How TfL's Network Performance Delivery put the "super" in Superloop

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EVERY JOURNEY MATTERS

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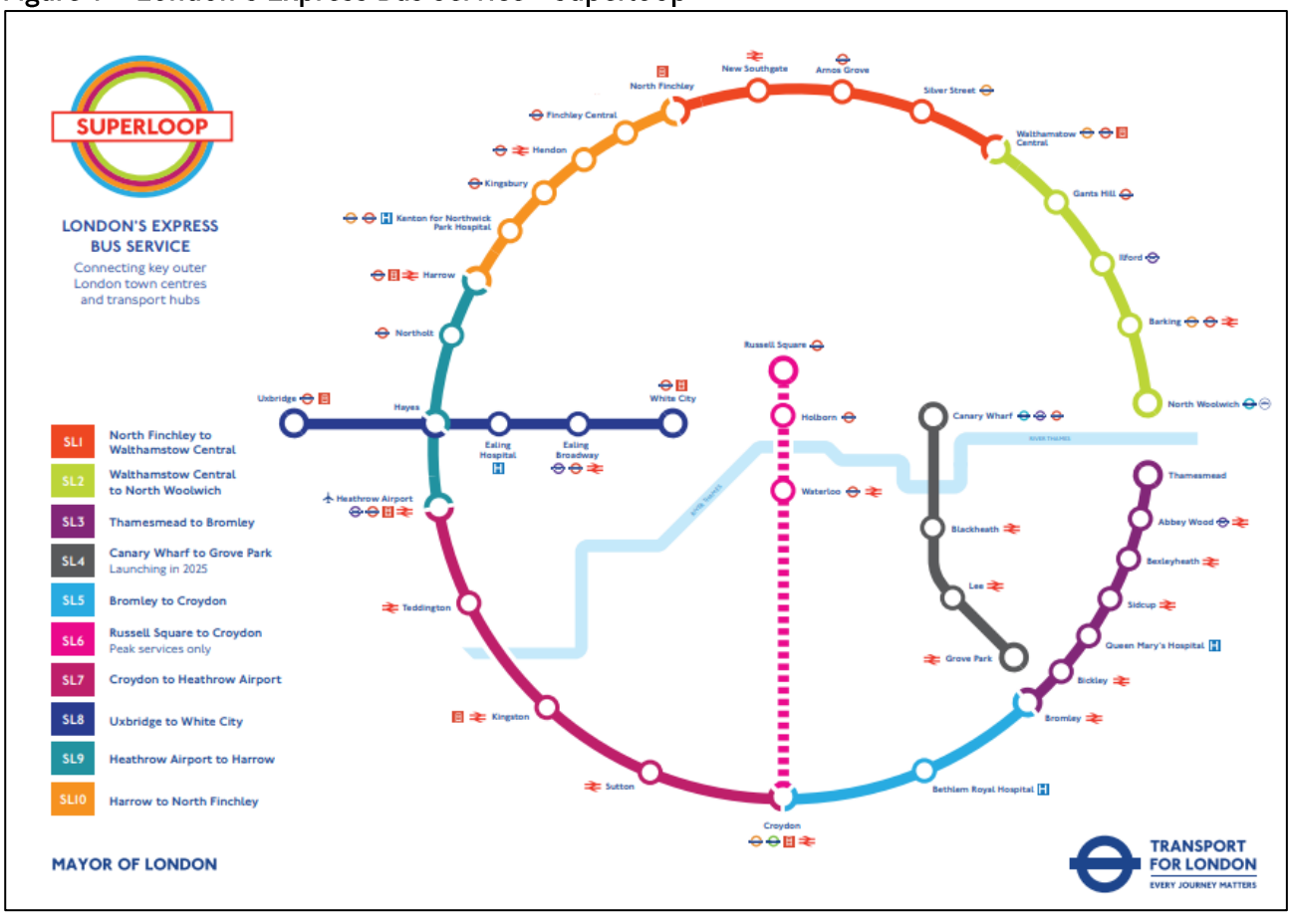
Introduction

Superloop was launched in Summer 2023 and is a network of 10 express bus routes. The goal is to improve connections and journey times between key outer London town centres and transport hubs. Unlike conventional bus services, Superloop routes only cover key locations and do not stop at every bus stop they pass. This means shorter journey times for passengers.

The Outer London loop covers 86 miles (138 kilometres), stops in 21 boroughs, has interchanges with 310 other bus routes, and serves 55 bus and rail stations. Superloop started in 2023 when TfL rebranded and renumbered four express bus routes. Five new express services were added at the end of 2023 and the start of 2024. Figure 1 below illustrates the Superloop and the locations it serves.

Figure 1 – London's Express Bus Service - Superloop



To ensure that at launch customers received the best possible service, multiple different departments within TfL came together. For example; buses were appropriately rebranded, bus shelters were cleaned, 'Superloop' route numbers and "Toppers" added, and bus driver welfare facilities improved. See Figure 2 below for some examples.

