DLR-type train service.
4. Headlines comparing Transit and Crossrail are:
 - Provision of a Kensal station is more efficient for journey times when it is three Transit stops rather than a single Crossrail station.
 - This is because of shorter access times to several Transit stops than a single Crossrail station, and the more frequent Transit and Crossrail services at Old Oak than the projected Crossrail service at a Kensal station.
 - Weighted journey times to Bond Street Crossrail platforms by Transit and Old Oak interchange are 2.8-3.3 minutes faster than Crossrail from the Gas Works developments, and 2.1-2.6 minutes faster from the Eurostar homes lands (based on 3½-4 minute journey to Old Oak).
 - The shorter access times are particularly important for these new developments at Kensal Gas works and the Eurostar lands, so Transit would help to market those developments better than Crossrail.
 - For existing housing, Transit takes an average of 1½-2 minutes longer (weighted time) than Crossrail for the test journey to Bond Street, compared to Crossrail.
 - However, compared to existing means of travel, Transit would still be a great improvement.
 - The journey time test has been towards Central London (taken as Bond Street platforms) - so is a harder test to satisfy than other, non-Crossrail destinations.
 - Travel to most non-Central London destinations throughout London will be even more efficient via Old Oak because of all the interchange possibilities there.
 - It is possible that a DLR-type operation would also be achievable, potentially with two stations rather than PRT's proposed three. Journey time savings would still be expected.

Supporting analysis

5. One kilometre access circles from nearby stations are shown as a background guide. The Gas Works and Eurostar sites adjoin the main Paddington railway but there is no station. A following paper shows that a Kensal Crossrail station is unlikely to be justified in a business case or operationally. The map below shows possible sites for a Crossrail station entrance and for additional Transit or bus stops (K1,K2,K3). The effective station catchment is within the yellow box.
6. The centre of the Gas Works site is close (630 yards) to the existing Kensal Green station - but separated by the Cemetery. That causes a dog leg route from the station of over 1500 yards. Kensal Green is on the Bakerloo and Overground lines. To the south, Ladbroke Grove station (Circle and Hammersmith & City Lines) is nearly 1600 yards.



7. There are frequent buses along Ladbroke Grove and Harrow Road. One route directly serves the Gas Works site (Sainsburys store), route 295.
8. Transport for London assess the area as having a Public Transport Accessibility Level of 4, which is good but not the highest for this type of catchment.
9. Because of the density of traffic in inner West London, it would be desirable if a future high density development had improved public transport accessibility, to maximise public transport use and minimise car use.
10. As an alternative to the fast rail option offered by Crossrail, bus-based options suffer from slow street running unless offered substantial lane and junction priorities. The following express bus options have been considered.

Express bus to Paddington Station

11. If the main demand is to/from Central London, then there is the potential for a conventional or express bus to Paddington Station to connect with Crossrail and the Underground.
12. To serve more of North Kensington (also an RBK&C objective with the Crossrail station), it might run via Kensal Road and Elkstone Road, or Ladbroke Grove and Golborne Road, before accessing the Harrow Road. Journey times would not be fast even with a limited stop service, because the narrow road widths preclude bus-only lanes until near Royal Oak on the Harrow Road. Based on 1¾ miles at 9mph (London Bus average) and 1 mile to Paddington Crossrail station at 15mph, the journey time would be about 16 minutes, with interchange time to add, so about 20 minutes overall.

Alternative express buses

13. Alternatives are a connecting bus to either Queens Park station (1.3 miles, 9 minutes at 9mph) or Ladbroke Grove station (1 mile, 7 minutes at 9mph) then Underground, and/or Crossrail from Paddington. Both Underground lines will have capacity for the likely passenger volumes generated by Kensal Gas Works development. An existing bus route such as the 70 could be rerouted to serve any new development on the Eurostar lands.
14. A summary of nominal journey times shows: (excluding access and waiting time)
 - Express bus to Paddington Crossrail: **20** minutes including interchange at Paddington.
 - Queens Park bus then tube to Paddington: **22** (9, +2 interchange, 7 Bakerloo, 4 i'change).
 - Ladbroke Grove bus then tube to Paddington: **18** (7,+2 interchange, 5 Circle/Hth, 4 i'change).¹
15. With journey times weighted by population volume and walking and waiting penalties, the approximate increase in journey times to Bond Street Crossrail platforms (used as a constant comparator against a Kensal Crossrail station) is about 25% (via Paddington), 45% (via Ladbroke Grove) and 50% or more via Queens Park.

