

I welcome the opportunity to respond to the National Infrastructure Commission.

[contact redacted]

London's transport infrastructure

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London has been fortunate to have had significant investment in public transport infrastructure over the past decade. However, as a world city growing at a very fast rate, transport infrastructure remains "behind the growth curve". A key part of the commission's work must be to build consensus on transport infrastructure to avoid rejection of bills in Parliament, as the original Crossrail bill suffered in 1994.

The delay caused by the 1994 rejection set back both Crossrail 1 and Crossrail 2. The result is that Crossrail 2 is effectively solving yesterday's problems, not preparing the city for the challenges of the future. However the worst part is that Crossrail 2 is being proposed with no view as to what large-scale schemes will be needed afterwards.

This is a critical flaw that must be rectified.

Question 1

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1. What are the major economic and social challenges facing London and its commuter hinterland over the next two to three decades?

The economy of London has become increasingly centralised, placing rapidly increasing demand on rail-based commuter services. The rise in housing costs in Central London only exacerbates the problem, with increasing numbers of people seeking to travel in from homes in zone 4 and beyond.

Two major schemes will alleviate this in 2018/2019 - Crossrail 1 and Thameslink. However, there is currently a gap of over 10 years to the opening of the next potential major schemes in 2030/2031 - Crossrail 2 and the Bakerloo Line Extension. It is entirely right to fear what 10 years of growth could do to the quality of commutes and safety of services. Ultimately, there must come a point at which bright, motivated people look elsewhere for a better standard of living. The danger is that 10 year gap between major scheme openings may simply be too long.

To put this in perspective, rail growth of 4% year on year results in a doubling of passengers in just 18 years. Since the opening of Crossrail 2 is 15 years away, it can be seen that the existing services in South West London may need to handle growth of 80% or more. It can be argued that this is simply not feasible, even if every seat is removed from trains.

Given the potential harm of relentless growth, the commission should consider whether London needs one or more tactical interventions targetted to open around 2025. One possibility might be express, no-station, tunnels for fast lines, which could be developed quickly as the lack of stations creates fewer planning or construction issues.

Another possibility might be tram systems for areas in zones 1 and 2 such as Hackney to Camberwell, again because tram schemes do not have tunnelling and can be progressed quickly.

It must be noted that the Network Rail long term planning process continues to highlight very high growth in demand on services beyond Greater London. It is already common to see standing for 60

minutes from places such as Winchester. Given the long distance rail infrastructure is at maximum capacity along the SWML (South West Main Line) and GEML (Great Eastern Main Line), there is real risk to economic growth.

(Maximum rail capacity on a two track line should be defined as 24tph (trains per hour) where each train is 12 carriages. While minor variations on this may exist, these maximums have been relatively constant for many years.)

Question 2

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2. What are the strategic options for future investment in large-scale transport infrastructure improvements in London - on road, rail and underground - including, but not limited to Crossrail 2?

London does not have a vision for large-scale investments beyond 2030.

The impact of this on decision today is explored in the answer to question 3. In this answer, I will outline three potential strategic investments that could be considered.

Extending the Metropolitan and Crossrail 1 in South East London

The Metropolitan line terminates at Aldgate in the City of London.

This is a waste and a classic example of how areas south of the river miss out on metro services.

For the past few years, there has been a proposal to demolish and redevelop the site just south of Aldgate station. In my opinion, TfL should be taking advantage of this unique opportunity to prepare for an extension of the Metropolitan line to Abbey Wood.

The proposal would close the existing Aldgate station, taking the line down and under the District line to a new Aldgate South station on the site mentioned above. A new four platform station would be built, with two Metropolitan line platforms beneath two District line platforms.

The Circle line would cease to run from Tower Hill to Liverpool Street, and the Hammersmith & City line would cease to run from Liverpool Street to Aldgate East. (This greatly simplifies one of the most complex metro junctions in London.)

From the new Aldgate South station, the potential would then exist to extend the line south. My preferred route is to City Hall (London Bridge), Bermondsey, Surrey Quays before surfacing and taking over the existing line through Deptford, Greenwich, Woolwich and Abbey Wood.

Bermondsey would be built as a cross-platform interchange with the Jubilee line, thus passengers from the Greenwich area wanting the West End would have an easy change.

This proposal is intended to be completed in association with a Crossrail 1 extension to Dartford. Rather than needing to build two additional tracks, the Crossrail 1 trains would use the existing tracks to Dartford. Passengers using the current Dartford to Greenwich through service would instead use the high frequency Crossrail 1 service to Abbey Wood and change to the high frequency Metropolitan line service to Greenwich.

It must be emphasised however that this proposal depends on securing and safeguarding the development site south of Aldgate.