Figure 2 – Superloop updates to bus shelters, flags & buses

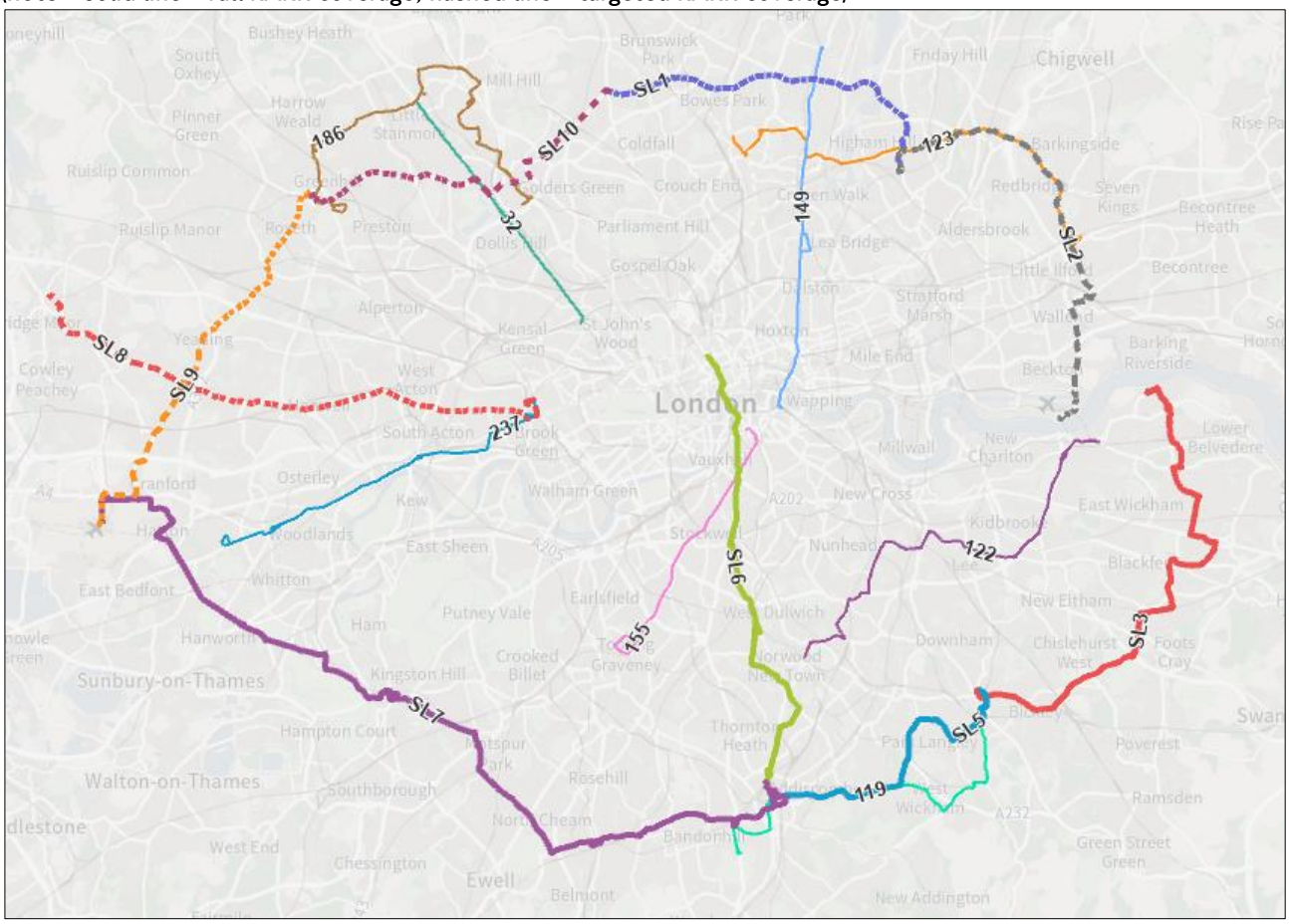
Network Performance Delivery (NPD) were charged with ensuring the existing express routes (which were to be rebranded as Superloop routes) would continue to perform well and receive bus priority at traffic signals. NPD also looked to provide enhancements to these services. For the new routes, upgrades were applied so that they would operate smoothly and quickly at launch – including experiencing bus priority at as many traffic signals as possible.

To ensure our objectives were met, the NPD RARR (Route Analysis Recommendation Report) programme was re-directed to address every Superloop route. As reported at JCT in 2023, the RARR programme is perfectly suited to deliver what was required for Superloop. In advance of rebranding / launch, a whole route analysis of each route identified faults to be resolved, compliance issues to be raised, and schemes to be identified (for future delivery). Most importantly, Bus Priority Optimisation (BPO) Timing Reviews were identified for delivery prior to route rebranding / launch, so that traffic signals were operating optimally and providing the best bus priority . Figures 3 and 4 show the 2023-24 RARR programme, incorporating Superloop.

Figure 3 – 2023-24 RARR programme – altered from planned to incorporate Superloop
(note – yellow = Superloop)

Period	Route	From-To
1 & 2	X26/SL7	East Croydon to Heathrow
3	123	Ilford to Wood Green
4	122	Crystal Palace to Plumstead
5	607/SL8 (partial) X140/SL9 (partial)	Ossie Garvin Roundabout to Uxbridge Heathrow to Hayes & Harlington Station
6	X68/SL6	Russell Square to West Croydon
7	SL2 (partial) SL3 SL1 & SL10 (limited)	Walthamstow to Woolwich Ferry North Terminal Bromley Town Centre to Thamesmead *SL1 & SL10: Individual sites not checked as part of previous RARRs*
8	SL5 & 119	Bromley North to East Croydon/Croydon Airport
9	237	Hounslow Heath to White City
10	149	Edmonton Green to London Bridge
11	155	Elephant & Castle to Tooting
12	186	Northwick Park Hospital to Brent Cross
13	32	Edgware to Kilburn Park

Figure 4 – 2023-24 RARR programme map
(note – solid line = full RARR coverage, hashed line = targeted RARR coverage)



The RARR programme pivot – achievements

To ensure our resource was appropriately targeted, prior to undertaking any RARR activity on the Superloop routes, we first analysed where these routes run and cross referencing them with our RARR programme (for the past two years). If a Superloop route ran along a recently completed RARR, it was decided not to re-cover that ground. This allowed us to focus our time on new Superloop routes (or sections), whilst also leaving resources to preserve some elements of the previously agreed 2023-24 RARR programme.

In total, four Superloop routes were given the full RARR treatment (X26 / SL7, X68 / SL6, SL3 & SL5). The remaining five Superloop routes were approached with a targeted RARR approach, focussing on stretches of that route which had not previously been on the RARR programme. See Figure 4 for full details.

The 10th Superloop route, SL4 is not due to launch until Spring 2025 and was omitted from the 2023-24 programme.

The amended RARR programme laid the groundwork for NPD to focus and deliver improvements for Superloop. As a result , the following outcomes were achieved;

- 100miles of the Superloop were covered by the RARR programme, the majority being walked and but all of it thoroughly examined
- 34 signal faults were identified, reported, and resolved
- 7 compliance issues were identified and raised for increased enforcement
- 73 capital improvement schemes were identified and raised for design and delivery (see Figure 5 for locations)
- 57 BPO Timing Reviews were identified, programmed and completed (see Figure 6 for locations)

Figure 5 – Scheme locations identified through the RARR programme to benefit Superloop

