Traffic Design and Management through Transport for London's Road Modernisation Plan

Abstract

As the population of London continues to grow, our roads are coming under increased pressure to support a diverse group of road users; including pedestrians, freight, motorists, buses and cyclists. Demand for space on the road network is set to increase and as a result Transport for London is making the largest investment in our roads for a generation. There are five key areas which this pioneering programme will focus on:

1) Investing in our roads to make them fit for the future
2) Major highway improvements
3) Delivering the Mayor's vision for cycling improvements
4) A safer London to reduce fatalities and serious injuries on our roads
5) Keeping London moving whilst tackling congestion

The East West Cycle Superhighway is amongst some of the schemes which encompass these five areas, putting us on the right track to complete the Road Modernisation Plan. This paper will address the challenges TfL face and how innovative scheme design and management can be utilised to modernise our road network.

Introduction

In late 2014 the Road Modernisation Plan was launched to facilitate Transport for London in satisfying the mayor's targets for surface transport in the capital. To rebalance the network for all road users, the Road Modernisation Plan is a £4billion investment which will strive to make our roads a safer place for cyclists and pedestrians whilst also drastically improving travelling conditions through a series of transformational projects. It aims to do so through tackling the five aforementioned objectives. The East West Cycle Superhighway is just one of the high profile schemes currently being built. This paper will provide an insight into the planning, modelling, innovation and operation of the network which is required to deliver the Roads Modernisation Plan. The delivered plan will give Londoners a road network which is more efficient, safe and reliable.

The East West Cycle Superhighway (EWSCH) will run from Tower Hill to Acton and will operate as a substantially segregated cycle route, providing cyclists with a two-way track in which they can move freely without conflict with motorists. The scheme has been designed to accommodate for projected uplifts in cyclists and strives to make London a safer, more practical city to cycle in, benefiting both those who are new to this mode of transport as well as cyclists who currently use the road network daily.

The Mayor's Vision for Cycling has been incorporated into the Road Modernisation Plan. It sets out our plan to provide safe junctions for cyclists and other vulnerable road users. There are 33 Better Junction sites which are high priority locations across London including Parliament Square, Tower Hill and Lancaster Gate all of which are incorporated in EWCSH. Innovative signal design and

Martha Hoskins Transport for London

network management will be used to accommodate for cyclists in order to ensure safe road conditions and a reliable network.

The EWCSH is being built with consideration for the future road network whilst also with the intention to reduce fatalities, serious injuries and collisions across London's streets. A large proportion of accidents involving cyclists occur at junctions and through the implementation of the scheme these numbers are projected to be reduced. At signalised junctions, cyclists will be physically segregated from other traffic and in several cases motorists and cyclists will be given separate traffic phases, enabling them to be segregated in time.

Planning and Consideration

Before planning could begin for EWSCH, several different factors needed to be considered. Amongst these were the widths required by cyclists, gradients and appropriate kerbing and street furniture. The behaviour of cyclists has been addressed by making allowances for different types of cyclists through bespoke research with the TRL, all of which is now published. Both conversational cyclists and well-practiced commuter cyclists have been accounted for in addition to those who wish to overtake travelling in the same direction.

At some signalised junctions that the route passes through, including Tower Hill, cycle phases will run separately to traffic phases further improving safety and reducing conflict for all road users. In other instances junctions may require specific movement prohibitions, such as banned turns to traffic. Throughout the design process it has been ensured that a facility can be created that will serve the predicted 6% increase in cycle demand per annum.

Throughout the planning process TfL's 'ONE' model was used. This Visum model, portraying the Central London road network, allows for adjustments to be made to variables such as predicted flow, lane capacity and signal timings, in order to view the impact that these changes may have on the network at a strategic macro level and the resultant vehicle reassignment. This allows engineers to accurately design lane allocations at the junctions and signal timings. As a result, the 'ONE' model has fed into a Vissim model which has provided assistance in determining weak points in the design and helped to address areas for iterative development. Additionally, the model informs us of where we can expect to see delay and more specifically the levels of delay and queues which will be a result of the build and implementation process of this scheme. This information can then be used by Travel Demand Management to advise road users of possible diversion routes during the construction phase.

Public consultation occurred from September to December 2014 and data was derived from the model to provide information to the public, boroughs and interest groups. As a result of using the 'ONE' model to recognise the impact of various iterations, it was recognised that there is a requirement to carry out 'Active Traffic Management' in order to protect key gyratories for both the intensive build programme and completed schemes.

A four step modelling process has been developed in order to understand the changes that the network will face as a result of the EWCSH being implemented. The 'ONE' model was used in this modelling process as an adaptive model which would react to the changes in signal timings, flow and capacity that were inputted into it.

Four step modelling framework

The first stage of the modelling framework is referred to as the 'Base' model. This model allows us to view the existing operation of the network and was built using 2012/2013 traffic counts. This model was validated against on-street conditions. From the 'Base' model we could extract journey times, modal delays, approximate queue length, flows and emissions in order to compare this with the data extracted from the following three steps of the modelling framework.