Rail and Transit-based alternatives to Crossrail

Better access to Kensal Green station (Bakerloo Line and London Overground)

16. The Gas Works site and Eurostar lands are within Kensal Green's nominal catchment area, but Kensal Green Cemetery blocks direct access. It may be possible to explore the business case for a travolator or other link in tunnel between the Gas Works and the station. Kensal Green station offers a 10-12 minute journey time to Paddington.
17. When access time from the Gas Works lands is included, this would rise to 15-17 minutes from the closest part of the development area, so it would be competitive with bus-based options and offers a direct tube line into the West End. The costs of a tunnel would be the key element to be understood. Would this be affordable within the £33m cost offered by RBK&C for a Crossrail station?

¹ These are nominal times and exclude the transport modelling rule which doubles walking and waiting times, which are perceived by passengers as taking longer than time in vehicles. Waiting time is x 2 in the Passenger Demand Forecasting Handbook, x 2½ in Transport for London studies. This Kensal analysis has used x 2.

Transit to Old Oak interchange

18. Old Oak interchange and its developments require new local communications in the forms of internal servicing roads and public transport, to join up the numerous sites, to maximise public transport use and to achieve direct and easy interchange between the various site development locations, railway stations and neighbouring centres.
19. The emerging strategic opportunity is of Old Oak interchange being a 'super hub', with a range of distributed hubs nearby, including Kensal, Willesden Junction, North Acton and Hammersmith Hospital.
20. A Transit local passenger system is relevant for this type of development area. The area of Park Royal City International is larger in scale than the Royal Docks development which of course has the DLR Transit network.
21. Detailed modelling has therefore been undertaken into the merit of local Transit stops to serve the Kensal area. Three stops are proposed with a Transit network, and these have been modelled in comparison with a single Kensal Crossrail station to assess the comparative accessibility and overall journey times.
22. The table overleaf is from a working spreadsheet ("Kensal Green accessibility analysis"), and shows that for the new Kensal development lands, Transit accessibility would be an improvement on Crossrail. Combined with a fast journey to Old Oak interchange, and short waiting times at that station for Crossrail, the total journey times to Central London would be quicker overall than the combined access, waiting and travel from a Kensal Crossrail station.
23. Weighted journey times to Bond Street Crossrail platforms by Transit and Old Oak interchange are 2.8-3.3 minutes faster than Crossrail from the Gas Works developments, and 2.1-2.6 minutes faster from the Eurostar homes lands (based on 3½-4 minute journey to Old Oak).
24. For existing housing in the catchment of a Kensal Crossrail station, Transit would still offer a better journey time than existing means of travel, and be only 1½-2 minutes slower than Crossrail from Kensal.
25. These Transit times are in comparison with Crossrail direct to Central London, so this is a tough test to beat. Transit via Old Oak would be a strong offer for most non-Crossrail journeys, not least with the large range of interchange opportunities there.
26. PRT costs as set out by the Ultra company suggest that a Kensal-Old Oak Transit line would be affordable within RBK&C's £33 million budget.