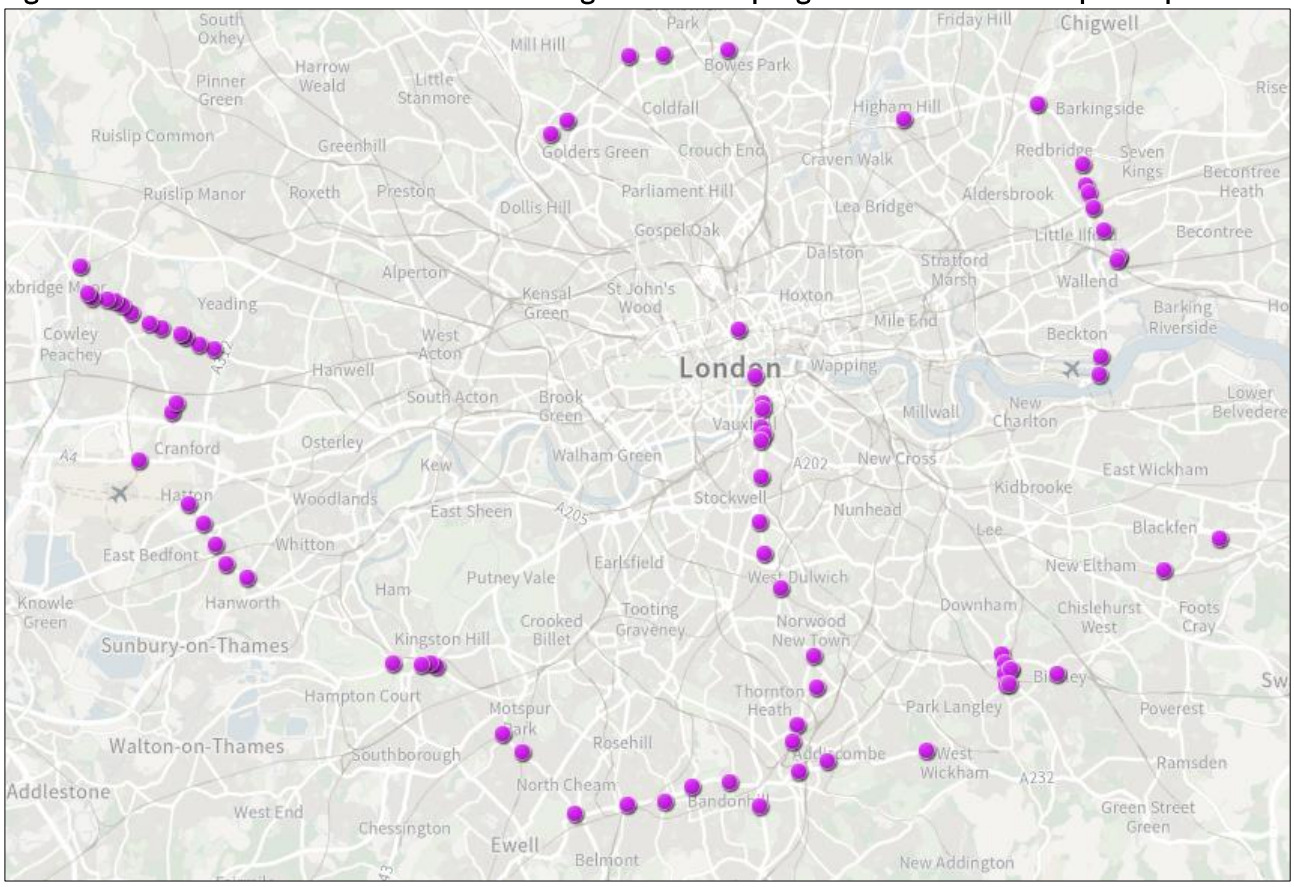
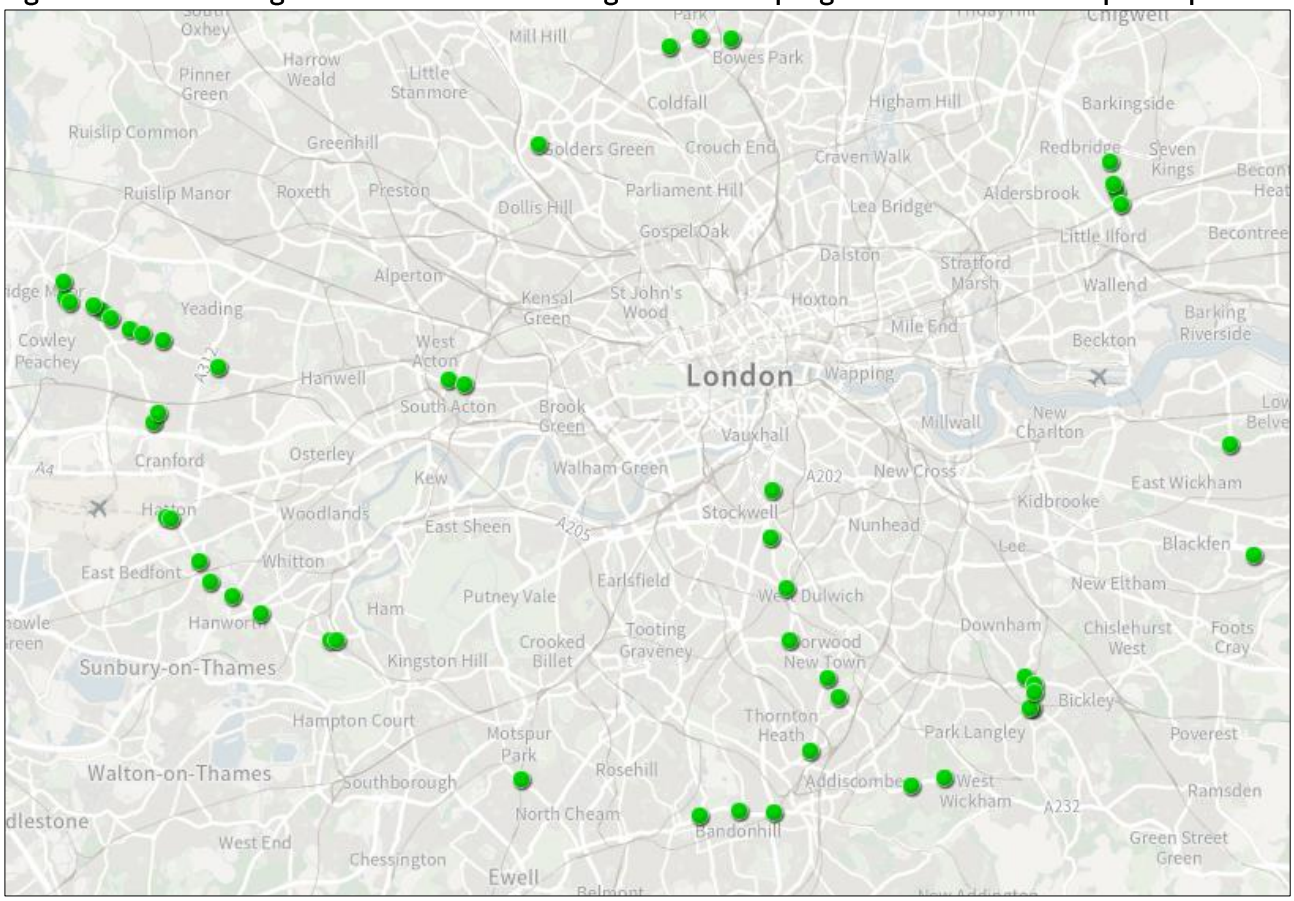


Figure 6 – BPO timing reviews identified through the RARR programme to benefit Superloop



As previously mentioned, the NPD RARR process was presented at the JCT Symposium last year (2023) and examples of the types of signal faults, compliance issues and improvement schemes identified were included in that presentation.