Additional Crossrail-style schemes

The primary mechanism to provide the necessary capacity is likely to be Crossrail-style schemes. To meet the growth curve, London needs to be targeting a major opening every 8 to 10 years, something that is considerably more aggressive than achieved to date.

Looking at the areas of London that could be served and could accommodate growth, there is probably a role for at least two more Crossrail schemes. Due to history, there are many more suburban lines south of the river. As such, logic dictates that at least one future Crossrail line will need to run from south of the river to Central London and back to south of the river. The main corridors left to be served would be:

- west towards Putney, Richmond, Roehampton, Hounslow
- south, towards Streatham, Sutton, Crystal Palace, Croydon
- south-east, towards Lewisham, Dartford, Orpington
- east, along the Thames

The most logical grouping would thus be west to south-east and south to east. (Note that areas in the North of London are already well served by the tube, with areas in the north-east served by Crossrails

1 and 2, and areas in the west served by Crossrail 1. The main target for a Crossrail scheme in north London would probably be the Metropolitan line, which might be added to the list of possible corridors.)

Crossrail 1 included some provision for Crossrail 2 in the design of Tottenham Court Road. Without the wider vision for London beyond 2030, it is likely that opportunities will be missed and mistakes made in developing Crossrail 2.

For example, looking at the outline of schemes above, it should be clear that at least one additional Crossrail will run via Clapham Junction (either the west or south corridors). Given this, it is absolutely vital that Crossrail 2 is built with at least passive provision for a four platform station with cross platform interchange at Clapham Junction.

Furthermore, it should be clear that at least one new line will need to run along the Charing Cross - Blackfriars - Cannon Street corridor, and as such this alignment should be safeguarded.

Eastern long-distance express line

At some point soon, the Brighton Main Line will be full. The Great Eastern Main Line will also be full. One possibility is to link them in a true large-scale project.

One possible routing would run from Gatwick to Canary Wharf via Bromley and Lewisham. Such an approach would be a game changer for Bromley, with journey times to Canary Wharf of less than 10 minutes.

From Canary Wharf, the line would continue on in tunnel to Stratford before surfacing and running next to the M11 to Epping. At Epping the line would divide, with one branch running to Chelmsford and the other to north of Harlow. Journey times from Epping and Harlow would also be transformed.

This is of course a very expensive scheme. Despite relatively few stations, it has major tunnelling and surface construction costs. It would likely link into expansion at Gatwick or Stansted airports, or major housing zones (such as at Oxted, Biggin Hill, or North Weald).

That said, it would certainly meet the criteria of widening the number of people able to access Central London jobs.

Question 3

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3. What opportunities are there to increase the benefits and reduce the costs of the proposed Crossrail 2 scheme?

First, lets consider Crossrail 2 in South West London. Currently South West Trains operates three distinct service groups - Long-distance (to Exeter, Southampton, Portsmouth, etc), Outer suburban (to Guildford, Woking, Dorking etc) and Inner suburban (to Shepperton, Kingston, Hampton Court, Chessington and Epsom). Unfortunately, the SWML only has 4 tracks, 2 fast and 2 slow, with the Outer Suburban services shared between the fast and slow. In essence, Crossrail 2 exists to provide an additional 2 tracks making 6 in total, allowing each of the three service groups to operate independently. Unfortunately, there are still two key conflicts which limit the benefits of the scheme.

The Raynes Park conflict

The first conflict is at Raynes Park, where the 20tph Crossrail 2 service interacts with the services to Dorking and Effingham Junction.

This conflict will require Raynes Park station to be completely rebuilt with complex and expensive flyover junctions. The Dorking and Effingham services also have to fight for space on the 2 track section from Epsom to Raynes Park, restricting the frequency of Crossrail 2 service to Epsom and Chessington, and slowing down the Outer Suburban services. The conflict between the two service groups will also hurt reliability.

My proposal to tackle this is the 'Mole Valley Link'. It proposes a new railway line from Leatherhead to Claygate. This route runs through open countryside and would require minimal tunnelling. It also runs near potential housing development sites at Malden Rushett, south of Chessington, where there is potential for a new station.

All services from Dorking would run via the 'Mole Valley Link', stopping at Leatherhead, Claygate and Surbiton, instead of Epsom.

While this is a longer route, the higher speeds and lower conflicts would provide a suitable journey time. The proposal works well because it gets the Dorking services onto the Outer Suburban tracks at Surbiton rather than at Raynes Park. This greatly simplifies the work needed at Raynes Park. (With the 'Mole Valley Link', only Crossrail 2 services meet at the Raynes Park junction.) It is possible that the cost savings at Raynes Park may be sufficient to pay the cost of the 'Mole Valley Link'.