MODELLED JOURNEY TIMES, KENSAL CATCHMENT TO BOND STREET
Comparing Crossrail and PRT

With PRT stops K1, K2 , K3	Journey times x estimated population, to Bond Street Crossrail platforms				weighted jny time PRT saving compared to Crossrail (negative is less journey time)
	PRT WITH 3 KENSAL STOPS		CROSSRAIL 1 KENSAL STOP		
	minutes	weighted jny time (walking, waiting 2 x actual)	minutes	weighted jny time (walking, waiting 2 x actual)	
	total jny time		total jny time		
Gas Works K1	33,441	43,182	27,516	39,232	3,950
Gas Works K2	82,488	106,177	76,614	114,028	-7,851
Gas Works K3	34,201	43,801	38,379	60,358	-16,556
Gas Works Homes overall:	150,130	193,160	142,509	213,618	-20,458
Eurostar lands K1:	20,128	25,557	16,453	23,107	2,450
Eurostar lands K2:	22,011	29,321	18,799	27,797	1,524
Eurostar lands K3:	35,905	47,209	37,682	58,963	-11,754
Eurostar Homes overall:	78,044	102,088	72,934	109,867	-7,780
existing residents K1:	148,378	210,656	126,853	196,306	14,350
existing residents K2:	27,747	38,619	23,528	35,807	2,813
existing residents K3:	71,923	104,470	64,677	103,104	1,367
Existing Housing overall:	248,048	353,746	215,058	335,216	18,529
time incurred overall:	476,222	648,993	430,501	658,701	-9,708

Assumes 4 minute PRT journey time to Old Oak interchange.
A 3½ minute journey would increase time savings with PRT.

Serving Kensal and North Kensington

Factors affecting a Crossrail service

1. The Royal Borough of Kensington & Chelsea desires access to Crossrail. The proposed station location is near Ladbrooke Grove, the Kensal gas works lands and the former Eurostar depot lands. It would also serve the North Kensington area which has significant deprivation in UK terms.
2. The scheme is based on the premise that the initial Crossrail scheme requires a proportion of cross-London trains to terminate westbound near Paddington and return through central London eastbound. RBK&C suggest that such trains could terminate at Kensal instead, and the Council is willing to fund the estimated £33m capital costs.
3. The HS2 proposal has the effect of making a Kensal Crossrail station impracticable in its business case and operationally.
4. There are three main reasons.

(1) Most or all Crossrail reversing trains will need to run as far as Old Oak rather than stop near Paddington. So there is no business case for a regularly served reversing station closer to Paddington.

(2) Crossrail trains to the North West suburbs are now being proposed for the 2020s. These will also raise operational frequency on the main tracks between Paddington and Old Oak, with additional penalties arising with any new intermediate station.

(3) Depot and siding connections from the main Crossrail tracks to Old Oak depot are likely to require a grade-separated junction in the vicinity of the gas works lands. This could make an intermediate station harder to position.

5. The London and South East Route Utilisation Strategy (published 28 July 2011) acknowledges stakeholder interest in a Kensal Crossrail station but says that a station is not consistent with the strategy for the Great Western Main line, set out in Chapters 7 and 8. *See LSE RUS para 8.3.14.*

Specific commentary

6. Each of these points is discussed in turn below.

(1) Most or all Crossrail reversing trains will need to run as far as Old Oak rather than stop near Paddington. So there is no business case for a regularly served reversing station closer to Paddington.

7. HS2 requires 25-40% of all London area passengers to join/alight at Old Oak, to relieve passenger capacity pressures at Euston terminus. Many passengers are expected to transfer to Crossrail – some towards Heathrow but the bulk towards Central London. There will also be transfer to orbital services.