Route rebranding – unintended consequences for Signal Bus Priority (BP)

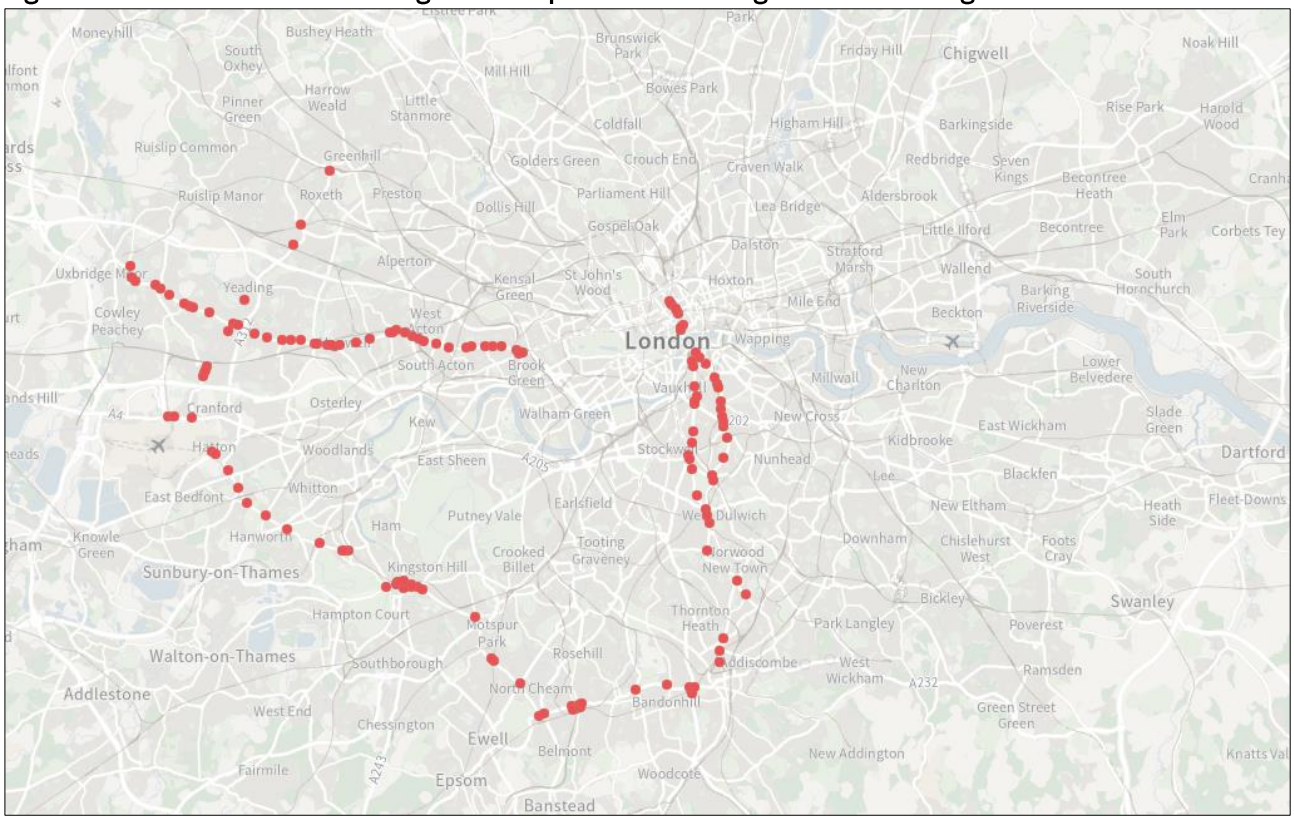
For buses to be detected and bus priority to be granted at traffic signals, a BP configuration is required. This configuration specifies which routes travel through the junction and where they are expected to be "seen" at a Virtual Detection Point (VDP).

The four existing express bus routes which were to be renamed with an "SL" prefix therefore required a number of BP configurations to be updated to feature their new route name. If this update did not occur upon launch, the bus priority enjoyed by the existing routes would cease to exist and the new Superloop routes would not receive any bus priority. To the customer, all that has changed is the route name, but they would then have experienced slower bus journey times!

To prevent this situation occurring, data analysis was undertaken to establish which traffic signals on the existing express routes (to be renamed "SL" routes) featured bus priority. Working with colleagues in the TfL Bus Directorate, the new Superloop routes were then preloaded into our configuration system. A member of the NPD Specialist Team then updated each BP configuration with the new route name. This amounted to over 140 BP configuration updates and ensured seamless bus priority during the route

Superloop renaming / rebranding. See Figure 7 for the locations of these BP configuration updates.

