Getting Better Value from London's Traffic Signals

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EVERY JOURNEY MATTERS

Summary

In TfL Surface Transport we are working on a number of projects to improve safety and efficiency for multiple modes of transport at our traffic signals. These endeavours will improve Journey Time Reliability (JTR) for our customers and this better time efficiency will provide economic benefits. JTR means the duration of a particular journey will be similar at a specific time of day, on different days of the week. Essentially, a customer will know how long it will take them to get somewhere, and can expect this journey time to be relatively stable. Thus, the benefits of this in terms of delay savings and customer satisfaction will result in us getting better value from our traffic signals. This report focuses on the following new technologies and strategies currently in use or soon to be rolled out to help us realise these aims:

1. **Excess Wait Time Reduction 'Masterplan'**
2. **Differential Bus Priority**
3. **Pedestrian and Cycle SCOOT**

Excess Wait Time (EWT) and the Roads Reliability Programme (RRP)

EWT = Actual Waiting Time (AWT) – Scheduled Waiting Time (SWT)

- **We assume average SWT to be half the headway**
- **AWT is calculated when buses do not arrive with even headway**
- **Therefore, EWT is the time spent waiting in excess of the scheduled wait time**

TfL is spending £6bn transforming London's road network to prepare the city for the future. As with most large scale projects, the long-term benefit produces some short term disadvantages, and the roadworks involved have led to an increase in bus journey times. Along with JTR, we can use EWT to determine the magnitude of the impacts and also to measure improvements made. There are several challenges involved with this target. Firstly, JTR relates to the time period 07:00-10:00 and is focused on London's radial corridor roads, whereas EWT is measured from 05:00 to 00:00 and across most of London's major road network. This means that between 07:00 and 10:00, attempting to improve JTR and EWT at certain junctions may be problematic; for example, at junctions between side roads and radial corridors where reducing EWT on the side road could reduce JTR on the corridor. Secondly, we are working to deliver these JTR and EWT improvements in an environment where a significant amount of road space has been reallocated to improve cycling and pedestrian facilities. Therefore, we are working with reduced capacity for vehicles.

Our ultimate goal is to reduce EWT to 1.1 minute. To get this underway, our Insight and Analysis department have produced maps using SurfacePlaybook (a new GIS tool which allows us to view multiple data layers over different base maps) data to show parts of the road network with the greatest decline in bus speeds compared to a 2014 'Pre-RMP' map. These maps reveal spatial similarities between sites where our current programmes (RSM SCOOT, Corridor Improvement Programme to relieve congestion, Timing Review Programme, Bus Priority Enabling) are soon to be underway, and areas with the greatest bus delay. Therefore, we expect the work that will be carried out as part of our business-as-usual programmes will bring an improvement to buses in these areas. However, from these maps we have also been able to prioritise certain timing reviews and SCOOT implementations and identify 150 sites for focused bus timing reviews. Moreover, we have identified a number of sites where there is the potential for new pedestrian call/cancel and differential bus priority technology rollout. These strategies comprise the EWT Roads Reliability Programme.

Bus Focused Timing Reviews

Additional bus focused timing reviews will involve thoroughly checking the junction, its infrastructure and its databases to identify why the site in question has experienced a reduction in bus speeds. The sites were chosen based on poor bus performance in 2015 compared to 2014. Examples of changes made on bus timing reviews carried out so far include changes of plans to improve offsets between junctions, reducing green time for side roads and reporting faulty bus detection for repair. This illustrates how simple it can be to recognise an immediate boost to bus performance, with these improvements also providing benefits to all road users.

Database checks help identify any detector faults and/or data transmission errors which could compromise junction optimisation or bus priority. The threshold degree of saturation values stored in our database will be reviewed to ensure that recalls and extensions are granted only when appropriate. Through these procedures we seek to achieve a clear positive outcome for buses and this should be evident when comparing JTR and EWT data from before and after the review. The data we use is gathered from Hyperion, and shows us the percentage change in bus performance in terms of bus speeds over specified peak periods.