13. There are then no reversing trains left in inner London, which eliminates any advantage of Kensal and means that a proposed intermediate station with a modest catchment is then in the way of the full Crossrail service.
14. Kensal's catchment size is a further commercial issue. The passenger demand at any Kensal station is unlikely to justify the full Crossrail train frequency. Local Underground station usage ranges from 2m entries and exits annually (Latimer Road, 2010) to 5.23m (Ladbroke Grove, 2010).
15. A share of current 3 hour morning peak boardings (Latimer Road, 827 in, Ladbroke Grove 2,084 in), if applied to a 10-coach, 6 trains per hour local Crossrail service in the high peak hour at approx 8-9 AM, would be an average of 7-18 passengers boarding per coach. This assumes all passengers travelled towards central London. In practice, some passengers would also travel west to Old Oak interchange. So a 6 tph, 10 minute headway service should be adequate.
16. Stopping all 24 Crossrail trains per hour would cause significant passenger disbenefit to users already on the trains, causing an adverse Benefit Cost Ratio for a new Kensal station. Kensal would not have the compensating benefit of lots of extra passengers – unlike at Old Oak Common.
17. A timetable offering a low stopping frequency at Kensal could probably be devised. For example, see the equivalent example in East London at Maryland, close to Stratford interchange, which also has 5-6 trains per hour in the peaks.¹ However such a timetable introduces a new operational risk on what by then will be the Crossrail 'main line' with at least 24 trains per hour in the peaks. The LSE RUS is also concerned that use of the GW relief lines by 'skip-stop' trains (which is a priority if fast Heathrow trains are to be maintained in some form) will be hindered by a station at Kensal.
18. Furthermore it is vital that trains 'present' themselves on time at the start of the tunnel section, to maintain regular headways through the Central London tunnels and minimise platform crowding. The impact of a Kensal Crossrail station on such a large service volume has not been assessed by RBK&C's consultants, MVA. Crossrail's Oak Old station is proposed with four platforms in its final post-HS2 format. This will help manage service performance. There is only space for two platforms at Kensal unless there are major infrastructure works not within the £33m funding. This may cause substantive objections from Crossrail when it has assessed its operational needs with a full train service running as far as Old Oak.
19. Overall, a Kensal station is unlikely to show a good Benefit Cost Ratio when including the monetised cost of additional operational risks on a busy 'main line'. It will also be necessary to discount in revenue terms the diversion of passengers from existing catchment stations (principally Kensal Green, Queens Park and Ladbroke Grove). TfL has estimated a BCR of under 1.5 : 1, too low to meet DfT value for money criteria, though MVA disagrees with this estimate.

¹ [http://www.nationalexpresseastanglia.com/travel-information/train-timetables/may-2011-timetable/\(station\)/MYL](http://www.nationalexpresseastanglia.com/travel-information/train-timetables/may-2011-timetable/(station)/MYL)

(3) Depot and siding connections from the main Crossrail tracks to Old Oak depot are likely require a grade-separated junction in the vicinity of the gas works lands. This could make an intermediate station harder to position.

20. The higher core Crossrail frequency between Paddington and Old Oak has operational impacts on track and junction designs, which no party has yet had the time to assess. A simple flat junction would incur operational risks and delay penalties, as trains to the depot could not simply wait to cross the path of in-bound services with the higher frequencies proposed. A flyover or flyunder would be required in a tight location, as well as junction signals and potentially an access track keeping depot trains clear of the main passenger tracks. As noted below, this may physically prevent construction of a Kensal Crossrail station, or raise other unforeseen issues.

Other Kensal operational factors

21. The MVA consultancy was commissioned by RBK&C to analyse the railway operational factors if Crossrail had an additional station at Kensal. The analysis was based on the initial Crossrail service pattern (10 trains per hour peaks west of Paddington, 14 reversing near Westbourne Park). It did not take account of changes to Crossrail services foreseen with HS2 and with the LSE RUS. MVA reported in March 2011.¹
22. The original Crossrail scheme had proposed two Crossrail tracks (one track each way), exclusively for Crossrail use between the Central Tunnel mouth at Royal Oak as far as Ladbrooke Grove. The tracks would then mesh in through ‘ladder’ junctions with the GW Main Line, with separate Crossrail line(s) to the depot. Crossrail’s own signalling (with Automatic Train Operation) would be used towards the Tunnel Portal, so trains would be as fast as 63 mph into the tunnel.
23. The layout allows trains into Paddington terminus from Reading etc on the relief lines (the local lines) to cross westbound Crossrail trains at **Ladbrooke Grove**. This allows more flexibility about timings, track use and performance margins approaching the terminus. Crossrail also has an uninterrupted run towards the **tunnel mouth** from Ladbrooke Grove. Regular interval tunnel headways are critical to Crossrail performance. (Below: Local railway junctions)