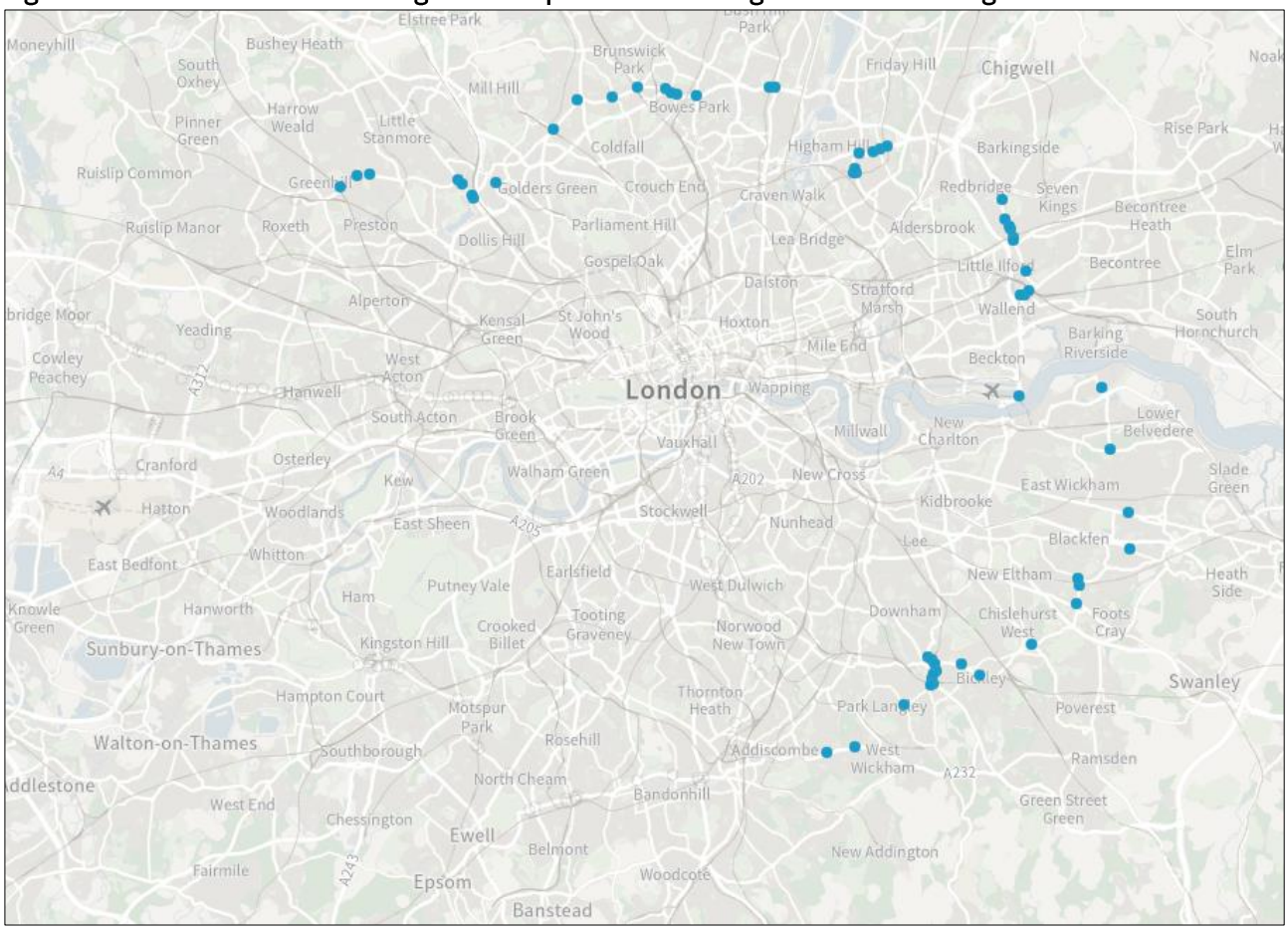
Figure 7 – Locations of BP configuration updates following route renaming



New Routes – more configuration updates!

To continue a similar theme to the section above, in order for buses to receive bus priority at traffic signals, the five brand new Superloop routes also needed to be added into our BP configurations. Once again, this required us to work with colleagues in the TfL Bus Directorate to preload these new routes into our BP configuration system, updating each BP location with the new route name. This amounted to 57 BP configuration updates and ensured that upon launch, all new Superloop routes received bus priority at traffic signals. See Figure 8 for the locations of these BP configuration updates.

Figure 8 – Locations of BP configuration updates following new routes being launched



Time for some Super Bus Priority!

As a result of the RARRs undertaken, over 50 locations were identified on Superloop which would benefit from a BPO Timing Review. At some locations this simply involved improving the operation of the BP at a junction by updating existing system settings. However, at many other locations, Superloop gave us an opportunity to be innovative and creative and make the BP these routes receive truly super!

Case Study 1 – Specific VDPs for Superloop buses not stopping on approaches where there are existing bus stops.

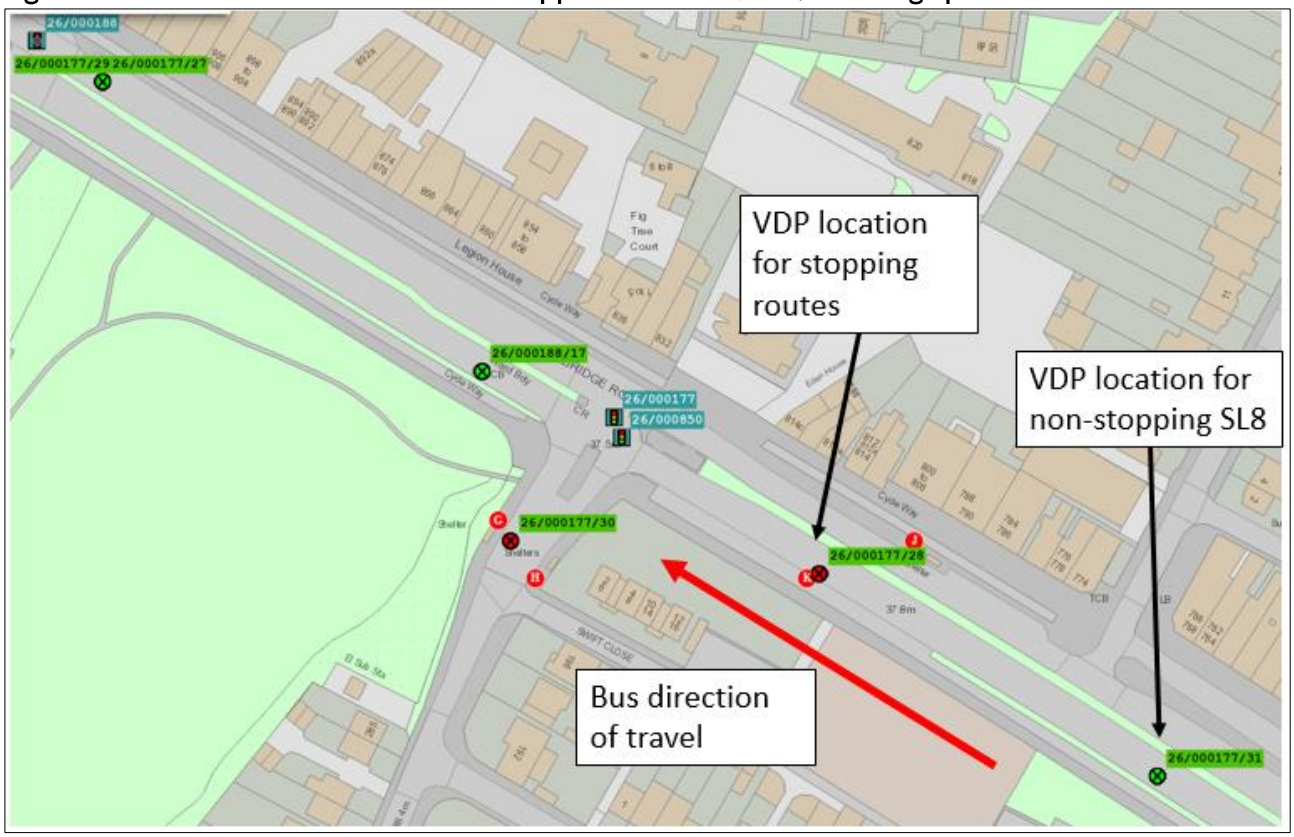
One limitation of BP at traffic signals is having a bus stop only a short journey time to the stopline. As we are only able to "see" the bus and offer a form of priority (extension or recall) once it leaves the stop, this reduces the time available. It is undesirable to detect a bus and offer priority before a bus stop as the dwell period is unknown, and any priority assigned may be wasted.

