consultancy engineering business environment

GLA - Future rail

ACE response

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Executive summary

There are a number of challenges facing London's rail network over the coming years. For the network to support the city's changing needs, the network will have to adapt in order to be fit for the future. ACE foresees significant changes happening across the network, not only in the short term, but also far into the future as technology advances and new capacity is required.

The key problem for the network in the future will be the constraint on capacity. Currently, at its peak, the network is stretched and prone to disruption. In conjunction with a growing population, these problems will only be exacerbated if no action is taken, and whilst the problem is easy to identify, there is no single solution.

Owing to shifting cultural and working patterns, the way we use the network will change going forward, with demand for a 24/7, 365-day network growing in the long term. This will have a substantial impact upon the timeframe in which engineering works can be carried out.

As a result, the way the network is maintained and upgraded in the future will be significantly different with more condition based and predictive maintenance being conducted, reducing the need for reactive and disruptive engineering works. Additionally, the network will have to be more resilient to the impacts of our changing climate in the future, particularly in relation to disruption derived from high temperatures and increased rainfall.

The quality of passenger's journeys will improve in the future with the increasing availability of Wi-Fi and mobile networks. Access to these networks will be a key feature of London's future railway.

Improving the capacity, frequency and the reliability of services will be a critical factor in the success of London's future rail network. Upgrades in terms of signalling, train communication and automation will have drastic impacts on how the railway operates. However, this will only be able to deliver so much capacity; increasing it will ultimately require new infrastructure to be built.

The way we see stations as terminal hubs for customers journey's will change in the future as over-station development becomes more prominent and practical. The style and layout of stations will change to reflect advancements in design and to accommodate higher numbers of passengers. London's stations will evolve to take on more retail functions in the future as stations become more than travel destinations.

London's future rail network will have a significant role to play in ensuring the mayor's transport strategy becomes a reality. Increasing the share of journeys made by public transport with the rail network accommodating a large portion of this. This will depend on the network becoming a more attractive transport option, especially to those with disabilities.

Furthermore, commitment to massive infrastructure projects, and their delivery, will be vital to ensure the mayor's transport strategy is met; much of the strategy's success relies on the completion of Crossrail 2, and this will require collaboration between stakeholders at all levels up and down the supply chain. Similarly, the delivery of High Speed 2 (HS2) and expansions to the freight network will help unlock extra capacity on the network.

Embracing technology will always be at the core of any forward-looking strategy; relying on new information sharing platforms and challenging the fundamental principles that have guided past strategies will be imperative in building a railway network fit for the 22nd century. This will require an appreciation for what the next iteration of our current technology will be and how it can be implemented.

Key issues facing London's rail network

London's rail network currently faces a plethora of challenges relating to its size, age and capacity constraints. Overcrowding on London's rail network continues to be a problem, and with London's population set to grow, this is an issue that will only become more prominent if no action is taken. By looking at current issues on the network we can identify problems and understand how they may impact what the network looks like in the future.

Engineering work and maintenance

People's lives are increasingly interconnected and conventional patterns of work are changing; working hours are becoming more flexible and being based in a central location less important. This will alter the way people use the public transport network, travelling earlier and later outside of the normal peak times. In the short to medium term this may mean no overall increase of peak time patronage, and potentially even a reduction, depending on how quickly people and businesses embrace more flexible working hours.

Further into the future, demand for a network available for 24 hours a day, 365 days of the year will likely increase. The number of people living in the city, in conjunction with changing lifestyles, will require the network to be operational for more of the day. Whilst over the short and medium terms, flexible working hours may have negligible impacts on the number of people travelling on the network, the growing size of the city will have significant consequences on the demand placed on the network in the longer term.

The implications of this on the way the network is maintained will be critical: the traditional four-hour window engineers have to maintain and upgrade the network overnight, as well as extended closures around holidays, will be increasingly reduced and compacted in the future. Maintaining

the railway in the current fashion will not always be possible meaning longer, planned closures will be increasingly common. An early appreciation of how people will see and use the network in the future will help inform and develop maintenance strategies going forward. Transport for London (TfL) should identify what lessons can be learnt from the maintenance work carried out on the night tube with its increased hours of operation, as well as what factors have enabled this.

As a result, condition-based and predictive maintenance will be increasingly important. Engineering work will have to be done in an increasingly short time frame in the future, so reducing the amount of reactive maintenance will greatly reduce disruption on the network. The rail network of the future will need to be intelligent enough to understand where and when things will go wrong and be able to take action before they do, operating on a just-in-time basis.