To complete the picture, Crossrail 2 services would run to Leatherhead via Epsom. Services from Effingham Junction would run via Sutton. The 'Mole Valley Link' would also allow Dorking services to be extended to start from Horsham. This would provide a small amount of relief to the line through East Croydon, widening the benefits of Crossrail 2 even further.

The Earlsfield conflict

The second conflict is the need for Outer Suburban services to serve Earlsfield. The station at Earlsfield is in zone 3 and currently served by Inner suburban services. TfL's current plans take Crossrail

2 via Balham. As such, Earlsfield would not be served by Crossrail 2.

Despite being an Inner Suburban location, at least some Outer Suburban services will be required to stop there. This is a clear conflict.

Passengers from Dorking, Walton, Weybridge and Effingham do not want to have their services stop at Earlsfield but will be forced to simply because the operators will have no other choice. The Earlsfield stop constrains the ability to maximise the Outer Suburban service, with 18tph being the maximum likely rather than the theoretical maximum of 24tph. Despite this, Earlsfield is still likely to see a cut of over 33% in services stopping, something TfL appears to want to avoid talking about.

My proposal to tackle this is the 'Swirl-Max' plan. It proposes to take the main line of Crossrail 2 via Earlsfield between Wimbledon and Clapham Junction. 20tph would run via Earlsfield, with the remaining 10tph taking a branch from Clapham Junction to Balham and on to Streatham. From Streatham, the branch would surface and completely take over the existing line through Haydons Road to Wimbledon, where the branch would terminate.

The 'Swirl-Max' proposal vastly increases the areas that benefit from Crossrail 2. Streatham is a fast growing area already, with the existing station seeing growth of 10% year on year, compared to 3% to 4% at most stations on the SWML. In addition, Streatham still offers considerable development potential, far more than many other Crossrail 2 stations along the SWML.

The 'Swirl-Max' route would provide 10tph to the Wandle Valley Opportunity area at Haydons Road station, which currently receives just 2tph. There is also the ability to create a new station at the A24 serving St. Georges hospital and driving developments in Colliers Wood and south Tooting.

Beyond these locations directly served by 'Swirl-Max', there is potential to link to development sites to the south at Mitcham and Hackbridge. Although the 'Swirl-Max' proposal does not propose taking Crossrail 2 to those areas, it does propose that the existing Thameslink service via Haydons Road is diverted to run via Mitcham Eastfields and Hackbridge stations (and on to Sutton, St. Helier and Wimbledon). This would double the service frequency to 4tph through these areas, driving development benefits linked to Crossrail 2.

Finally, it should be noted that 'Swirl-Max' provides a way to serve both Balham and Tooting, rather than one or the other. With four stations near the Northern Line, the relief gained is likely to be better than TfL's own scheme. (TfL's scheme is flawed in that it allows passengers from Raynes Park and beyond the ability to change onto the Northern Line. Since the journey to London Bridge and Bank will be quickest via the Northern Line, the likelihood is that TfL's plan will make the Northern Line worse, not better.)

Thus, while 'Swirl-Max' may be slightly more expensive than the TfL scheme, the benefits that accrue are significantly greater.

Chelsea

Crossrail 2 proposes a station at Chelsea which has proven unpopular with residents. Removing the station would save costs and speed up journey times for South West London. Alternatively, re-routing the line via Battersea Power Station would link to the Vauxhall Nine Elms area that is likely to need additional transport provision over and above the Northern Line extension.

Crossrail 2 in Central London

Crossrail 1 provides four double-ended stations in the heart of zone 1

- Bond Street, Tottenham Court Road, Farringdon and Liverpool Street, plus Canary Wharf. By contrast, Crossrail 2 provides just one double-ended station at Tottenham Court Road.

The provision of a single "destination" station will focus demand on the line. A major concern must be that dwell times there (the time it takes to get everyone on and off the train) will exceed the time available to run a 30tph service. The provision of a second central London station should be a requirement of progressing Crossrail 2.

The best option for such a station is under Jermyn Street, with one end linked to Green Park station. This has the advantage of linking to the Jubilee line, broadening the benefits of Crossrail 2 via interchange. It also further relieves the Victoria line, avoiding the tendency for passengers to clog up the tube with "last mile" journeys to the Green Park area.

Passive provision

As noted in the answer to question 2, the lack of a strategic vision for new lines beyond Crossrail 2 will cause decisions to be taken that may prove to be unwise. Specifically, there is a high likelihood of a future Crossrail line (Crossrail 3 or 4) being routed via Clapham Junction. As such, passive provision for a four platform cross-platform interchange at Clapham Junction is vital.

As it happens, the two branches of the 'Swirl-Max' proposal could be the basis of this Crossrail 3 or 4. One branch would be allocated to Crossrail 2 and the other to the new Crossrail line.