One opportunity which Superloop presented at many locations was related to its limited stopping schedule. As Superloop routes do not stop at many of the stops on the approach to traffic signals, where possible a new, unique Superloop VDP was created upstream of the bus stop and existing VDP location.

By having a VDP further from the stopline, we were able to "see" the Superloop bus earlier which offered a larger "window" for BP extensions. Given that extensions offer the best time-saving for buses, and are least disruptive to signal operation, utilising this technique was extremely beneficial.

An example of where this technique was implemented is J26/177 (Uxbridge Road / Church Road) for the SL8. As shown in Figure 9, there is a bus stop (K) near the junction, which SL8 does not stop at. A new, unique VDP was created upstream of this to "see" the SL8 much earlier. As a result, on this approach, 10% of SL8 buses benefit from a BP extension, compared to only 6% of buses detected at the VDP located at bus stop K.

Figure 9 – VDP locations on westbound approach to J26/177, showing specific VDP for SL8.



Case Study 2 – Specific VPDs for Superloop buses at SBP sites permitting them higher BP opportunity

A variation and development of Case Study 1, by uniquely detecting a Superloop bus it is also possible to configure our UTC BP system to offer stronger BP for a Superloop bus.

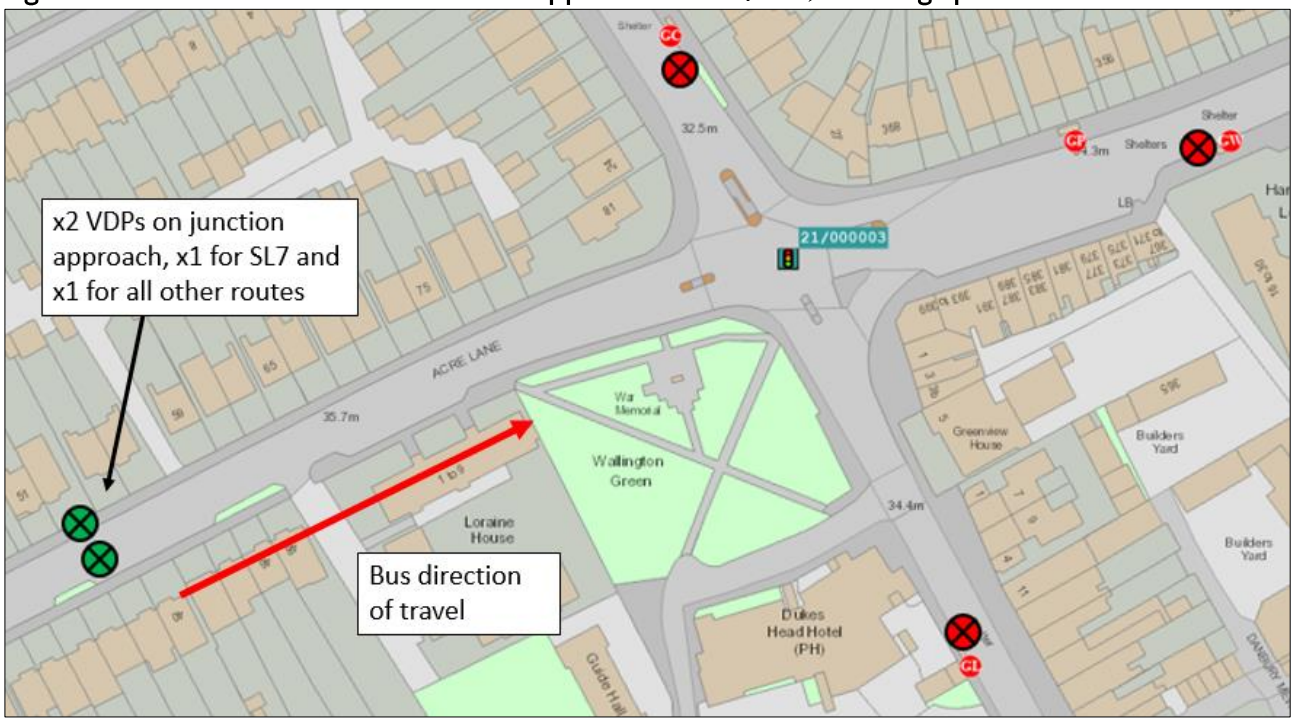
In London, we aim to maximise extensions (due to their high benefit and low disruption) for nearly all buses but are cautious with BP recalls which can be more disruptive to signal timings and optimisation, particularly on high frequency bus routes.

By uniquely detecting a Superloop bus, we can specifically configure our system with higher BP recall thresholds. This will grant the lower frequency Superloop buses stronger priority to reduce delay and deliver faster journey times.

An example of where this technique was implemented is J21/003 (Croydon Road / Manor Road) for the SL7. As shown in Figure 10, there are two VDPs on the eastbound approach

to the junction. One VDP for the Superloop, and one for all other routes. With this in place, our BP system was then configured with higher BP recall thresholds for the Superloop. As a result, on this approach, 27% of SL7 buses benefit from a Bus Priority recall, compared to only 10% buses detected at the non-Superloop VDP.

Figure 10 – VDP locations on eastbound approach to J21/003, showing specific VDP for SL7.



Case Study 3 - Making Superloop buses always "late" at Differential Bus Priority locations

In London, about 25% of our UTC BP locations operate Differential Bus Priority (DBP). At DBP locations, only buses which are late (according to schedule) are considered for potentially disruptive BP recall events. This serves as a way of limiting the potential harmful impact to signal timings of too many BP recalls.