Currently, the necessary infrastructure required to monitor and accommodate predictive maintenance across the network is not in place, relying instead mainly on manual checks and reporting. Moving towards a system of automation, and ensuring we have the technological capability to monitor the health of the network, will be the critical first steps to a more efficiently maintained railway in London. It will be vital that TfL are able to identify how to implement a system of predictive maintenance over the long term, whilst maintaining compatibility with the necessary legacy systems. Increased use of drones and sensors to monitor assets and infrastructure can allow for significant advancements in data collection and analysis. Having this information, collected and processed quickly, will greatly improve the way in which work can be carried out on the network.

Climate change will also have a significant impact on rail travel in London. Longer periods of warmer weather with higher peak temperatures in the future will cause more frequent and significant disruption to the network as rails become too hot to allow trains to run at their maximum speed. The construction of our railway tracks will be required to change, whether this is through the use of composite materials more resistant to overheating, placement of sleepers and ballast or through advancements in the ways track is stress tested in extreme temperatures.

Similarly, with periods of heavier precipitation predicted in winter months, considerations must also be given to how our railways will continue to be resilient against all forms of weather; a rise in the use of slab track in the future will require consideration about drainage systems around London's railways and the impact this could have on journey times as well as the surrounding environment where runoff is concerned.

Quality of the journey

Another key issue facing London's rail network is the quality of the journey passengers make. Currently, access to facilities, such as Wi-Fi, charging sockets and air conditioning, throughout the duration of a journey is still not common place on many parts of the network. These facilities will become. Passengers will expect to be able to reliably access their emails and social media accounts wherever they are on the network as well as make phone calls or send messages. Improvement in this area can significantly increase customer satisfaction levels as well as have a drastic modernising effect on London's rail network.

Frequency and capacity constraints

Currently, the number of trains per hour (tph) running on London's rail network is close to capacity, running between two to three minutes apart at their peak, and even closer in some places. Alterations to timetables and improvements to signalling systems will enable us to make better use of the remaining capacity within the network currently. However, without investment in technological or hard infrastructure, the number of trains that can be run on the network will always be limited.

The rail network of the future must look to examples of how and where extracting the maximum capacity out of the current network has already been achieved and learn the lessons of these to apply them moving forwards. The Victoria line currently runs 36 tph in its morning and evening peak hours and is now regarded as one of the most frequent metro systems in the world1. This same degree of industriousness and investment that brought upgrades to the Victoria Line will be required to achieve a rail network fit for London's future.

In the short to medium term, technological advances will allow trains to run closer together and effectively 'talk' to the train in front and behind. As this technology becomes more established, the platooning of trains becomes much easier, with trains potentially coupling and decoupling in transit to further improve the service passengers receive according to the requirements of the network.

Whilst there are significant benefits to be gained from increasing frequency, these will not ease the long-term limitations of capacity. New tunnels and lines will be required throughout London, and the proposed Crossrail 2 route will do much to improve North-South connectivity across the city and beyond the borders of the capital. Similarly, HS2 will also have significant implications on capacity, in both directions in and out of London. London's freight network will also come under increasing pressure should the number of freight trains coming from Southampton, Felixstowe and

[1] https://www.londonreconnections.com/2017/ninety-second-railway-making-victoria-frequent-metro-world/

other key intermodal hubs increase. In this instance, TfL would have an interest in ensuring the capacity of the freight network beyond London's orbital routes is expanded in the future.

With more frequent trains and new capacity being created in the future, care must also be given to the available land for depots. Some depots will require expanding to accommodate additional and different rolling stock for their respective lines, and some depots will have to be built from scratch. Furthermore, existing depots will likely be altered and upgraded to include facilities capable of repairing and housing modern rolling stock. As London continues to grow, the competition for land between housing and commercial developments will only increase meaning the land available for any new depots will be limited. This is a key issue that TfL will have to factor in over the long term.

Stations of the future

Some of London's current stations are overcrowded and suffer from poor design which is detrimental to the passenger experience and seriously hinders the total passenger throughput the station is capable of. Many of London's stations are housed in old Victorian buildings that were appropriate in accommodating the number of people that used them when they were built but have since become outdated. Furthermore, our understanding of design and how this can be used to accommodate higher volumes of people has advanced significantly. London's oldest and busiest stations will require further investment in future years to ensure that they can accommodate the passengers that will be arriving and departing from their platforms.

These new stations will be open plan and subtly direct passengers through good architectural and engineering design making them easy to navigate. Card tickets will be fully replaced with electronic, contactless ticketing in the short term following the trend towards simplicity. Biometric ticketing, with new technology scanning facial features, finger prints or even the vein structure in your palms, will become increasingly common, charging an associated payment account and removing the bottlenecks created around the physical barriers that exist currently. Intelligent signage will direct passengers to the platforms and platform edge doors will direct passengers where to stand, preventing delays and decreasing alighting and boarding times.