Stage two or 'Future Base' was created in order to look at the predicted future operation of the network without the scheme (EWCSH) built into the model i.e. if TfL were to 'do nothing'. This has been built on predicted flow data for 2016, the year in which the scheme is due to be completed. The model incorporates the expected growth as well as developments that are already in the build process or have been committed to and any predicted traffic works. It incorporates the twenty other major schemes that (in July 2014) were predicted to have been implemented, or substantially completed by the end of 2016. This provided us with a model which would act as a directly comparable model to any future schemes, showing the predicted state of the network existing in 2016.

The 'Do Something' model (stage 3) allowed us to develop the 'Future Base' to incorporate the EWCSH scheme without traffic mitigation. Whilst looking at the same parameters (e.g. queue length, delays and journey times) we could address the impact of the scheme and decide on appropriate mitigation. This model iteration provided us with the timings and contingencies required to create the 'Sensitivity' model; the fourth and final stage of the modelling framework.

The fourth stage is a model of the predicted final operation of the network with the scheme and mitigations in place i.e. Active Traffic Management. This model provided us with and allowed us to calculate the proposed journey times, delays, capacity, queue length and emissions that we could expect to see once EWCSH is in operation. Key performing measures, such as journey times by mode and pedestrian wait times were displayed through periods of consultation and allowed us to calculate the costs and benefits of the scheme.

Cycle Innovation

Detection and optimisation

Practically all signalised junctions along the EWCSH route are operating with SCOOT technology. Trials commenced last year on pedestrian SCOOT in which detectors are installed at pedestrian

crossings to extend green man invitation period to satisfy fluctuating pedestrian demand. Currently trials are taking place to establish whether it is possible to get traffic signals to install similar technology which reflects cyclist demand to incorporate into the SCOOT system. Cycle SCOOT detection will be rolled out along the Superhighway.

Studies are currently being carried out along Cable Street on Cycle Superhighway 3 which allows signal timings to be adjusted to optimise green splits at key junctions where we experience high numbers of cyclists in the peak hours. Two new types of detector technology are currently being trialled with a further three to be tested in order to assess the possibility of introducing them across London. This will allow more junctions to reflect the demand of cyclists on a second by second basis as well as allowing us to respond to changes in the number of cyclists over the course of the year due to seasonal variations.

Low level signals

The UK's first low level signals were installed early last year along the Cycle Superhighway 2 route and are becoming common practice to be installed along our cycle routes, including EWCSH. These innovative signals are found in certain parts of Europe but this is the first time that they have been approved for use in the UK. Trials, which were carried out in 2013 alongside the Department for Transport, concluded that over 80% of the cyclists involved favoured the use of low-level signals. This is primarily due to the improved visibility of the signals resulting from this eye level technology. Low level signals will also allow us to provide early release to cyclists as well as allowing cyclists to be separately signalled from traffic. The installation of these signals are all part of the Mayor's Vision for Cycling in London and demonstrates ways in which we strive to innovate to accommodate for cyclists.

Hold the left turn

Modelling has been carried out to calculate the effects and benefits of separately signalling left turning vehicles and cyclists. This would allow us to hold left turning vehicles at junctions whilst allowing cyclists to safely turn left first due to a high number of collisions in these situations. This is primarily to remove the conflict between cyclists who wish to proceed ahead and left turning traffic. This requires the segregation of lanes for cyclists and vehicles which makes sites along the EWCSH suitable for this innovative design. However it is also necessary to ensure provisions are made for right turning cyclists as well as making considerations into whether ahead and left turning cyclists should be separated. An example of considerations made for the right turning cyclists can be found along the CS2 route where 'two stage right turns' are already in operation. Holding the left turn has great potential at junctions where there is a moderate volume of left-turning traffic and a high volume of cyclists wishing to turn left or continue ahead. This design will allow us to achieve the Road Modernisation Plan's targets of reducing fatalities and injuries on the road by making cyclists journeys through junctions safer.

Managing the build and operation

Build work started on street for EWCSH in early 2015 and since then round the clock operational work has been scheduled in order to deal with reduced and continuously changing road capacity. As we actively manage the traffic, in a similar manner to the Olympic Games, we are starting to timetable work to assist key routes and to ensure that London keeps moving. Outcomes Delivery's operational ATM (active traffic management) work takes place between the hours of 06:30 and 19:00 Monday to Friday. However additional ATM cover is also provided at other times, as required by the build programme. With the use of CCTV and outstation engineers we are able to tailor the operation of our traffic signals to be responsive to diurnal changes in capacity or layout together with alterations in lane use, prohibited moves and diversions.

Keeping London moving while these projects are completed will be a major challenge but *"Sometimes great cities have to do things that are a little bit difficult. In five years' time people will love them and not be able to imagine what we did without them." (Boris Johnson, Tfl Board of Approval, February 2014).*