One innovative amendment which has been tested and deployed for Superloop buses is to amend the BP configuration so that whenever a Superloop bus is detected, it always returns as "late". The Superloop bus is then always considered for priority at DBP locations regardless of its schedule deviation.

By implementing this technique, a Superloop bus is prioritised above other routes so reducing delay and delivering faster journey times.

An example of where this technique was implemented is JII/005 (Uxbridge Road / Askew Road / Old Oak Road) for the SL8. As shown in Figure II, prior to this technique being implemented the approaches containing Superloop offered a low number of BP Recalls per day (II% for westbound, and I2% for eastbound). Once the configuration was updated so that every Superloop bus returned as "late", the recall percentages for both approaches increased to I8% and I9%.

Figure 11 – Table showing BP recall data for before and after a BPO timing review where Superloop buses were configured as always "late"

Junction link	Recall total (before review)	% buses receiving Recall (before review)	Recall total (after review)	% buses receiving Recall (after review)	% increase in BP Recalls
Uxbridge Road Westbound	46	11%	68	18%	7%
Uxbridge Road Eastbound	53	12%	86	19%	7%

Case Study 4 – Bus Priority Secondary detection

One consequence of VDPs being further from the stopline (to increase our BP extension "window") is the increase in bus journey variability. For example; a VDP 50m from the stopline will likely have a bus journey time of 5-7seconds with low variability, but a VDP 100m from the stopline will naturally have a longer bus journey time and increased variability. As a result, some BP extensions may be granted, but that bus may not clear the stop line and not benefit from the extension.

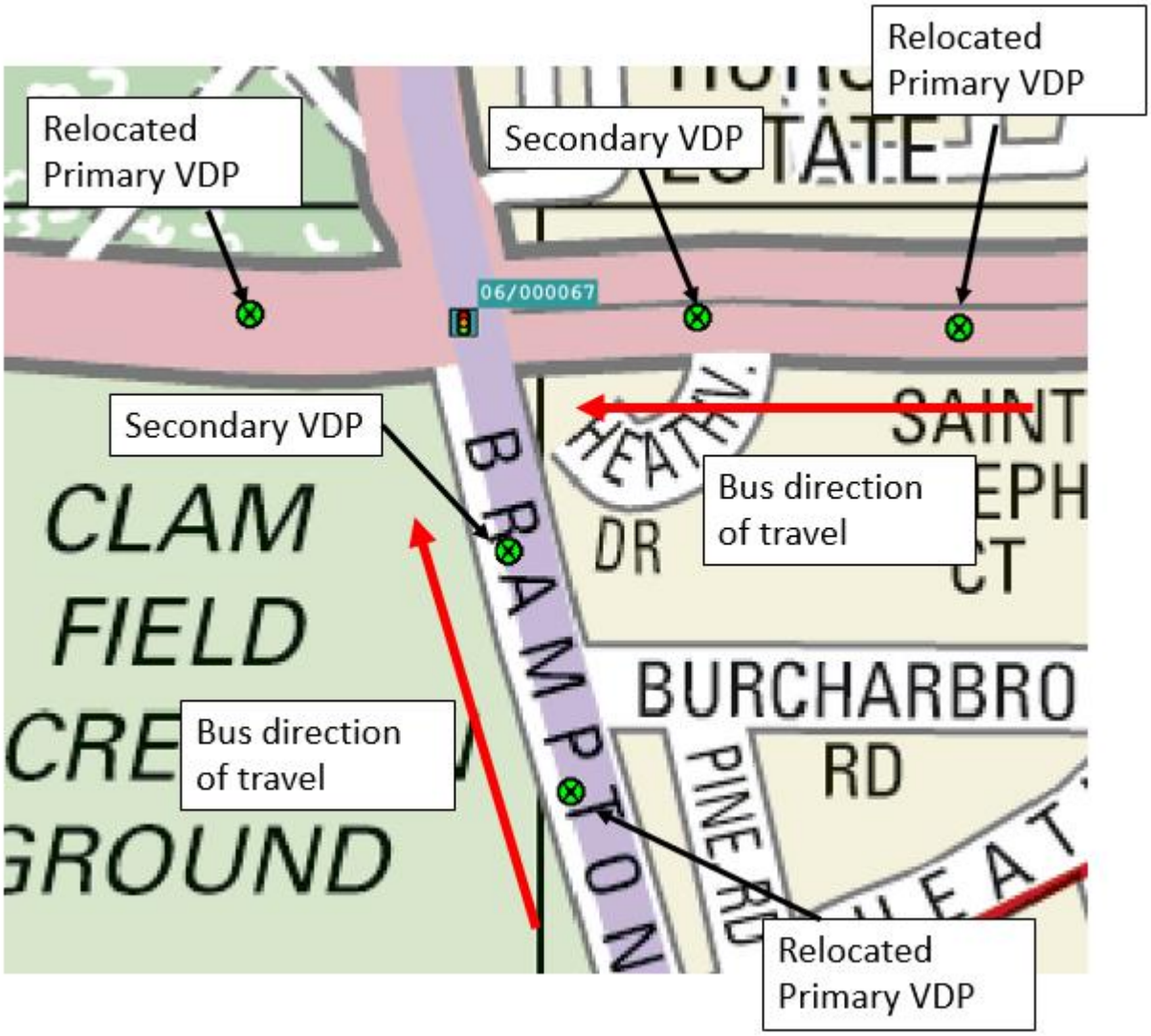
For Superloop, this issue was especially relevant given that one aim was to position VDPs further from the stopline to increase our extension "window". This therefore generated longer bus journey times with higher variability.

To resolve this issue, the use of BP secondary detection was investigated and implemented. Secondary detection uses a second VDP much closer to the stopline which serves to correct any variation in bus journey time resulting from the initial point of detection.

For example, if a bus were detected at the first VDP with a configured journey time of 10seconds, but then proceeded slowly along the link, the secondary detector would "see" the bus was slower than expected and correct the journey time (of the bus on the link) and adjust the BP extension (if one were granted) accordingly. As a result, any extensions granted are more accurate and useful to the bus, ensuring it does indeed clear the stop line even if it travels more slowly than usual.

An example of where secondary detection was implemented is J06/067 (Bostall Hill / Woolwich Road) for the SL3. For both junction approaches used by SL3, primary VDP positions were repositioned to increase the bus journey time and bus priority extension "window". New secondary VDP positions were then created nearer to the stop lines to correct the bus journey time and improve the accuracy and benefit of a bus priority extension. Figure 12 shows the position of the primary and secondary VDPs.