Differential Bus Priority

Differential Bus Priority (DBP) only grants priority to buses running with excess headway compared to that scheduled. It therefore has a less disruptive effect on the network as a whole than current BP, which grants priority much more frequently. DPB utilises iBus data to allocate each bus a priority level based on its deviation from the schedule (ranging from <1 minute to >5 minutes).

A trial was carried out at fourteen junctions along the A3 between 14 March and 30 April 2016. The results showed a 1per cent improvement in EWT overall, with the greatest benefit recognised at junctions with high frequency bus services. Further data collection will inform the rollout strategy of DBP across London's Road Network. However, the trial has indicated that the four types of site below will see the greatest benefits from DPB, and this will help inform the rollout:

- Sites with high frequency bus routes (more than 20 buses per hour)
- Sites with conflicting bus routes (bus routes on two or more approaches to the junction, especially which run in opposing phases)
- Areas where bus journey times decline per kilometre along a route
- Sites where the hardware is ready for DBP upgrade

A focus on such sites and on specific bus routes will help to draw out the maximum benefit in terms of reduced EWT. So far 40 sites have been selected for the trial expansion.

Pedestrian Call/Cancel

This technology has been used at certain pelican and puffin crossings for a number of years. It uses simple infrared detectors to detect heat presence and cancels the demand for a pedestrian stage if no pedestrians are detected. We are now starting to implement this technology at a range of junction types, not just pedestrian crossings. Our focus is on junctions where JTR or EWT could be improved if unnecessary pedestrian stage occurrences were to be minimised.

Pedestrian and Cycle SCOOT

At present, around 4050 of the capital's c.3600 traffic signals operate with SCOOT technology, reducing delays by an average of 12 per cent. As we continue our rollout of SCOOT technology, we are beginning to integrate signal timing optimisation for cyclists and pedestrians depending on demand. This follows successful trials of newly developed pedestrian and bicycle SCOOT technologies.

• Pedestrian SCOOT: This is based on the same principle as regular SCOOT. It optimises green man-time based on the number of pedestrians waiting to cross. Raw data from detectors is sent to a Pedestrian Data Processor, which then converts it into one of four priority levels. These priority levels are then used by UTC SCOOT to extend the invitation to cross (green man time) depending on the number of pedestrians waiting. The detectors used are above-ground cameras which detect the height of objects in the pedestrian waiting area; in this way they can distinguish people from vacant ground-space and determine the demand to cross the road.

Six trial sites were chosen where the six second invitation to cross was deemed to be insufficient for the number of pedestrians in the area. After the success of these trials, we are looking to extend this technology to other locations where the normal six second window to cross may not be enough. In doing so, we will improve pedestrian comfort by incorporating their demand into signal optimisation.

• Cycle SCOOT: Here we use upstream detectors to determine offsets between consecutive sets of signals, and stopline detectors to calculate green-splits for cyclists; thus, cyclist demand is incorporated into normal junction optimisation. Cycle SCOOT uses radar detectors in the same way vehicle SCOOT uses magnetometers. Radar is used because the magnetic disturbance caused by a bicycle is not always sufficient to be picked up by a magnetometer. The data collected is processed and extends the length of the cycle stage depending on the demand. There are currently ten sites at which cycle SCOOT is operational; these are located on Cycle Superhighway 2 (Stratford High Street) and Cycle Superhighway 3 (Cable Street and Royal Mint Street), both in East London. Following successful trials at these ten sites, we are looking to roll out cycle SCOOT across the Cycle Superhighway network in order to reduce stops and delays for cyclists and encourage a friendlier and more efficient cycling environment.

The calculations of the financial benefits these new technologies will provide are ongoing. However, we expect that balancing the network for all modes of transport will improve JTR for all our customers and overall will save people their precious and valuable time.

Conclusion

This paper has provided a summarised insight into several of the many activities performed within RSM Outcomes Delivery which help us to get better value from our traffic signals. This value can be measured monetarily, temporally and through customer satisfaction. By balancing the network more fairly for all road users across all modes we will start to see better value in all of its guises. In addition to this, the changes we are making are equipping London for the future and helping it become a more pleasant city to live, work and relax in.

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