The passive provision point is important. Crossrail 1 has built two tunnels in the east, one to Stratford and one to Canary Wharf.

Unfortunately, this means that both tunnels will be relatively under-used assets, with the services split between the two at a location too close to Central London. However, on more than one occasion I have been told that it will be hard to split Crossrail 1 because there was no passive provision for it. (Apparently, the engineering to build a new sub-surface junction on Crossrail 1 is hard.)

Being more aggressive

Given the demand curve, one option is to be more aggressive with Crossrail 2. It seems clear that there is enough demand for two Crossrail lines to open in 2030, not one, but there is limited scheme management capacity in TfL and bill time in Parliament. One way to catch up the demand curve is to build four tracks through Central London from Victoria to Euston on the Crossrail 2 alignment. This is simple to achieve in engineering terms, as the tunnel boring machine planned to run from Wimbledon to Victoria would simply be extended to Euston. Using the same alignment also avoids extra scheme management time or Parliamentary bill time. To manage immediate costs, trains from

the South West would terminate at Euston, while trains from the North would terminate at Victoria, acting as two independent services.

With this duplicate core section, it would then be easy to extend on from Euston and on from Victoria as a follow on scheme. In the north, enough capacity would be available to send a branch to Stratford and the Lower Thames area. In the south, enough capacity would be available to properly relieve the Northern line and serve areas further south.

The key is the realisation that the most expensive stations on Crossrail 2 are the Central London ones, and as such it may make sense to build them once with four platforms, rather than building them with two platforms and having to return later to expand them. While it sounds expensive, the likelihood is that the additional cost would be of the order of £2bn (£500m for extra tunnelling and £500m extra for each expanded station). This makes the concept a very cheap way to lay the foundations for future extensions.

Costs

There appear to be limited ways to reduce the cost of building Crossrail 2 as currently planned. The station at Wimbledon must be a major target for cost reduction, with 'Swirl-Max' proposing a fast line tunnel to avoid expensive demolition and construction work.

There is one more radical possibility however. If the 'Mole Valley Link' and 'Swirl-Max' were both adopted, then Crossrail 2 could be completely separately from Network Rail (by dropping the Hampton Court branch and Waterloo services to Kingston). Such a separation would allow a change in the technology used for Crossrail 2.

The alternative technology would be the "DLR-style" automated metro that was identified in the 2013 Regional vs Metro consultation. A DLR-style automated metro technology could allow 40tph of shorter trains to provide the same capacity, requiring lower cost shorter platforms. An automated metro is likely to also have lower operating costs.

Question 4

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4. What are the options for the funding, financing and delivery of large-scale transport infrastructure improvements in London, including Crossrail 2?

Funding is not my specialist area. However, I believe that all taxpayers in London should pay a transport investment levy to help fund large-schemes. In addition, development sites near locations that receive transport upgrades should continue to pay a levy.

To broaden the tax base to those that live outside Greater London, two additional areas should be considered. Firstly, those living inside the M25. Secondly those living in districts clearly linked to the London commuting economy. The latter category is subjective, but it would be wise to provide an objective way to classify boroughs near London, such as by the percentage of workers that commute to locations inside the M25.

Question 5

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5. How have major metropolitan areas in other countries responded to similar challenges and priorities? Are there any lessons to be learned and applied in London

Barcelona's new metro line 9 offers a novel construction technique which does not appear to have been examined in London yet. Rather than constructing twin tunnels, each large enough for a single track, Barcelona line 9 uses a single large Tunnel Boring Machine to create a tunnel large enough for 4 tracks (2 on the top deck and 2 on the lower deck). Rather than using the extra space for tracks, the project chooses to use the space to construct the stations within the tunnel, dramatically reducing the cost of building each station. Since stations are the most expensive part of an underground railway, this technique should definitely be evaluated for London.

Summary

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While Crossrail 2 should be supported, it is not without flaws. The 'Mole Valley Link' and 'Swirl-Max' proposals tackle the key issues south of Clapham Junction, while an additional station at Green Park would tackle the flaws inside zone 1. Taken together, these three proposals would greatly increase the benefits linked to Crossrail 2, and the potential for development.

A more aggressive approach would be to build four tracks between Euston and Victoria, with the northern and southern halves of Crossrail 2 overlapping. This has a low additional cost, perhaps around £2bn, but lays the foundation for future extensions that do not have the complication of development in Central London.

Beyond Crossrail 2, extending the Metropolitan line to South East London is worthy of further study, simply because it would be relatively cheap.

Finally, London lacks a wider vision for large projects. This needs to be rectified urgently, as without it decisions on Crossrail 2 may not take into account the wider future context.

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