Figure 12 - Position of primary and secondary VDPs at J06/067



By relocating detection, bus priority extensions at this junction increased by over 200% (from approximately 20 extensions per day to over 60 per day). In addition, by using secondary detection, it has been possible to ensure that buses are actually getting the intended benefit.

Figure 13 shows how the secondary detector on the westbound approach corrects the journey time of buses – with 52% buses being slower on street than anticipated (to the left of the 7-second bar) and 21% buses being faster on street than anticipated (to the right of the 7-second bar). By using secondary detection on this approach, BP extensions are corrected for almost 75% of all extensions granted. Secondary detection ensures the bus priority extension is correct and that the bus clears the stop line.

Figure 13 – Graph to show correction of bus journey time by secondary VDP

(note – the tall, central blue bar represents no correction to the BP extension needed. All bars to the left of this represent a bus being slower on street than anticipated by SCOOT, with the BP extension adjusted (increased) accordingly. All bars to the right of the central blue bar represent faster buses on street, again with the BP extension adjusted (reduced) accordingly)

It should be noted that not all the above techniques were necessary or possible at every Superloop Bus Priority junction. Implementation of each technique was also limited by the available technology at each site.

So was it all worth it?

For three of the four existing Superloop Routes, we were able to measure a benefit by comparing data from before and after our work. It should be noted that this quoted benefit does not include capital improvement schemes as these had not been delivered at the time of data collection.

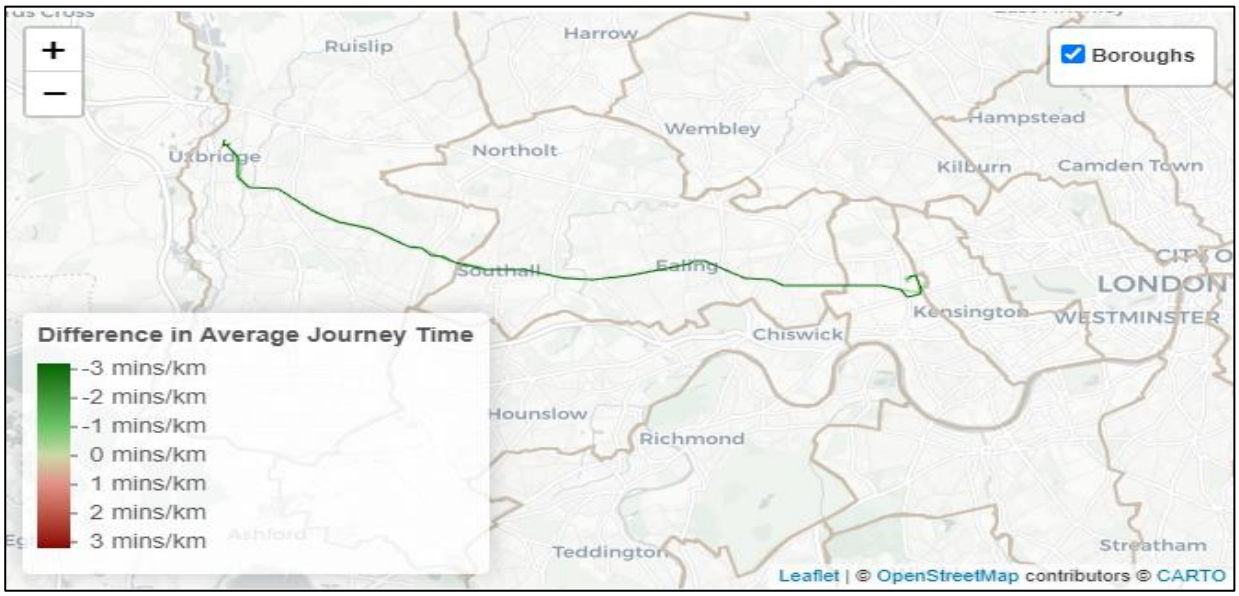
For the SL7, SL8 & SL9, a total of 149.3 people hours were saved as a result of the work undertaken. This benefit primarily relates to targeted BPO Timing Reviews having been completed. No patronage data for the SL6 is available so it has not been possible to measure a benefit for that route.

In terms of time savings, the TfL Operational Analysis Team reviewed the performance of SL7 post launch and reported 2023/24 P5 route performance improvements of 3.5-3.75 minutes (dependant on inbound and outbound run) vs the 2024-P3 baseline (before our timing changes), 0700-1900 on weekdays. See Figure 14 below.

Figure 14 – Run time improvements on the SL7 as a result of targeted BPO Timing Reviews (and other RARR actions such as fault resolution).

In the same way, TfL Operational Analysis also reviewed the performance of the SL8 and reported that in 2023/24 P4, SL8 observed performance improvements of 40s – 3 minutes 10s dependant on inbound and outbound run vs the 2023-P9 baseline (before our timing changes), 0700-1900 on weekdays. See Figure 15 below.

Figure 15 – Run time improvements on the SL8 as a result of targeted BPO Timing Reviews (and other RARR actions such as fault resolution).



And what's next for Superloop?

The final route for Superloop, SL4, is due to launch in Spring 2025 when the Silvertown Tunnel in East London opens. This route runs between Canary Wharf and Grove Park via Blackheath. In preparation for this, the SL4 route was covered in P2 of the 2024-25 RARR programme and 13 schemes were identified that will improve route performance. These schemes have been passed for delivery with a target implementation prior to route launch. 7 BPO Timing Reviews have also been identified and will be programmed on the Timing Review Programme for completion prior to route launch.

An 2024 election pledge by London's Mayor, Sadiq Kahn, was to double the Superloop routes from 10 to 20 if he was re-elected. Having been re-elected, at the time of writing we are waiting on confirmation of Superloop 2, the routes, origins, and destinations.

Acknowledgements

I would like to acknowledge the work of the NPD Specialist Team (listed below), who all contributed to the successful launch of Superloop.

Neil Barnes was responsible for the updates to BP configurations at approaching 200 junctions, in addition to further changes to configurations made during BPO Timing Reviews.

All other members of the Specialist Team undertook "Superloop RARRs" and all the associated activities – scheme generation, BPO Timing Reviews, fault reporting and many hours pounding the pavements of London!

A special mention to Christopher Cockbill who analyses, crunches, and makes sense of numerous data sets to enable the rest of the Specialist Team do their jobs more effectively. And, for his assistance in creating numerous maps & charts used for this paper and the associated presentation.

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