Conflict with Reading-Paddington local trains

24. K&C’s **Kensal Station** with its track specification would take out part of **Ladbrooke Grove** junction, because they are close together. It would require local relief line services from Reading to Paddington terminus to cross over at **Portobello Junction** with less flexibility

¹ MVA (with First Class Partnerships), Kensal Crossrail RailSys Modelling v3.4.doc, March 2011

about approaching the terminus platforms. This adds delay disbenefits to Paddington ‘terminators’, and to Crossrail trains who may be stuck behind the Reading local trains awaiting a slot across the westbound Crossrail trains. So it looks a small change but creates significant extra disbenefits, commented on in MVA paras. 5.2.2-5.2.5.

25. There will be fewer Reading-Paddington ‘terminators’ when a full Crossrail service is extended west of Paddington. So most or all of this specific operational issue can be avoided. However, other problems arise which may be equal or greater in magnitude.

Operational issues for Crossrail depot, and train timing into Crossrail Central Tunnel

26. The design of Kensal station looks elegant in theory – fast (overtaking) tracks on the outside of two reversing (or through) platforms where trains can call. A simplified diagram is shown below, though it is more complicated than that on the ground. Thin lines show depot access.



27. This minimises space requirements in a tight local geography. However it means there is no exclusive depot route that avoids the main running lines, between the Crossrail tunnels and Old Oak Depot.
28. This may sound minor but Crossrail will use a different signalling system to the GW main lines, and these will not be ‘tuned’ to allow through running immediately. Crossrail may need at least one exclusive track when Paddington-Abbey Wood services begin in December 2018. This point was not considered by MVA.
29. Any Kensal station could not open until the two signalling systems have been ‘tuned’ to talk to each other. Both will be new in 2018/19 and ‘bedding-in’ time is likely. So a Kensal station might not open until 2019/20 – by which time it will only be 4-6 years before full Crossrail services (not reversing anywhere) will be needed via Old Oak Common. So a reversing station would have a very time-limited benefit, which may not justify the £33m cost.¹
30. A further problem is that the respecification of the running lines causes inbound Crossrail trains to have to stay on the GW signalling system until east of Portobello Junction. MVA cover this point in their para 5.2.4. Crossrail trains will approach Portobello more slowly at 30-55 mph not up to 63 mph. This further reduces Crossrail optioneering and increases timekeeping risks in the all-important Central Tunnel Section where regularity of headways is important to keep down crowding and keep up reliability.
31. As noted above, it is possible that a 24tph service as far as Old Oak Common could require grade-separation rather than flat junctions to get trains into Old Oak Depot without conflicting with the inbound tracks towards London (at present everything is an at grade ‘flat’ junction). This is probable but not yet certain, and is being assessed by Crossrail as a result of the HS2 and LSE RUS proposals.

¹ Paragraphs 28 and 29 are a JRC assessment based on information in the July 2011 Modern Railways about Crossrail signalling issues.

32. Grade separation may be very difficult to achieve with a Kensal station, as the proposed station is shoe-horned between Ladbroke Grove Junction and the existing Depot flyover from the south side (fast) tracks. So there could be an absolute physical problem.

Conclusion

33. **A Kensal Crossrail station has local access and development benefits, but the railway business case and operational factors militate against the station, particularly with the emerging strategic context of Old Oak interchange and the consequential changes to Crossrail service patterns and frequencies. The LSE RUS does not support a Kensal station.**
34. There remains a good case to identify alternative accessibility options for the Kensal gas works development and for the adjoining former Eurostar lands on the opposite side of the Great Western main line, within RBK&C's funding limit of £33m. A satisfactory link would also benefit the wider North Kensington catchment.
35. Transit appears to be a strong option, giving competitive times to Central London and other parts of London via Old Oak.
36. A better link to the nearby Kensal Green Bakerloo and Overground station is also worth reviewing.