Stations will no longer simply be terminal hubs where people begin and end their journeys. Over station development will transform London's train stations into places where people live and work; they will become commercial and residential centres, making train stations destinations for more than just the passengers passing through. This will be important for London's stations with international connections where rail passengers may take advantage of more generous baggage allowances, compared what is permitted on aeroplanes.

London mayor's transport strategy

The London mayor's transport strategy published back in March 2018 set out the vision for the transport network across the capital. One of the main thrusts of the strategy was to ensure 80% of all journeys made in the capital were by either public transport, on foot or bicycle by 2041. Before this can be achieved there are significant barriers that must be overcome, and London's future rail network will have a significant part to play.

The vision to have Crossrail 2 open by 2033 is critical for the strategy's success. As noted in the strategy, Crossrail 2 is essential for the future of London, particularly by unlocking around 200,000 new homes and supporting up to 200,000 new jobs. With the HS2 connection into Euston Station, London risks grinding to a halt if Crossrail 2 is not funded and delivered by 2033. ACE is concerned about how the strategy will operate should Crossrail 2 not go ahead as there appears to be no plan B.

Furthermore, if London's rail network in the future is to contribute to achieving the 80% target, it will be vital that rail presents itself as the best option for users. ACE notes that any shift to a preferred transport mode naturally occurs when it is the best option for users. Recent increases in the use and convenience of private hire vehicles and rideshare platforms suggest a significant challenge attracting these users back to the public transport system. One key element of this will be ensuring that the rail network of the future caters sufficiently for all users, including those with disabilities and other issues relating to their use of the network.

Improving ease of use and access for those travelling on the rail network will be vital in encouraging more journeys to be made on London's rail network knowing that it will be just as convenient, if not more so, than alternative means available. This will involve transforming some of London's busiest stations, with most of the underground network having poor access arrangements from street to platform level.

Improving frequency, capacity and reliability

It will be vital for London's future rail network that employing the latest building information modelling (BIM), as well as digital information sharing platforms, is seen as standard practice and not an example of where one project is leading the way. Whilst Crossrail is commonly regarded as a global example of how the advantages of digital technology can be leveraged, this should be regarded as the standard for major infrastructure projects in London. The advantages of having a connected data environment where information and data can be stored and managed for multiple assets all in one place are significant, especially for any future owners and operators. In the future,

London’s rail network should be embracing digital solutions and replacing outdated, analogue legacy systems. With the current pace of technology, continuing to operate in the same way prevents progress being made.

Consideration must also be given to how the network will be powered in the future. Increased demand on the national grid supply from more and more people using more electrical devices puts a strain on the electricity network, especially at peak times. For trains running above ground, diesel traction will be gradually phased out to ensure that environmental targets can be met, moving initially to bi-modal trains, before becoming fully electric. In the future we will likely see innovative solutions to aid with energy generation and conservation. Trains could be running with wind turbines or solar panels installed in the future to generate their own electricity or be fuelled from alternative sources such as hydrogen. This would likely be in tandem with significant enhancements to the onboard battery of electric rolling stock, greatly improving the energy efficiency of these trains.

Being able to accurately predict the technology of the future is extremely difficult and the advantages of being ahead of the emerging trend significant. London’s rail network of the future should be focused on improving the outcomes for the passengers, and part of this will involve being receptive and responsive to emerging technological trends. There will almost certainly be improvements to the use of rolling block technology, for example, allowing trains to run closer together. However, the exact iteration of this, or any other technology, will not always be obvious. TfL must ensure the rail network of the future has this principle at its core, allowing it to continue to move with changes in technology.

About ACE

As the leading business association in the sector, ACE represents the interests of professional consultancy and engineering companies, large and small, in the UK. Many of our member companies have gained international recognition and acclaim and employ over 250,000 staff worldwide.

ACE members are at the heart of delivering, maintaining and upgrading our buildings, structures and infrastructure. They provide specialist services to a diverse range of sectors including water, transportation, housing and energy.

The ACE membership acts as the bridge between consultants, engineers and the wider construction sector who make an estimated contribution of £15bn to the nation's economy with the wider construction market contributing a further £90bn.

ACE's powerful representation and lobbying to governments, major clients, the media and other key stakeholders, enables it to promote the critical contribution that engineers and consultants make to the nation's developing infrastructure.

Through our publications, market intelligence, events and networking, business guidance and personal contact, we provide a cohesive approach and direction for our members and the wider industry. In recognising the dynamics of our industry, we support and encourage our members in all aspects of their business, helping them to optimise performance and embrace opportunity.

Our fundamental purposes are to promote the worth of our industry and to give voice to our members. We do so with passion and vision, support and commitment, integrity and professionalism.

Further information

For further details about this consultation response, please contact:

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